3rd Science and Engineering of Polymeric Materials

SEPM 2018

Organized by the

Tunisian Chemical Society

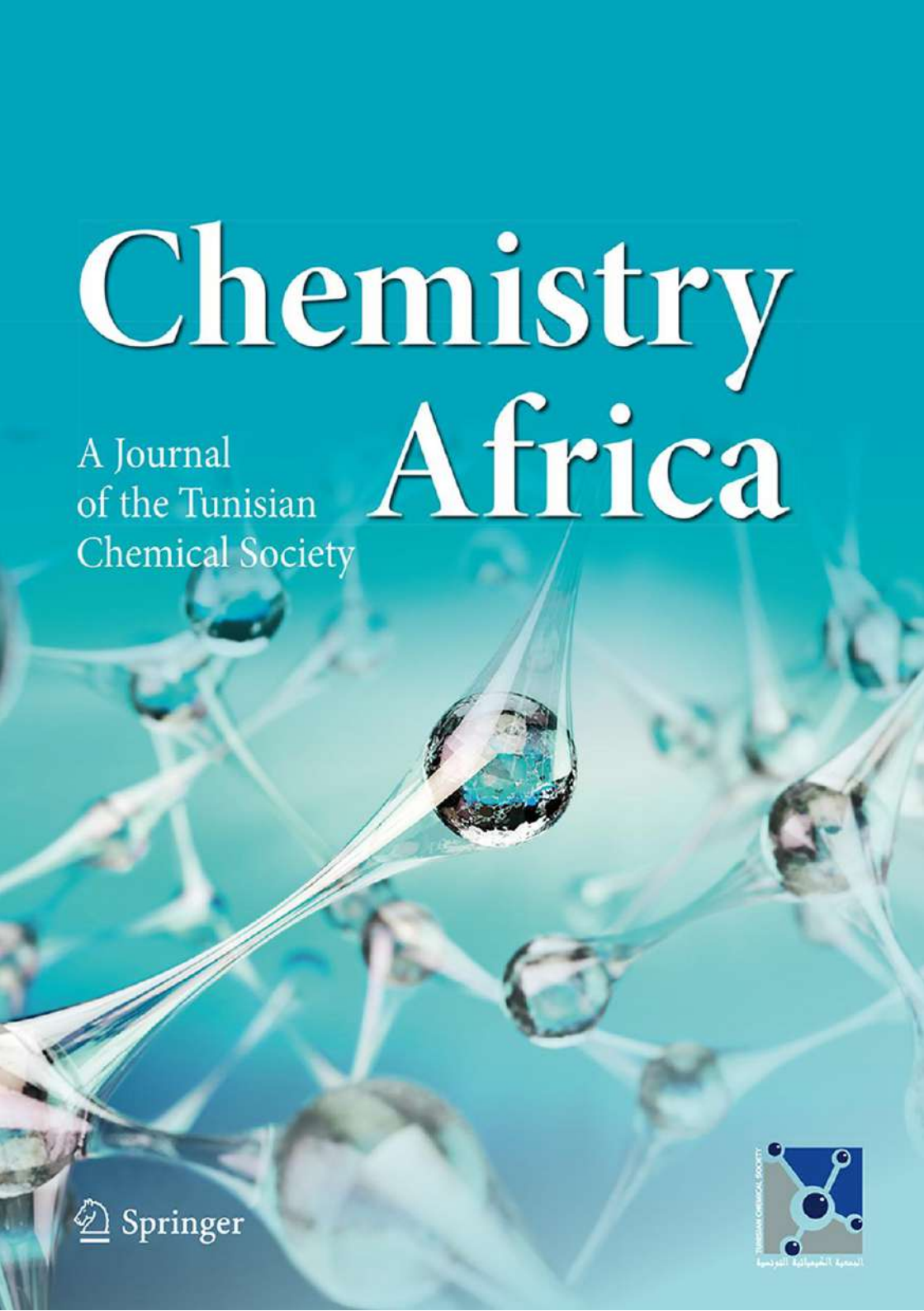
18-21 March 2018

Concorde Green Park Palace,
Port El Kantaoui-Sousse, Tunisia

Abstracts of Lectures and Communications
List of Participants

Chemistry Africa

A Journal of the Tunisian Chemical Society



Springer

Sunday 18 March 2018	
15.00	**Welcoming participants, distribution of documents and check in**
19.30	***Dinner***
Monday 19 March 2018	
09.00 - 09.20	**Official Opening of the SEPM 2018**
09.25 - 10.00	**Plenary Lecture 1 Pr Mária OMASTOVÁ** *Polymer Institute of Slovak Academy of Sciences, Bratislava, Slovakia*
10.00 - 10.35	**Plenary Lecture 2 Pr Filip DU PREZ** *University of Ghent, Belgium*
10.35 - 11.05	**Photo Group + Poster Session 1 (P 01 - P 28) + Coffee break**
11.05 - 11.40	**Plenary Lecture 3 Pr Hern KIM** *Myongji University, Republic of Korea*
11.45 - 12.45	**Oral Communications - Session 1 : OC01 - OC04**
13.00	***Lunch***
15.00 - 15.35	**Plenary Lecture 4 Pr Saber CHATTI** *INRAP - Sidi Thabet, Tunisia*
15.35 - 16.10	**Plenary Lecture 5 Dr Marc DELGADO AGUILAR** *University of Girona, Spain*
16.15 - 17.15	**Oral Communications - Session 2 : OC05 - OC08**
17.15 - 17.45	**Coffee break**
17.50 - 18.50	**Oral Communications - Session 3 : OC09 - OC11**
19.30	***Dinner***
21.30 – 22.30	**Roundtable on "Chemistry Africa"** (Open to all participants) **The new journal of the Tunisian Chemical Society Edited by Springer** *Moderated by :* **Dr Nabil Khelifi** - Senior Editor Manager of Springer MENA Program Springer, Germany **Dr Mohamed Mehdi CHEHIMI** - Executive Editor-in-Chief of Chemistry Africa

Being on time is the main factor for conference's success

Tuesday 20 March 2018	
09.00 - 09.35	**Plenary Lecture 6 Pr Elisabetta RANUCCI** *Università degli Studi di Milano, Italy*
09.35 - 10.10	**Plenary Lecture 7 Pr Jean-François GERARD** *University of Lyon, France*
10.10 - 10.50	**Poster Session 2 (P 29 - P 56) + Coffee break**
10.55 - 11.30	**Plenary Lecture 8 Dr Tobias ROBERT** *Fraunhofer Institute for Wood Research, Braunschweig, Germany*
11.35 - 13.05	**Oral Communications - Session 4 : OC12 - OC16**
13.15	***Lunch***
14.30	***Afternoon off - Social event for the foreign participants*** ***Excursion to some touristic Area***
17.30 - 18.30	**Workshop Dr Nabil KHELIFI** *Springer, Germany*
20.30	***Dinner Buffet***
Wednesday 21 March 2018	
09.00 - 09.35	**Plenary Lecture 9 Pr Dimitrios N. BIKIARIS** *Aristotle University of Thessaloniki, Greece*
09.35 - 10.10	**Plenary Lecture 10 Pr Mehmet Atilla TASDELEN** *University of Yalova, Turkey*
10.10 - 10.40	**Poster Session 3 (P 57 - P 84) + Coffee break**
10.45 - 12.00	**Oral Communications - Session 5 : OC17 - OC21**
12.05 - 12.40	**Plenary Lecture 11 Pr Armand SOLDERA** *University of Sherbrooke, Canada*
12.45	**Awards Distribution, Closing Remarks**
13.00	***Lunch and check out***

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FOREWORD

On behalf of the Tunisian Chemical Society, it is a great pleasure to welcome you to the International Conference on Science and Engineering of Polymeric Materials (SEPM 2018).

As the two first editions in 2014 and 2016, SEPM is intended to cover all aspects of polymer science and engineering from fundamental, rational design of macromolecules to polymeric materials for applications in various sectors with social economic outputs.

The Organizing Committee has considered many issues to make SEPM 2018 an ideal forum to discuss recent progress and challenges in polymer science and engineering and to offer the delegates opportunities for cooperation and networking. Indeed, for this 2018 edition:

(i) we have taken the decision to invite renowned Speakers keeping in mind geographical diversity; “one country, one Invited Speaker” principle. Invited Speakers come from 11 countries located in 4 continents. Their research activities cover broad range of fundamental (polymer chemistry, physics and multi-scale modelling) and timely, applied aspects of polymeric materials (energy, environment, biomedical engineering, healthcare, sustainable development, sensors and actuators, packaging, adaptable and self-healing polymers).

(ii) we have planned an evening round table to discuss the birth and take off of Chemistry Africa (CHAF), the new chemistry journal published by Springer in association with the Tunisian Chemical Society. CHAF will publish selected SEPM conference papers in one of the forthcoming issues. CHAF Editors will participate to inform the audience on the scope of the journal, give a status report on submissions and tell the young generation and experts the benefit in publishing in CHAF.

(iii) we have selected the beautiful beach resort of Concorde Green Park Palace which we do hope will be an inspiring venue for all delegates.

Dear participants, thank you very much in anticipation for coming all the way to Port El Kantaoui to share with us your sound research on polymeric materials. We do hope you will enjoy both the science and your time in the magnificent Concorde Green Park Palace as well as sightseeing in this splendid coastal area of Tunisia.

Yours with kindest regards

Pr Hatem BEN ROMDHANE

Chairman

On behalf of the TCS

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Sunday 18 March 2018	
15.00	**Welcoming participants, distribution of documents and check in**
19.30	***Dinner***

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Monday 19 March 2018 (morning)				
09.00 - 09.20	**Official Opening of the SEPM 2018**			
09.25 - 10.00 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 1** **Pr Mária OMASTOVÁ** *Polymer Institute of Slovak Academy of Sciences, Bratislava, Slovakia* **Elastomeric nanocomposites for advanced application**			*Chairman:* Dr Mohamed M. Chehimi
10.00 - 10.35 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 2** **Pr Filip DU PREZ** *University of Ghent, Belgium* **Vitrimers: Recyclable Thermosets and Composites of the Future?**			*Chairman:* Pr Armand Soldera
10.35 - 11.05	**Photo Group + Poster Session 1 (P 1 - P 28) + Coffee break**			
11.05 - 11.40 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 3** **Pr Hern KIM** *Myongji University, Republic of Korea* **Poly(Ionic Liquids)-Based Functional Materials and Their Applications to Energy and Environmental Issues**			*Chairman:* Pr Hatem Ben Romdhane
Oral Communications - Session 1				
	Room A - *Chairman: Pr Dimitrios N. Bikiaris*		**Room B -** *Chairman: Dr Marc Delgado Aguilar*	
	Com.	*communicating*	*Com.*	*Communicating*
11.45 - 12.00	OC-01 A	Khouloud BAATOUT	OC-01 B	Mariam KESKES
12.00 - 12.15	OC-02 A	Amira KALLEL ELLOUMI	OC-02 B	Valentina SESSINI
12.15 - 12.30	OC-03 A	Zeinab BAATOUT	OC-03 B	Zoi TERZOPOLOU
12.30 - 12.45	OC-04 A	Ouezna HAMOUMA	OC-04 B	Ibtihel AYADI
13.00	***Lunch***			

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Monday 19 March 2018 (afternoon)				
15.00 - 15.35 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 4** **Pr Saber CHATTI** *INRAP - Sidi Thabet, Tunisia* **New polymeric systems based on 1,4-3,6-danhyrdohexitols for pollutant adsorption**			*Chairman:* Pr Adel Megriche
15.35 - 16.10 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 5** **Dr Marc DELGADO AGUILAR** *University of Girona, Spain* **Super porous nanocellulose-based structures: Development of highly selective and absorbent bio-based devices**			*Chairman:* Pr Sami Boufi
Oral Communications - Session 2				
	Room A - *Chairman: Pr M. Atilla Tasdelen*		**Room B -** *Chairman: Dr Tobias Robert*	
	Com.	*communicating*	*Com.*	*Communicating*
16.15 - 16.30	OC-05 A	Regis MERCIER	OC-05 B	Sabrine HANANA
16.30 - 16.45	OC-06 A	Omaima ANAYA	OC-06 B	Khaled LAABIDI
16.45 - 17.00	OC-07 A	Achref JEBNOUNI	OC-07 B	Antonio GARCIA CONTRERAS
17.00 - 17.15	OC-08 A	Mokhtar DARDOURI	OC-08 B	Raymond HAJJ
17.15 - 17.45	**Coffee break**			
Oral Communications - Session 3				
	Room A - *Chairman: Pr Ridha BEN Salem*		**Room B -** *Chairman: Pr Nizar Bellakhal*	
	Com.	*communicating*	*Com.*	*Communicating*
17.50 - 18.05	OC-9 A	Amal BELAIDI	OC-09 B	Hatem BESROUR
18.05 – 18.20	OC-10 A	Asma SAAIDIA	OC-10 B	Ahmed EL AFERNI
18.20 – 18h35	OC-11 A	Zaïneb AOUISSI	OC-11 B	Marwa KAMLI
19.30	***Dinner***			
21.30 – 22.30	**Roundtable on "Chemistry Africa"** (Open to all participants) **The new journal of the Tunisian Chemical Society Edited by Springer** *Moderated by :* **Dr Nabil Khelifi** - Senior Editor Manager of Springer MENA Program Springer, Germany **Dr Mohamed Mehdi CHEHIMI** - Executive Editor-in-Chief of Chemistry Africa			

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Tuesday 20 March 2018 (Morning)		
09.00 - 09.35 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 6 Pr Elisabetta RANUCCI** *Università degli Studi di Milano, Italy* **Recent Results On Polyamidoamine Chemistry And Applications**	*Chairman:* Pr Farhat Rezgui
09.35 - 10.10 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 7 Pr Jean-François GERARD** *University of Lyon, France* **Thermo-Reversible Interfaces Based On Diels-Alder Reactions In Carbon Fiber / Epoxy Composite Materials**	*Chairman:* Pr Mohamed Jaziri
10.10 - 10.50	**Poster Session 2 (P 29 - P 56) + Coffee break**	
10.55 - 11.30 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 8 Dr Tobias ROBERT** *Fraunhofer Institute for Wood Research, Braunschweig, Germany* **Itaconic Acid as Renewable Building Block for Unsaturated Polyesters**	*Chairman:* Pr Majdi Abid

Oral Communications - Session 4

	Room A - *Chairman: Pr Hatem Majdoub*		**Room B -** *Chairman: Dr Régis Mercier*	
	Com.	*communicating*	*Com.*	*Communicating*
11.35 - 11.50	OC-12 A	Wafa GRATI	OC-12 B	Ismail TAS
12.05 – 12.20	OC-13 A	Yesmine FOURATI	OC-13 B	Mohamed NAOUS
12.20 - 12.35	OC-14 A	Abdelkader LABIDI	OC-14 B	Eya BEN KHALIFA
12.35 - 12.50	OC-15 A	Meriem MIHOUB	OC-15 B	Fatma MONCER
12.50 – 13.05	OC-16 A	Abdelqader IMRAGAA	OC-16 B	Ali ZAZOUA

13.15	***Lunch***
14.30	***Afternoon off*** ***Social event for the foreign participants*** ***Excursion to some touristic Area***
17.30 - 18.30	**Workshop Dr Nabil KHELIFI** *Springer, Germany* **How to get your Manuscript Published in a Scientific Journal: Tips and Hints**
20.30	***Dinner Buffet***

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Wednesday 21 March 2018 (Morning)					
09.00 - 09.35 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 9 Pr Dimitrios N. BIKIARIS** *Aristotle University of Thessaloniki, Greece* **Poly(ethylene-2,5-furanoate) (PEF): The revolution In packaging materials. Is it possible its industrial production ?**				*Chairman:* Pr Mustapha Majdoub
09.35 - 10.10 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 10 Pr Mehmet Atilla TASDELEN** *University of Yalova, Turkey* **Polymer nanocomposites via click chemistry reactions**				*Chairman:* Pr Oral Ayhan
10.10 - 10.40	**Poster Session 3 (P 57 - P 84) + Coffee break**				
Oral Communications - Session 5					
	Room A - *Chairman: Dr Mohamed M. Chehimi*		**Room B -** *Chairman: Pr Elisabetta Ranucci*		
	Com.	*communicating*	*Com.*	*Communicating*	
10.45 - 11.00	OC-17 A	Gülen TÜRKER	OC-17 B	Jenny ALONGI	
11.00 - 11.15	OC-18 A	Yalçin COSKUN	OC-18 B	Roland EL HAGE	
11.15 - 11.30	OC-19 A	Imen KACEM	OC-19 B	Hanen MAHJOUBI	
11.30 - 11.45	OC-20 A	Jawhar HAFSA	OC-20 B	Ayhan ORAL	
11.45 – 12.00	OC-21 A	Yosra BEN SALEM	OC-21 B	Imen ABDELHEDI MILADI	
12.05 - 12.40 *(30 mn speech + 5 mn discussion)*	**Plenary Lecture 11 Pr Armand SOLDERA** *University of Sherbrooke, Canada* **Multi-scale approach for the design of polymers**				*Chairman:* Pr Mária Omastová
12.45	**Awards Distribution, Closing Remarks**				
13.00	***Lunch and check out***				

Speakers' Abstracts

Mária OMASTOVÁ

Polymer Institute, Slovak Academy of Sciences
Dúbravská cesta
Bratislava, Slovakia

Mária Omastová, PhD., D.Sc., received Ph.D. in macromolecular chemistry in 1993 from the Polymer Institute Slovak Academy of Sciences (PI SAS) in Bratislava, and D.Sc. in 2009. After postdoctoral tenure at the Leibniz Institute of Polymer Research Dresden, Germany, she joined the Department of Composite Thermoplastic of PI SAS as research fellow.

Her research interests are focused on conducting polymers, conductive polymeric micro- and nano-composites, their application as sensors and actuators, modification of carbon-based nanofillers, surface and interphase characterization of polymeric, organic and inorganic materials by X- ray photoelectron spectroscopy, etc.

She published about 140 peer-reviewed papers, and 6 book chapters, which are cited more than 2700 times.

M. Omastová is now head of Department of Composite Materials at PI SAS. She has been principal investigator of 10 national projects, and many bilateral and multilateral projects, COST projects, and principal investigator for PI SAS of European project FP7 and Horizon 2020. She has chaired several international conferences and is a usual reviewer in reputable scientific journals.

Elastomeric nanocomposites for advanced application

Mária Omastová

Polymer Institute, Slovak Academy of Sciences, Dúbravská cesta 9, 845 41 Bratislava, Slovakia

Polymer nanocomposites with carbon based fillers having at least one dimension in the nanometre range represent a new class of materials with significantly improved properties when compare to conventional polymeric composites. Carbon nanotubes (CNT) have unique properties and are attractive building blocks for the development of novel polymer/ nanocomposite materials with enhanced functionality. One example of such nanocomposite materials are sensors, as elastomer/CNT based gas sensors [1]. Nanocomposites using styrene butadiene rubber (SBR) as the polymeric matrix and two types of carbon nanofillers, carbon black (CB) and multiwall carbon nanotubes were prepared. The ability of SBR/CB and SBR/ CNT composites to act as sensors for three organic gases, toluene, THF, and n -hexane, by the changing of their electrical properties was studied. The degree and rate of response depends on filler type and concentration, type of analyte, and analyte concentration. Response of SBR/CB composites to the presence of all three studied gases compared to SBR/CNT composites was much faster. When polymeric matrices start to swell, the disconnection of smaller CB particles can occur much faster than in case of long cylindrical CNT particles [1].

The application of polymer/CNT nanocomposites as actuators will be discussed in the second part of the contribution. The photomechanical actuation is preferred to electromechanical transduction due to the following reasons: wireless actuation, low noise, easy scaling up and down. Dimensional changes in polymers can happen reversibly, dependently on intensity and time of illumination with light. Nanocomposites based on ethylene-vinylacetate copolymer (EVA) and various amount of modified CNT were prepared by solution casting and tested as actuators. To improve the dispersion of carbon nanotubes within the EVA polymeric matrix, pyrene-based compatibilizer was used [2]. The photo-actuation behaviour of Braille element prepared from nanocomposite was investigated by the Scanning electron microscopy. An expansion was detected upon illumination of the Braille element. The photo-actuation measurements of the stretched nanocomposites in the form of strips containing different amounts of CNT were performed using LED as light source and dynamical mechanical analysis. Actuation of composites depends on sample preparation. Results confirmed bimodal actuation of nanocomposites prepared on the base of elastomer as EVA and well dispersed CNT [2,3]. Nanocomposites exhibit stability along several cycles maintaining the reversible photo-actuation behaviour, showing high potential for the fabrication of small actuators and devices.

Currently, polymer composite containing carbon nanofillers are used different fields including transportation, automotive, aerospace, defence, sporting goods, energy, and other sectors. Such wide range applications of these nanocomposites are due to their high durability light weight, design and processability.

ACKNOWLEDGMENTS

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REFERENCES

[1] Tabačiarová J., Krajci J., Pionteck J., Omastová M., Mičušik M., Macromol. Chem. Phys., 217, 1149 (2016).

[2] Czaniková K., Torras N., Esteve J., Krupa I., Kasák P., Chodák I., Omastová M.: Sens Actuators, B *186*, 701 (2013).

[3] Winter A.D., Czaniková K., Larios E., Vishnyakov V., Jaye C., Fischer D.A., Omastová M., Campo E., J. Phys. Chem. C 119,20091(2015).

Filip DU PREZ

Centre of Macromolecular Chemistry (CMaC)
Department of Organic and Macromolecular Chemistry
Krijgslaan, Belgium

Since 1999, Prof. Filip Du Prez is heading the Polymer Chemistry Research group (PCR) in which currently 25 researchers focus on the development of new polymer structures, exploration of powerful polymer functionalization methods and the design of polymer materials for high-value applications.

The three main PCR research themes are:

1) 'From polymer functionalization to absolute control'
2) 'Dynamic and self-healing polymeric materials'
3) 'Giving renewable polymers function(ality)'.

A couple of actual topics are sequence controlled polymers, vitrimers, novel click chemistries in macromolecular science, functional polymers from renewable resources and self-healing polymers.

This research resulted in about 250 A1 publications (more than 6700 citations, h-index 44), more than 10 book chapters, 11 patent applications and more than 20 (inter)national awards for the PCR-coworkers in the last 5 years. In 2014, he received the UGent Prometheus research award for several groundbreaking contributions to research in polymer science. He is promotor-coordinator of the UGent Chemtech valorization consortium, including 2 business developers, that takes care of the interface between chemistry research at UGent and the industry. In 2008, he had a Visiting Professor position at the CAMD Research Centre (UNSW, Sydney). In the same year, he became editor of the European Polymer Journal. Since 2016, he is the representative of the Belgian Polymer Group in the European Polymer Federation (EPF).

Vitrimers: Recyclable Thermosets and Composites of the Future?

Filip Du Prez, Johan Winne

Polymer Chemistry Research Group, Centre of Macromolecular Chemistry (CMaC), Department of Organic and Macromolecular Chemistry, Krijgslaan 281 S4, Belgium

Most covalent adaptable networks (CANs) give highly interesting properties for material processing such as reshaping, recycling and repairing. Classical thermally reversible chemical cross-links allow for a heat- triggered switch between materials that behave as insoluble cured resins, and liquid thermoplastic materials, through a fully reversible sol-gel transition. In 2011, a new class of materials, coined vitrimers[1,2], was introduced, which extended the realm of adaptable organic polymer networks. Such materials have the remarkable property that they can be thermally processed in a liquid state without losing network integrity. This feature renders the materials processable like vitreous glass, without the need of molds or precise temperature control.

In this presentation, first vitrimers based on transamination of vinylogous urethanes will be presented[3]. These urethane-like chemical moieties emerge as interesting bonds for building vitrimers as they combine chemical robustness with rapid exchange kinetics.

We show on model compounds that the exchange reactions is swift in a favorable temperature window and can even be fine-tuned by the presence of simple acids or base additives[4]. Next, different kind of cross-linked materials, ranging from flexible elastomers to rigid thermosets and composites, were made from bulk chemicals. These materials behave at room temperature as classical thermosets but become processable when heated as evidenced by stress-relaxation experiments. In addition, the networks are recyclable many times by consecutive grinding/compression molding cycles without significant mechanical or chemical degradation.

In a second part of the presentation, we report poly(thioether) networks, prepared through a straightforward thiol−ene photopolymerization, that can be turned into catalyst-free vitrimer materials by partial alkylation of the thioethers (1−10%) to the corresponding trialkylsulfonium salts.[5]

References

(1) Montarnal, D.; Capelot, M.; Tournilhac, F.; Leibler, L. **Science** 2011, 334, 965.
(2) Denissen, W.; Winne, J. M.; Du Prez, F. E. **Chem. Sci** 2016, 7, 30.
(3) Denissen, W.; Rivero, G.; Nicolaÿ, R.; Leibler, L.; Winne, J. M.; Du Prez, F. E. **Adv. Funct. Mater.** 2015, 25, 2451.
(4) Denissen, W.; Droesbeke, M.; Nicolaÿ, R.; Leibler, L.; Winne, J.; Du Prez, F. **Nat. Comm.** 2017, 8, 14857.
(5) Hendriks, B.; Winne J.; Du Prez F., **ACS Macrolett.** 2017, 7, 930.

Hern KIM

Department of Energy Science and Technology
Smart Living Innovation Technology Center
Myongji University, South Korea

Dr. Hern Kim is currently a professor of Energy Science and Technology at Myongji University, South Korea. He received his BSc (1982) and MSc (1984) of Chemical Engineering from Seoul National University and PhD (1991) of Chemical Engineering from University of Houston, U.S.A. He is the director of both Smart Living Innovation Technology Center and CCS Innovation Technology Center. His research interests are focused on fundamental aspects and applications of advanced materials including inorganic-organic hybrid nanomaterials, nanofibers, membranes, ionic liquids, (electro-/photo-) catalysts, stimuli-responsive materials which can be used for biorefinery, smart windows, CO2 capture/storage/conversion/ utilization, electrochemical sensors, battery/supercapacitor, water splitting, separation processes, and so on. He has published over 140 papers since 2007 in SCI Indexed journals.

Poly(Ionic Liquids)-Based Functional Materials and Their Applications to Energy and Environmental Issues

Hern Kim

Department of Energy Science and Technology, Smart Living Innovation Technology Center, Myongji University, South Korea

In the last decade, ionic liquids (ILs), having remarkable properties, have been regarded as highly potent materials for energy storage and energy conversion applications specifically in the electrochemical field. Currently, the use of ionic liquids as electrolytes is improving the performance, speed, cyclability and long term stability of various electrochemical devices. However, ionic liquid-based electrolytes are intrinsically liquids and still present some drawbacks that are difficult to overcome, such as the need of thorough encapsulation due to leakage. In those cases, solid or quasi-solid electrolytes such as polymer electrolytes have important advantages including mechanical stability, safety and simple processing. Lately, the combination of polymers with ionic liquids has emerged as a hot topic in the field of polymer science in general and in the field of polymer electrolytes in particular. Poly (ionic liquid)s (PILs) have stirred great interest in the fields of polymer chemistry and materials science, not only because of the combination of the unique properties of ILs with the macromolecular architecture, but also a matter of creating new properties and functions. PILs refer to special type of polyelectrolytes which carry an IL species in each of the repeating units. Thus, the cationic or anionic centers are constrained to the repeating units in the polymer chain. It is worth noting that although ILs are generally in liquid state near room temperature, PILs are in fact solid in most cases, except a couple of exceptions. However, despite their remarkable versatility, PILs are still limited in terms of their application in electrochemical devices due to their ionic conductivity. Currently synthesized PILs possess a solid state conductivity in the order of 10^{-5} to 10^{-11} S/cm. To date, the maximum solid state conductivity measured in dry conditions for thoroughly purified PIL having high molecular mass is around 7×10^{-5} S/cm at 30^{o}C.

Main-chain poly(ionic liquid)s based on 1,2,3-triazole with pentaoxyethylene spacer was developed via copper-catalyzed alkyne-azide cycloaddition (CuAAC) of a novel azide/alkyne-terminal monomer and subsequently quaternized by alkyl halides followed by anion exchanges with several fluorinated salts. Introduction of the extended ethylene oxide fragments [–$(CH_2CH_2O)_5$–] has made this new PIL with methyl substituent and bis(trifluoromethane)sulfonimide counteranion exhibit ionic conductivity of 1.16×10^{-4} S/cm at 30^{o}C. This new electrolyte efficiently switches an electrochromic device (ECD) with 18% optical contrast from its transparent state to a colored state in 4.75 sec and while bleaching takes 11.8 sec. The development of this polyelectrolyte with simple structure and excellent physical and thermal properties is promising for the design of new all-solid state energy efficient smart windows and devices and other electrochemical device applications.

Saber CHATTI

Institut National de Recherche et d'Analyse Physico-chimique
Technopole de Sidi Thabet
Sidi Thabet, Tunisie

Saber CHATTI received his PhD in macromolecular chemistry in 2001 at the University Paris South - Orsay (Paris XI) after working on the valorization of biomass derivatives by the synthesis of biomaterials under microwaves irradiations.

He undertook two years (2002-2003) of postdoctoral position with Prof. Hans R. Kricheldorf (University of Hamburg, Germany) sponsored by the Alexander von Humboldt Foundation in Bonn.

In 2004 he was appointed assistant professor at the National Institute of Physical Chemical Analysis in Tunis and professor in November 2013 at the same institute.

In June 2012, he received a graduate fellowship for 5 years from the CNRS in France to elaborate and characterize new materials in order to extract a large varieties of molecules of interest in water and soil such as : Glyphosate, Atrazines, polyphenols, aliphatic acids,… and also the synthesis and characterization of several biopolymers from sugar diols (1,4:3-6-Dianhydrohexitols) such as polyethers, polycarbonates, polyesters, polyether-sulfones and polyetherketones.

New Polymeric Systems based on 1,4-3,6-Danhrdohexitols For Pollutant Adsorption

Saber CHATTI

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We have elaborated and characterized several polymers based on biosourced monomers (1,4-3,6-dianhydrohexitols and its derivatives) mainly by polycondensation (1-3). However, we have shown that many polymers, based on these chiral diols, have high efficiency capacity adsorption of polar pollutants (glyphosate, atrazines, amphetamines, polyphenols, chlorophenols…). present in waters and soils (4). In addition we have demonstrated that our polymers have a very good miscibility with various silicone oils. In this case, we have obtained new crosslinked systems with new adsorption properties, more thermostable (Tg ≥ 300 ° C) and good adhesion on silica gel. The thermal stabilities of these semi interpenetrating networks based silicon and aromatic/heterocyclic polymers from 1,4 -3,6-dianhydrohexitols seem very promising, specially efficiency on SPE,SBSE, SPME applications (5).

References:

1- Saber Chatti; Moez A. Hani; K. Borhorst ; Hans R. Kricheldorf. (2009) Poly(ether-sulfone) of Isosorbide, Isomannide and Isoidide. High Performance Polymers Journal, 21, 105-118, 2009.
2- Hana Ben Abderrazak, Aurélie Fildier, Hatem Ben Romdhane, Saber Chatti, Hans R. Kricheldorf (2013).Synthesis of new poly(ether-ketone)s derived from bio-based diols. Macromolecular Chemistry and Physics, 214, 1423-1433, 2013.
3- Saber Chatti, Steffen M. Weidner, Aurélie Fildier, Hans R. Kricheldorf (2013). Copolyesters of isosorbide, Succinic Acid and isophthalic Acids-Biodegradable, High Tg Engineering Plastics. Journal of Polymer Science Part A: Polymer Chemistry, 51, 2464-2471, 2013.
4- Aurélie Cortéjade, Audrey Buleté, Laura Prouteau, Saber Chatti, Cécile Cren, Emmanuelle Vulliet (2017). Development and optimisation of home-made stir bar sorptive extraction for analysis of plastic additives: application in human urine. Analytical Methods, 23, 2017.
5- Saber Chatti, Hervé Casabianca, Régis Mercier (2017). Using polymers based from 1,4 :3,6-dianhdrohexitols for the adsorption of chemical substances in water. Patent under examination (submitted 12/2017- B2634FR00).

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Marc Delgado-Aguilar is docent and researcher at University of Girona, in Spain. He received his PhD in Chemical Engineering in 2015. He has participated in several committees and more than 50 international and national conferences as oral and invited speaker. Although his short age, his work has been already attributed directly to 50 publications in indexed journals (mostly Q1) since 2015. His research interests include production, characterization and applications of nanostructured cellulose, papermaking, natural fiber reinforced thermoplastics based composites, nanocomposites, wood-based composites, life cycle assessment, nanocellulose-based hydrogels and aerogels, among others. He has chaired several international conferences and is an usual reviewer in reputable scientific journals.

Dr. Delgado-Aguilar is currently the Spanish Coordinator of an Ibero-American network (NANOCELIA) which aims at developing industrially feasible methodologies for cellulose nanofibers production and exploring novel applications and opportunities for this nanostructured bio-based and biodegradable material.

Super porous nanocellulose-based structures: Development of highly selective and absorbent bio-based devices

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Cellulose nanofibers (CNF) are becoming a topic of great interest, not only for research community, but also for several companies that are currently investing on the development of highly efficient production systems. The most reported applications are usually related to papermaking, rheology modifiers and transparent membranes for printed electronics. CNF are interesting due to their huge specific surface, high mechanical properties and their capability to be chemically functionalized for a wide range of purposes and applications. Usually, CNF are produced in water due to the hydrophilic character of cellulose. If this water is properly removed, interesting dry 3D structures can be created by means of freeze-drying, receiving the name of aerogels. This aerogels usually present a porosity between 95 and 99 %, exhibiting a huge and available surface to absorb and adsorb substances. In this work, cellulose nanofibers were produced by means of TEMPO-mediated oxidation, enzymatic hydrolysis and fully mechanical methods to produce nanocellulose-based aerogels. These aerogels were properly modified in different ways, including esterification and ionic crosslinking. On the one hand, aerogels were modified with alkyl ketene dimer (AKD) to partially hydrophobize their surface. For this, an experimental batch of 24 aerogels was prepared, including the three types of CNF and eight modification degrees. The obtained aerogels were characterized in terms of morphology, hydrophilicity and water-oil absorption capacity under static and dynamic conditions, as well as their suitability for recycling and reuse for selective oil removal. The results showed that it is possible to obtain 3D-structured aerogels with a high oil absorption capacity by a simple and presumably low-cost methodology. On the other hand, ionic crosslinking based on the incorporation of $CaCl_2$ and $AlCl_3$ was investigated. In this case, dimensional stability in water, compression strength and water retention capacity were studied, showing that it is possible to obtain highly stable aerogels with good water absorption capacity. Overall, this presentation will show several ways of creating nanocellulose-based functional structures for different purposes, as well as the main findings and perspectives for the future markets and applications.

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Elisabetta Ranucci is Full Professor in Industrial Chemistry at the University of Milan, where she teaches classes of Polymer Chemistry. She gained her doctor degree in Chemistry at the University of Pisa. From 1998 to 2001 she was visiting Professor at the Kunglig Tekniska Högskolan - KTH, Stockholm, Department of Polymer Technology, where in 2001 was appointed as “Docent”- in Polymer Technology by an international jury.

Her research interests focus on:

- Synthesis of chiral polymers for molecular recognistion. Polymer self-assembly.
- Polymers for biotechnological applications: bioactive, biodegradable and biocompatible polymers with antiviral and antimalarial activity; hydrogels as scaffolds for tissue engineering applications.
- Decoration and stabilization of inorganic nanoparticles with bioactive polymers.
- Multifunctional composite resins for the absorption of inorganic and organic pollutants from wastewater.
- Bioinspired polymers with flame-retardant activity.
- Polymers from renewable sources.

She has published more than 130 papers and filed 16 original patent applications. Her current h-index (Scopus) is 28.

From 2009 to 2016 she has acted as external referee of Start Grant and Consolidator Applications, European Research Council calls.

Recent results on polyamidoamine chemistry and applications

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Linear polyamidoamines (PAAs) are a well-known family of synthetic polymers that can be designed to be water soluble, biocompatible and biodegradable. PAAs promote the intracellular trafficking of biologically active substances, including DNA[1] and proteins,[2] and imaging probes.[3] In addition, they have proven to be able to target antimalarial drugs to *Plasmodium*,[4] to act as broad-spectrum polymeric antivirals[5] as well as substrates for primary neural cell culturing.[6] PAAs are normally obtained by a facile synthetic process involving the polyaddition of *prim*- or *sec*-amines to bisacrylamides in water, at room temperature and in the absence of catalysts. By using α-amino acids as monomers, polyamidoaminoacids (PAACs) are obtained. PAACs maintain the chirality and the amphoteric properties of the starting monomers. A PAAC obtained from the reaction of L -arginine and N,N'-methylenebisacrylamide proved highly citycompatible. Cell internalization studies demonstrated its preferential localization in the perinuclear region. L- and D-ARGO7 stereoisomers exhibited mirror-like pH-dependent circular dichroism spectra in the 200-340 nm region with maximum values at 280 nm and strong absorption at pH>6.5.[7] ARGO7 polymers let envisage a potential for stereochemical-governed intracellular localization and interactions with biocell components.
Cross-linked PAAs absorb large amounts of water forming hydrogels. Tubular PAA hydrogel conduits that were implanted in rats sciatic promoted sciatic nerve regeneration with good histological morphology and functional recovery, and complete reabsorption with no evidence of local inflammation.[8] Composites hydrogels based on PAA matrices reinforced with PLLA mamebranes combined the biomimetic properties and softness of the surface-exposed PAA hydrogels with the strength of PLLA mats and successfully support short-term self-renewal of hPSCs stem cells.[9]

References

1. R. Cavalli, A. Bisazza, R. Sessa, L. Primo, F. Fenili, A. Manfredi, E. Ranucci, P. Ferruti *Biomacromolecules* **2010**, *11*, 2667.
2. S.C. Richardson, N. G. Pattrick, Y. K. Man, P. Ferruti, R. Duncan *Biomacromolecules* **2001**, *2*, 1023.
3. D. Maggioni, M. Galli, L. D'Alfonso, D. Inverso, M. V. Dozzi, L. Sironi, M. Iannacone, M. Collini, P. Ferruti, E. Ranucci, G. D'Alfonso *Inorg. Chem*. **2015**, *54*, 544.
4. P. Urbán, J. J. Valle-Delgado, N. Mauro, J. Marques, A. Manfredi, M. Rottmann, E. Ranucci, P. Ferruti, X. Fernàndez-Busquets *J. Contr. Release* **2014**, *177*, 84.
5. N. Mauro, P. Ferruti, E. Ranucci, A. Manfredi, A. Berzi, M. Clerici, V. Cagno, D. Lembo, A. Palmioli, S Sattin Sci. Rep. **2016**, 6:33393 | DOI: 10.1038/srep33393.
6. N. Tonna, F. Bianco, M. Matteoli, C. Cagnoli, F. Antonucci, A. Manfredi, N. Mauro, E. Ranucci, P. Ferruti, *Sci. Technol. Adv. Mater.* **2014**, *15*, 045007.
7. A. Manfredi, N. Mauro, A. Terenzi, J. Alongi, F. Lazzari, F. Ganazzoli, G. Raffaini, E. Ranucci, P. Ferruti *ACS Macro Lett.* **2017**, 6, 987−991.
8. V. Magnaghi, V. Conte, P. Procacci, G. Pivato, P. Cortese, E. Cavalli, G. Pajardi, E. Ranucci, F. Fenili, A. Manfredi, P. Ferruti *J. Biomed. Mat. Res. A* **2011**, *98A*, 19-30.
9. C. Gualandi, N. Bloise, N. Mauro, P. Ferruti, A. Manfredi, M. Sampaolesi, A. Liguori, R. Laurita, M. Gherardi, V. Colombo, L. Visai, M. L. Focarete, E. Ranucci *Macromol. Biosci*. **2016**, *16*, 1533−1544.

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Jean-François Gérard was graduated as MsC from Department of Materials Science, INSA Lyon, and Université St Etienne in 1980. He obtained his PhD degree in Macromolecular Materials Science from INSA Lyon in 1985 for a research dedicated to the synthesis and characterization of self-emulsifying zwitterionic polyurethanes sponsored by St Gobain Co. He obtained a Senior Scientist position at CNRS in 1985 within the URA 507/UMR 5627 CNRS laboratory in Lyon. In 1997, he moved from his DR CNRS Senior Scientist position to a full Professor position at INSA Lyon. He has been Head of the Ingénierie des Matériaux Polymères laboratory (UMR 5223 CNRS) from 2001 to 2011, Vice-President for Research of INSA Lyon from 2011 to 2016, and he is now Vice Scientific Director of the Institut de Chimie CNRS. He acted as vice-co-ordinator of the Network of Excellence 'Nanostructured and Functional Polymers and Nanocomposites' from 2004 to 2008 and from 2007, he is the Vice-President of the European Center for Nanostructured Polymers (ECNP). Jean-Francois Gérard is the General Chairman of the European Polymer Federation. His major interests relate to polymer science, i.e. soft mat (polymer networks, supramolecular polymers and interfaces, wettability, colloidal suspensions), nanostructured polymers and nanostructuration processes, nanocomposites, hybrid organic inorganic nanomaterials, (nanoblends, polymer confinement, nanostructuration from oxo-clusters, ionic liquids, nanoparticles, etc), interfaces and interphases in multiphase polymer materials, polymer surfaces, adhesion processes in multiphasic materials, etc. He has published more than 250 original papers, 10 book chapters, and 13 patents and gave more than 170 invited lectures in conferences.

THERMO-REVERSIBLE INTERFACES BASED ON DIELS-ALDER REACTIONS IN CARBON FIBER / EPOXY COMPOSITE MATERIALS

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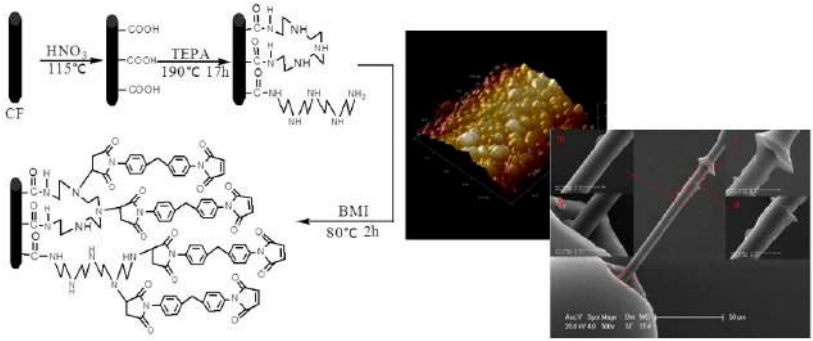
Thermo-reversible Diels-Alder bonds formed between maleimide and furan groups have been generated into the interphase region of carbon fiber based epoxy microcomposites allowing the ability of ensure an interfacial self-healing. The maleimide groups were grafted on untreated ex-PAN carbon fiber surface by combining three steps: *i/* surface oxidization in order to generate reactive carboxylic groups, *ii/* amination with tetraethylenepentamine, and *iii/* grafting of a bismaleimide. The furan groups were introduced by copolymerization of furfuryl glycidyl ether during formation of the epoxy network matrix synthesized from the polyaddition polymerization of the diglycidylether of bisphenol-A and the diisophorone diamine.

The interfacial(phase) behavior was evaluated by considering the single fiber micro-debonding test. By measuring the debonding force of the carbon fiber embedded in an epoxy microdroplet as a function of the embedded length, it was demonstrated that the interfacial shear strength could be very close to the values reported in the literature and that the healing efficiency could be tailored from the grafting conditions, i.e. the density of reactive sites. The interphase with D-A adduct had a repeatable self-healing ability and after the fourth healings, they could recover a relative higher debonding force. Such an approach could be proposed to introduce a new functionality to composite materials based on carbon fibers, i.e. the ability of healing the initial damages occurring at the interface which is the weakest component in such high performance materials.



(a) Protocol for grafting maleimide functional groups at the carbon fiber surface; (b) Atomic Force Microscopy (AFM) of the maleimide-grafted carbon fiber; (c) Scanning Electron Microscopy of the debonded grafted carbon fiber (down left is the slipped epoxy droplet and right up is the remaining meniscus of epoxy matrix on carbon fiber after debonding)

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Tobias Robert received his PhD degree in organic chemistry from the University of Cologne (Germany) in 2010 in the group of Hans-Günther Schmalz. Because of his interest in green chemistry, he then moved to Kingston (Canada) where he worked as a postdoctoral researcher at Queen's University in the groups of Philip Jessop and Michael Cunningham on CO2-switchable polymers for water purification applications. After another postdoctoral stay with Martin Oestreich at the TU Berlin funded by the DAAD (German Academic Exchange Service), he joined the department of Surface Technology of the Fraunhofer-Institute for Wood Research in 2013 as research scientist. His research interests focus on novel bio-based monomers, the development of new renewable polymeric materials for coating and UV-curing applications, and the integrated utilization of biomass waste streams as source of innovative materials.

Itaconic Acid as Renewable Building Block for Unsaturated Polyesters

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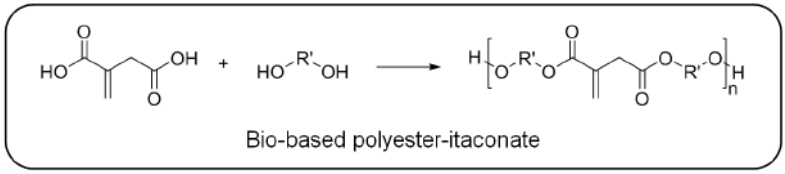
Over the last years itaconic acid has drawn considerable interest as novel and renewable building block for bio-based polymers. It has been used as (co-)monomer in radical polymerization reactions to obtain polyitaconates with different fields of application. However, itaconic acidcan also be used as monomer for unsaturated polyesters. Due to the higher reactivity compared to polyesters derived from maleic acid, these materials can also be used in UV-curing applications and have the potential to be an alternative to polyester acrylates. In addition, by using other bio-based building blocks, such as 1,3-propanediol, it is possible to obtain polymers of this type that are completely derived from renewable resources.
Herein,a series of novel polyester itaconateswill be reported. Furthermore, the challenges associated with the synthesis compared to other (unsaturated) polyesters will be discussed. Finally, real life applications of these materials, such as UV-curing printing inks and wood coatings will be presented.



Bio-based polyester-itaconate

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Dimitrios Bikiaris is a full professor at the Chemistry Department (laboratory of Polymer Chemistry and Technology) of Aristotle University of Thessaloniki. His research interests include the synthesis and characterization of polyesters, polymer composites and nanocomposites, surface modification of nanofillers, synthesis and characterization of copolymers, modification of natural polymers, investigation and application of new biocompatible polymers for tissue engineering and pharmaceutical uses, preparation and study of drug solid dispersions in polymeric matrices and drug nanoencapsulation targeted release using biocompatible polymers, chitosan nanoparticles, IOs nanoparticles and polymer-drug complexation. His work has been attributed directly to 310 publications in international journals, with 9870 citations and h-index 55. He has been the leading project manager and participated to 38 research projects (national, European and international), and has also published 4 book chapters and 15 international patents. His research group consists of more than 15 members and holds strong collaborations with International Universities and Research Centres, Greek Universities and Industrial partners. He has participated in more than 130 international and 40 national conferences, having 80 oral and invited presentations and 190 poster presentations. He served as a reviewer in more than 120 international scientific journals and as an editorial board member of 5 scientific journals. Furthermore, he has participated in reviewing panels of the Hellenic and European Commission (FP7 and Horizon2020) and as evaluator for national research programs in various European countries.

Poly(ethylene-2,5-furanoate) (PEF): The revolution in packaging materials. Is it possible its industrial production?

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Polymers based on 2,5-furandicarboxylic acid (2,5-FDCA), consist a new class of alipharomatic polyesters that can be prepared from monomers derived straight from renewable resources like furfural and hydroxymethylfurfural (HMF). For this reason, this class of materials has recently gained high interest. The historical progress on FDCA-based polyesters is extensively described in literature [1-2]. From these reports, it is clear that poly(ethylene-2,5-furanoate) (PEF), which is the most important polyester of this class, has been known for more than 70 years and that several preparation routes have been followed, in which the effect of temperature, pressure, diacid/diol stoichiometries, catalysts and precursors (di-acid or di-ester) has been evaluated. However, this polymer has not gained any increased interest until recently.

PEF has been recognized as the most important polyester of this series, since it is considered to be a potential alternative to poly(ethylene terephthalate) (PET). This is because PEF has excellent properties compared with PET, especially enhanced gas barrier properties (against O_2 and CO_2) and can replace PET in many applications, especially as food packaging material. PEF can solve many problems and especially the use of additional gas barrier layer of pol(vinyl alcohol) or nylon in bottles and films applications. However, its synthesis and mainly the production of high molecular weight PEF, with high purity and absence of coloration is still under investigation. This is the main problem for its industrial production.

Purity of 2,5-FDCA and metallic catalysts are two of the most important factors with adverse impact on polyester properties and mainly on coloration. Since PEF is expected to overtake the market in the future as a food packaging material, while replacing its fossil-based counterpart PET, the color of PEF and how it is affected by various synthesis parameters is a subject that needs to be extensively studied before its commercialization. The coloration of the 2,5-FDCA based polymers may be caused by 3 reasons: a) sugar-based impurities in the monomer, b) side reactions and especially decarboxylation during synthesis and c) presence of various additives. Catalysts play important role to molecular weight increase but most of them and especially titanate compounds case high coloration.

Even though PEF is not yet commercially available and some products of it are not on the market, extensive research is under consideration to solve its problems associated with coloration, synthesis of materials with high mechanical properties and of high molecular weights.

References.

[1] A. Gandini. Polymer Chemistry 1 (2010) 245-251.
[2] A.F. Sousa, C. Vilela, A.C. Fonseca, M. Matos, C.S.R. Freire, G.-J.M. Gruter, J.F.J. Coelho, A.J.D. Silvestre. Polymer Chemistry 6 (2015) 5961-5983.
[3] Papageorgiou G.Z., Papageorgiou D.G., Terzopoulou Z., Bikiaris D.N. Eur. Polym. J. 83 (2016) 202-229.

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Dr. Mehmet Atilla Tasdelen was born in Gaziantep, Turkey. He completed his primary and secondary education in this town. He was accepted to Chemistry Department of Ege University, Izmir in 1996. After his graduation in 2000, he was accepted as a M.Sc. student to Istanbul Technical University, Polymer Science and Technology Programme. He has received his M.Sc (2002) and Ph.D. degree (2008) under the supervision of Prof. Yusuf Yagci. He also conducted research in Ghent University, Belgium in 2007. He joined Yalova University, Department of Polymer Engineering in July, 2010 as an assistant professor and in February 2013 he was promoted to full associate professor. His research topics focus on the design of functional polymer architectures and polymer materials, photoinitiated cationic and radical polymerization, controlled polymerization techniques, 'click' chemistry and nanocomposites. He is co-author of more than 90 original research papers and several book chapters. Dr. Tasdelen is currently serving as associate editor for Journal of the Turkish Chemical Society, Section A: Chemistry and Chemistry Africa and sitting in the international advisory editorial board of Dutch Journal of Chemical Technology, Designed Monomers and Polymers and Current Applied Polymer Science.

Polymer Nanocomposites via Click Chemistry Reactions

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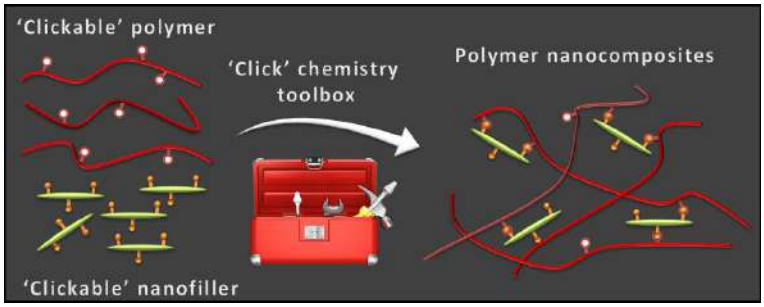
The emerging areas of polymer nanocomposites, as some are already in use in industrial applications and daily commodities, have the potential of offering new technologies with all manner of prominent capabilities. The incorporation of nanomaterials into polymeric matrix provides significant improvements, such as higher mechanical, thermal or electrical properties. In these materials, interface/ interphase of components play a crucial role bringing additional features on the resulting nanocomposites. Among the various preparation strategies of such materials, an appealing strategy relies on the use of click chemistry concept as a multi-purpose toolbox for both fabrication and modulation of the material characteristics (Scheme 1). This review aims to deliver new insights to the researchers of the field by noticing effective click chemistry-based methodologies on the preparation of polymer nanocomposites and their key applications such as optic, biomedical, coatings and sensor. [1]



Scheme 1. Representation of click reactions in polymer nanocomposite fabrication

One of the authors (M.A.T) would like to acknowledge and thank Turkish Academy of Sciences for financial support.

References

[1] M. Arslan, M. A. Tasdelen, Polymers, 2017, 9, 499.

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Armand Soldera is currently a professor at the Université de Sherbrooke (Quebec, Canada), and director of the Quebec Centre for Functional Materials (www.cqmfscience.com). He received a Ph.D. in Molecular Physical Chemistry for his work on liquid crystals from the Université de Strasbourg in France. He was a postdoctoral fellow, first at Université Laval in Québec, Canada, working in polymer and liquid crystal sciences, and at RUG in Groningen, Netherlands working on scattering of polymers. In 1994, he was hired by the French Commissariat à l'Énergie Atomique (CEA) as a research engineer in the military division, where he began to work on molecular simulations of polymers. He joined the Université de Sherbrooke in 2002 as an assistant professor in the chemistry department, became associate professor in 2005, full professor in 2009, and department chair from 2010 to 2016. He founded the Laboratory of Physical Chemistry of Matter (lpcm.recherche.usherbrooke.ca). He was adjunct professor at ISMANS (Le Mans, F.) from 1996 to 2016. His research focuses on the study of the intimate link between micro and macroscopic scales in soft matter (polymers, liquid crystals, and organic glasses). He merges together simulations and experiments following a multi-scale approach.

Multi-scale Approach for the Design of Polymers

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This presentation is an overview of the simulation tools available to assist experimentalists in the design of materials, which therefore implies a molecular understanding of the underlying properties. There is definitively a gap between the traditional experimental approach and the atomistic simulation methodology. While one works with complex systems constituted of polymers whose very structure can be very complex, the other studies ideal systems. The polymers are therein mainly pure homopolymers with low number of defects. The question that will be thus addressed in this presentation is: Is simulation able to tackle problems encountered by polymer scientists, or engineers, from an atomistic viewpoint?

In fact, the link between the micro- and the macro-structures is far from being straightforward. To describe real systems, a series of models with a specific set of rules and restrictions following chemical, physical and thermodynamical guiding principles is required. These models must be chosen accurately to efficiently describe the system of interest. More specifically, each scale needs a certain level of approximation to address the specific problem. To ascertain accuracy of the representation, validation with experiments is a crucial step. To illustrate this intimate link between experiments and simulation in addressing polymer problems, several examples stemming from the Laboratory of Physical-Chemistry of Matter are discussed. These problems stem from the thematic of the lab, or from collaborations with polymer scientists or engineers.

The first part is dedicated to the preparation of the simulated system. Reaching the mechanical equilibrium, as it is experimentally the case, is shown to be the crucial step.[1] To extract efficient conclusions from simulations, a validation step is nevertheless mandatory. As it is shown in the figure below, a linear relationship is demonstrated between simulated and experimental glass transition temperatures for a series of vinylic polymers.[2] Further and more complex simulations can then be fostered, and an understanding of this tricky transition can then be grasped from an atomistic perspective.[3] Finally, examples related to an increase in performance of polyelectrolyte membranes for fuel cells are investigated,[4] with an emphasis on the possible increase in proton conductivity through the shearing of membranes.[5]

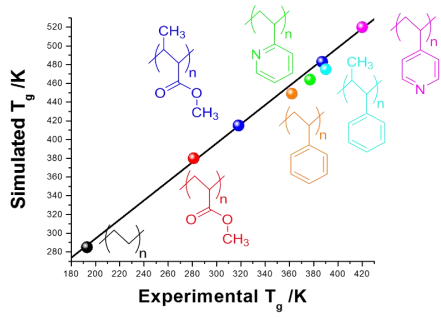

Figure: Simulated and experimental glass transition temperatures for a series of vinylic polymers.

References:

[1] N. Metatla and A. Soldera, Macromol. Theory Simulations **20**, 266 (2011).
[2] A. Soldera and N. Metatla, Phys. Rev. E **74**, 61803 (2006).
[3] F. Godey, A. Fleury, A. Ghoufi, and A. Soldera, J. Comput. Chem. **39**, 255 (2018).
[4] A. Fleury, F. Godey, P. Laflamme, A. Ghoufi, and A. Soldera, Fuel Cells (2016).
[5] N. Metatla, S. Palato, and A. Soldera, Soft Matter **9**, (2013).

Oral Communications' List

(alphabetically authors' name)

Name	Ref
I. Abdelhedi, O. Ben Hassine, R. Mercier, H. Ben Romdhane, S. Chatti *FST - Tunis* Development of new materials derived from polydimethylsiloxane for the extraction of pollutants in wastewater	**OC 21B**
J. Alongi, F. Carosio, P. Ferruti, A. Manfredi, E. Ranucci *Università degli Studi di Milano, Italia* Linear polyamidoamines as novel biocompatible intumescent flame retardants for cotton	**OC 17B**
O. Anaya, I. Abdelhedi Miladi, E. Drockenmuller, H. Ben Romdhane *FST - Tunis* 1,2,3-Triazolium-based linear ionic polyimides: A new candidate of polymer electrolytes	**OC 06A**
Z. Aouissi, H. Mahjoub , T. Othman *FST - Tunis* Study of the complex formation between sodium carboxymethylcellulose and chlorure of hexadecylpyridinium	**OC 11A**
I. Ayadi, W. Dhaoui, S. Contreras, F.O Medina *FST - Tunis* Photodegradation-adsorption of methyl orange on polyaniline/BiOBr composites under simulated solar light irradiation	**OC 04B**
K. Baatout, N. Jaballah, M. Chemli, D. Kreher, M. Majdoub *FSM - Monastir* Fluorescein-containing semi-conducting poly(*p*-phenylenevinylene)s for electronic organic applications	**OC 01A**
Z. Baatout, S. Teka, N. Jaballah, N. Sakly, X. Sun, F. Maurel, M. Majdoub *FSM - Monastir* Green-synthesized cyclodextrin derivatives for humidity detection	**OC 03A**
A. Belaidi, M. Guettari, T. Tajouri *FSB - Bizerte* Gamma radiation effect on the intrinsic viscosity of the polyvinnylpyrrolidone	**OC 09A**
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J. Hafsa, K. Mkadmini Hammi, D. Le Cerf, K. Limem, H. Majdoub, B. Charfeddine *Faculty of medecine, Sousse* Characterization, antioxidant and antiglycation properties of polysaccharides extracted from the medicinal halophyte *Carpobrotus edulis* L	**OC 20A**
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Oral Communications' Abstracts

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Fluorescein-containing semi-conducting poly(*p*-phenylenevinylene)s for electronic organic applications.

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During the last two decades, π-conjugated organic conducting polymers have been attracting great deal of interest due to their suitability for several application fields such as organic light emitting diodes (OLEDs), field effect transistors (FETs), organic photovoltaics (OPVs) and supercapacitors [1,2]. However, the major characteristic of these organic semi-conducting materials is their tuneable optoelectronic properties, benefiting from the richness of the organic synthesis and therefore from an adjustable molecular structure. In this contribution, we describe two new poly (*p*-phenylenevinylene) (PPV)-type semi-conducting polymers containing the fluorescein dye moiety (**P1** and **P2** Figure 1), for organic thin-layer electronic applications.

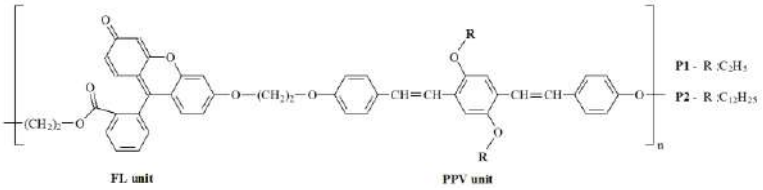

Figure 1: Structures of the FL-containing PPVs

These π-conjugated polymers were soluble in volatile solvents and their macromolecular structures were confirmed by ^{1}H NMR, ^{13}C NMR and FT-IR spectroscopies. They exhibited an amorphous morphology with thermal stability up to 300 °C. These organic materials showed a good film quality and the surface properties of their thin layers were investigated by contact angle measurements. The absorption and photoluminescence properties of these optical active polymers were studied in dilute solutions and as thin films. The results showed semi-conducting materials with an optical gap value less then 3eV for both polymers in dilute solution and in thin film. Also, the fluorescence results show different emissions of the polymers, which vary between blue, green and white, depending on the excitation wavelength of the diluted solutions and thin films.

We also investigated the intramolecular Förster resonant energy transfer (FRET) from PPV π-conjugated segment to fluorescein unit upon UV excitation. The phenomenon of FRET is affected by the length of the side chain on polymers backbone.

The HOMO/LUMO energy levels were evaluated by cyclic voltammetry measurements and it shows a p-type semi-conducting polymers. Single-layer diodes with [indium-tin oxide/ **polymer** /aluminium] configurations have been fabricated and showed relatively low turn-on voltages.

Keywords: Semi-conducting polymer; poly(*p*-phenylenevinylene); organic thin layer; fluorescein dye; photoluminescence; organic diode.

References

[1] F. Massuyeau et al/, Journal of Luminescence 131 (2011) 1541-1544
[2] N. Jaballah, M. Chemli, J.L. Fave, M. Majdoub, Optical Materials 50 (2015) 144-153

Fluorinated Poly(1,2,3-Triazolium Ionic Liquid)s Obtained Through AA + BB Copper(I)-Catalyzed Alkyne-Azide Cycloaddition (CuAAC)

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Poly(ionic liquid)s (PILs) have stirred great interest in the fields of polymer chemistry and material science. The potential of PILs have been demonstrated by numerous examples in various applications such as dye sensitized solar cells, fuel cells, supercapacitors, sensors, electrochromic devices, separation membranes, catalysis, anti-biofouling surfaces and analytical chemistry.[1,2] This is due to their unique properties combining high-thermal stability and high-ionic conductivity. 1,2,3-Triazolium-based poly(ionic liquid)s constitute a broad in scope addition to the PIL family.[3] On the other hand, fluorinated polymers are particularly interesting and attractive compounds because of their versatility and their unique combination of relevant properties especially for their high dielectric constant and the high electrochemical stability. Therefore, developing new TPILs with fluorinated groups appears as a promising approach to obtain the highest possible value of ionic conductivity.

In this work, we describe the synthesis and characterization of series of fluorinated 1,2,3-triazolium-based poly(ionic liquid)s (TPILs) by AA + BB CuAAC cycloaddition followed by N-alkylation of the resulting poly(1,2,3-triazole)s by N-methylbis(trifluoromethylsulfonyl)imide.

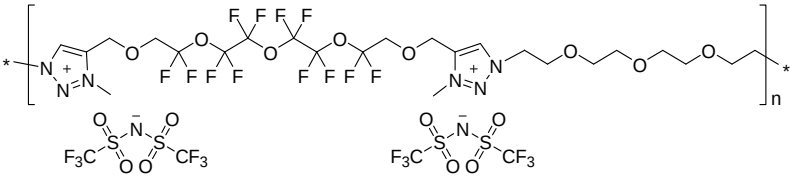

Figure 1 - Example of TPIL conducting material

Keywords: CuAAC, poly(1,2,3-triazolium)s, poly(ionic liquid)s, polyelectrolytes, conducting materials.

References.

[1] J. Taxter; F.Yang, *Chem. Soc. Rev.*, **2017**, 46, 1124-1159.
[2] Detrembleur and al., *ACS Macro Lett*. **2017**, 6, 121−126.
[3] M. M. Obadia; E. Drockenmuller*; Chem. Commun*. **2016**, 52, 2433.

Green-synthesized cyclodextrin derivatives for humidity detection

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The β-cyclodextrin (β-CD) is a bio-sourced macromolecule formed by the cyclic association of seven glucose units giving rise to a conical and rigid structure with hydrophilic exterior and hydrophobic interior [1]. These structural properties support its exploitation in various potential fields such as pharmaceutics, textiles, cosmetics and sensors [2]. However, we have not reached any reports on humidity sensing properties of this cage molecule in QCM-based devices. Indeed, the hydrosolubility of the β-CD limits its use in development of active membrane with good stability under high humidity. Besides, the elaboration of such layer is difficult due to its poor solubility in volatile organic solvents commonly used in processing techniques. To overcome these problems and in order to valorize the bio-sourced macrocyclic molecule in sensor developments, we adopted the chemical modification of the alcohols groups in the β-CD as an approved approach to improve its lipophilicity

Hence, two partially benzylated β-cyclodextrins (β-CDBn$_x$, x = 7 and 14) were prepared via a green and one-pot synthesis in aqueous media. The macromolecular structures were methodically investigated by means of NMR, FT-IR and MALDI-TOF spectroscopies and studied with DFT calculations. The XRD patterns and thermal analyses revealed an amorphous morphology for the benzylated derivatives. The AFM characterization proved good solution-processing characteristics and improved film-forming quality. Contact angle measurements evidenced a systematic increase in the surface hydrophobicity with the benzylation rate.

As a first application, the partially benzylated derivatives were used as sensitive membrane for QCM-based humidity sensor without need of pre-functionalization of QCM surface; the results showed linear response and good sensing characteristics by increasing the RH from 11 to 98% in room temperature. The highest sensitivity was obtained for the β-CDBn$_7$ which exhibited short response and recovery times (15 s and 17 s), good response reproducibility and long-term stability. Therefore, β-CDBn$_7$ could be a promising candidate for the development of low-cost QCM-based sensors.

References

[1] G. Crini, Chem. Rev. 114 (**2014**) 10940-10975.
[2] S. Teka, A. Gaied, N. Jaballah, S. Xiaonan, M. Majdoub, Mater. Res. Bull. 74 (**2015**) 248-257.

Flexible paper@carbon nanotube@polypyrrole electrodes : The synergy of diazonium chemistry and sonopolymerization.

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Flexible supports (paper, textile, PET sheets, elastomers…) have attracted the attention of many researchers recently owing to their low cost and physical and mechanical characteristics. They are used as substrates for conductive polymers and/or Csp² nanomaterials in view of making *e.g.* electronic paper,[1] thermoelectric power generators,[2] sensors,[3] and optothermal actuators.[4]
Herein, cellulosic paper served as support of amino- and sulfonatebenzenediazonium salt-modified multiwalled carbon nanotubes (CNTs). The diazonium functionalization helped to easily disperse the CNTs in water and on the paper strips to provide nano-platforms for sonochemically (US) synthesized polypyrrole (PPy) coating (Fig. 1a-b). 1h sonochemical synthesis provided the highest electrochemical output compared to chemical synthesis (Ch) (Fig. 1d). The SEM image of the film (PPy/CNTs/Paper) showed that the CNT were evenly wrapped with PPy forming core/shell CNT/PPy nanowires (Fig. 1c).

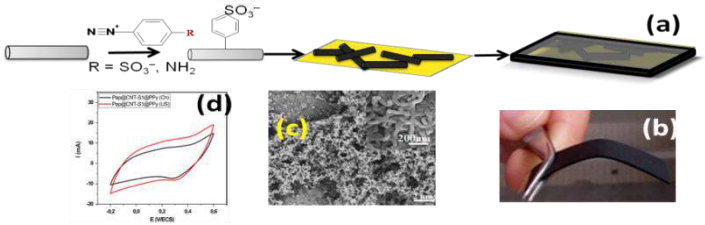

Fig. 1. Synthesis and properties of paper@CNT@PPy strips. (a) General 3 step synthesis, (b) digital photograph and (c) SEM image of the paper electrode at two magnifications, and (d) cyclic voltammetry of paper electrodes prepared by sono and chemical polymerization in H_2SO_4 0.5 M (potential range: −0.2 to +0.6 V/ECS; scan rate =10 mVs^{-1}).

The paper electrodes prepared so far are robust with highly adhering CNT/PPy coatings; they do not crumble even after overnight dipping in water. They could be utilized for electronic devices (e.g. sensors, thermoelectrics, printed electronics).

References

[1] D. Tobjörk, R. Österbacka, Adv. Mater. 23 (2011) 1935-1961.
[2] M. Bharti, A. Singh, S. Samanta, A. K. Debnath, D. K. Aswal, K. P. Muthe, S. C. Gadkari, Energy Convers. Manage. 144 (2017) 143-152.
[3] H. Jia, J. Wang, X. Zhang, Y. Wang, ACS Macro Lett. 3 (2014) 86-90.
[4] K. Czaniková, et al. Sens. Actuat. B Chem. 186 (2013) 701-710.

ADVANCES IN SYNTHESIS OF AROMATIC & HETEROCYCLIC POLYMERS

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In the domain of polymers obtained by polycondensation, the synthesis strategy based on the so called multicomponent reactions (MCR) has recently regain great interest since the early Works in 1970s (1) on the design of polymers via the Mannich réaction. The research Works carried out at present involved other well-known and for some of them old MCRs like Passerini reaction, Ugi reaction and Biginelli reaction (2-3)
In order to broaden the scope of this strategy to, this work evidences the potential of different multi-component reactions for the synthesis of complex aromatic and heterocyclic polymers. On the basis of results obtained from preliminary studies on model compounds, experimental conditions for different multi-component polycondensation processes were established. So specific attention was devoted to one-pot syntheses of polytri(arylimidazole)s(4), polytetra(arylimidazole)s or polypyrazolopyridines via reactions involving 3 or 4 reactants. The chemical structure of these polymers was confirmed by NMR. Most of them display a high Tg and a good thermal stability.

References

1- M. TRAMONTINI, L. ANGIOTINI, N. GHEDINI, Polymer, 29, 771, 1988
2- A. BOUKIS, A. LLEVOT, M.A.R. MEIER, Macromolecular Rapid Communications, 37, 643, 2016
3- A. SEHLINGER, P.K. DANNECKER, O. KREYE, M.A.R. MEIER, Macromolecules, 47, 2774, 2014
4- E. CHAUVEAU, C. MARESTIN, V. MARTIN, R. MERCIER, Polymer, 49, 5209, 2008

1,2,3-Triazolium-based linear ionic polyimides: A new Candidate of polymer electrolytes

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Poly(ionic liquid)s (PILs), i.e. macromolecular analogues of ionic liquids (ILs), ideally combine the best features of ionic liquids (Ils) (e.g. tunable solubility as well as high thermal, chemical, electro-chemical and ion conducting properties…) with those of polymeric materials (e.g. processability, viscoelasticity, adhesion, film-forming properties, and microstructural design). [1]
Rapid advances in the chemistry, physics, and macromolecular architecture of PILs have prompted the development of new polyelectrolytes that have found applications in many fields, such as batteries, supercapacitors, solar cells, environment (water treatment), gas separation, catalysis, microelectronics (transistors, OLEDs), bio-related applications and so on...[2]
1,2,3-Triazolium-based PILs (TPILs) have recently contributed to the development of these polyelectrolytes.[3,4] Their synthesis merges the versatility of step growth polymerization methods with the functional tolerance of CuAAC, the efficient N-alkylation of 1,2,3-triazole rings and the optional ion metathesis.
This work reports the synthesis of a new series of poly(imide-triazolium) via the post-polymerization modification of their precursor poly(imide-triazole)s. These polymers were characterized by ^{1}H-NMR. Their physico-chemical properties were determined by differential scanning calorimetry (DSC), thermogravimetric analysis (TGA) and size exclusion chromatography (SEC). These materials can be considered as new candidates of solid polyelectrolytes for gas separation membranes.

Key words: Poly(ionic liquid), CuAAC, poly(imide-triazole), poly(imide-triazolium)

References:

[1] A. Jourdain, I. Antoniuk, A. Serghei, E. Espuche, E. Drockenmuller, *Polym. Chem.*, **2017**, 8, 5148-5156.
[2] A. S. Shaplov, R. Marcilla, D. Mecerreyes, *Electrochimica Acta*, **2015**, 175, 18-34.
[3] I. Abdelhedi-Miladi,D. Montarnal, M. Obadia, H. Ben Romdhane, E. Drockenmuller, *ACS Macro Lett.*, **2014**, 3, 1187-1190
[4] M. Obadia, E. Drockenmuller, *Chem. Commun.*, **2016**, 52, 2433-2450.

EFFECT OF π-LINKERS ON PHYSICO-CHEMICAL AND ELECTRICAL PROPERTIES OF CONJUGATED SEMI CONDUCTING POLY-2,7- CARBAZOLES.

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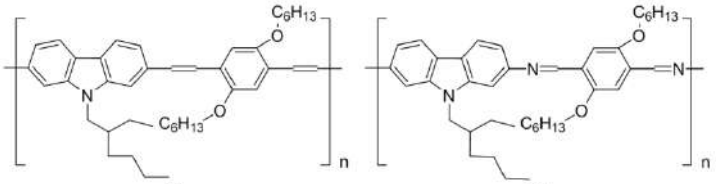
Two new conjugated soluble polymers containing 2,7-disubstituted carbazole and functionalized Hydroquinone moieties in the main chain, were synthesized.



Structures of the polymers P_1 and P_2

The effect of vinylene and azomethine π-linkers on physicochemical and electrical properties of the PPV derivative (**P1**) and the polyazomethine (**P2**) is reported in this work. Differential Scanning Calorimetry analysis showed an amorphous behavior for the two materials and glass transitions at 135°C and 151°C respectively for **P1** and **P2**. The polyazomethine **P2** presents higher thermal stability (407°C) than **P1** (370°C). The measured very weak fluorescence of **P2** was related to the photo-induced electron transfer (PET). The addition of trifluoroacetic acid (TFA) to **P2** revealed a significant hypsochromic effect of the absorption bonds and a turn-on of the fluorescence as well as visual changes. The electrochemical behaviors were investigated by cyclic voltammetry and showed a band gap reduction of **P2** compared to **P1** du to the electron-withdrawing effect the azomethine (–CH=N–) linkers. Finally, the electrical characteristics of the two materials were extracted from single-layer diodes in the space-charge limited current regime (SCLC) and organic field effect transistors (OFETs) demonstrating a total loss of the hole mobilities in the **P2** based thin film devices. The hole effective mobility of **P2** was generated by exposition to TFA vapors.

Keywords: Semi-conducting polymers, Carbazole; π-linkers; Polyazomethine; Photo-induced electron transfer (PET); Organic Field-Effect Transistors (OFET).

Synthesize of new polymers from polystyrene and application in treatment of waste water: Extraction of heavy metals

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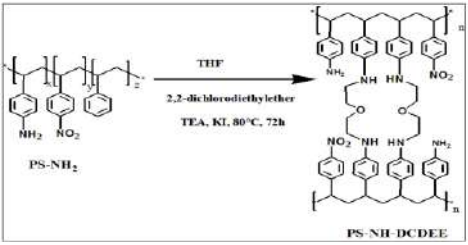
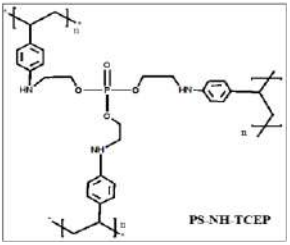
In order to remove heavy metals in wastewater a new structures and selective new extractants led to the development of new series of macromolecules were synthesized and implicated in this domain. Hence, in our present work, the polystyrene was chemically modified to synthesize novel substituted polymers bearing functional groups such as amine [1,2] and organophosphorus. These polymers were subsequently used in the extraction of heavy metals (Cr^{3+}, Fe^{3+}, Ni^{2+}, Cd^{2+} and Pb^{2+}….) from aqueous solutions. The obtained materials were characterized via attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR), elemental analysis (EA), and thermogravimetric (TGA), thermodynamic (DTA), and differential thermogravimetric (DTG) analysis.





Keywords: Polystyrene, chelating groups, ions metallic extraction.

References:

[1] N.L. Lala, T.C. Deivaraj, J.Y. Lee, Auto-deposition of gold on chemically modified polystyrene beads, *Colloids Surf. A* 269 (2005) 119-124.

[2] M. Dardouri, A. Bel Hadj Amor, F. Meganem, Diazabenzo crowns grafted on the polystyrene and application of extraction of metal cations, *Desalination Water Treat.* 57 (2016) 6477-6486.

Gamma Radiation Effect On The Intrinsic Viscosity Of The Polyvinnylpyrrolidone

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The polyvinnylpyrrolidone (PVP) (M_w = 1,3.10^6 g.mol^{-1}) was irradiated in air and at 25°C, by different doses, D , of gamma radiation ranged between 0.8 $kGy$and 5 kGy. The obtained samples were dissolved in deionized water, and different post gamma radiation polymer concentrations were prepared. The freshly prepared solutions were used in a rheological study to determine the gamma irradiation effect on the intrinsic viscosity of irradiated PVP. The variation of the reduced viscosity versus the concentration shows generally two different behaviors separated by a critical concentration: behavior of a polyelectrolyte and neutral polymer for all the dose range. The critical concentration depends mainly on the received dose.

Keywords: gamma radiation, intrinsic viscosity, critical concentration

Interchain interaction effects on the optical properties of excitons in differently substituted conjugated polymers for high efficient solar cells

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The efficiency of the organic photovoltaic cell (OPV) depends critically on the charge generation, recombination, and transport. For highly efficient OPVs, high exciton diffusion length is necessary. In our work, the influence of symmetric alkoxy side chain on exciton diffusion was investigated. We measured exciton diffusion in new poly(1,4-phenylene-ethynylene)-altpoly(1,4-phenylene-vinylene)s (PPE-PPVs) conjugated polymers by the use of Forster mechanism. We find that exciton diffusion length is small side chain symetrie-dependent. We also find that P8/18-8 have le biggest Forster radius since it have the highest PL quantum yield. This shows that small differences in molecular structure can't impact very much on the exciton diffusion as compared with the photoluminescence quantum yield impact.

References

[1] D. A. M. Egbe, G. Adam, A. Pivrikas, A. M. Ramil, E. Birckner, V. Cimrova, H. Hoppe, N. S. Sariciftcia. *J. Mater. Chem.* **20,** 9726-9734 (2010).
[2] F. C. Spano, C. Silva. *Rev. Phys. Chem*. **65**, 477-500 (2014).
[3] M. A. Saidani, A. Ben fredj, S. Romdhane, F. Kouki, H. Bouchriha. *Phys. Rev. B.* **86** (16), 165315 (2012).
[4] N. Bouguerra, A. Růžička, C. Ulbricht, C. Enengl, S. Enengl, V. Pokorná, D. Výprachtický, E. Tordin, R. Aitout, V. Cimrová, and D.A. M. Egbe. *Macromolecules*, 2016, 49 (2), pp 455-464]

Study of the complex formation between sodium carboxymethylcellulose and Chlorure of hexadecylpyridinium

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Dynamic light scattering, viscosity, conductance and fluorescence measurements were carried out in order to examine the polymer-surfactant interaction in mixed solutions of anionic polysaccharide and surfactant. We have studied the influence of (Sodium carboxymethylcellulose (NaCMC)) on the aggregation phenomena of a cationic surfactant (Chlorure d'hexadecylpyridinium). Two characteristic concentrations were investigated: the critical aggregation concentration (cac) and the critical micelle concentration (cmc).
The (cac) have been determined either by conductance or by DLS experiments. The counter-ion condensation behavior of the anionic polymer and the pre-micellar ion-association behavior of the surfactant were investigated.
Critical micellar concentrations (cmc) and related thermodynamic parameters of pure surfactant in aqueous solutions at 5 different temperatures have been also determined.
The results revealed that cmc increases with temperature and at the same time the counter- ion binding β onto the self-aggregated assemblies decreases.
We have also determined the thermodynamic parameters for the system (surfactant-polyelectrolyte) at different temperatures. Analysis by DLS showed an increase in shape of the system around the (cac), an addition of surfactants above cac leads to a decrease in the hydrodynamic radii. At high surfactant concentration, the relative viscosity increases. This can be explained by physical cross-linking of surfactant micelles with NaCMC chains.

Development of composite based on biomaterials for the valorization of agricultural by-products

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This project is interested in the development of new materials belonging to the category of WPC (Wood Polymer Composite) which destined for specific applications, in particular in the sector of packaging. The particularity of the project is that the filler used comes mainly from agricultural by-products, and has a lignocellulosic character. Indeed, the agricultural sector in general and olive oil in particular, plays a preponderant role in the Tunisian economy. This activity causes serious environmental problems. The extraction process of olive oil generates large quantities of solid by-products (olive pomace) and liquids (margines). These by-products have negative impact on the environment, such as clogging of the soil, pollution of surface waters and the release of bad odors. Raising awareness of these impacts has favored research in a perspective of valorization of these residues, in order to convert them into useful substances.
Therefore, this study propose the use of those residues as charge in biodegradable polymer, which is the Mater-Bi NF04P (Novamont, Italy). This polymer origin is at once fossil (PBAT) and biobased (starch). The various formulations, from zero to 25% by weight of filler, were prepared in a twin-screw extruder and analyzed from the point of view of the thermal, mechanical and morphological properties.
The micrographs obtained from the SEM revealed good dispersion of the microparticles and a distribution that appears to be uniform. In addition, there is certain adhesion to the contact of the components (particles / polymer) which has as effect to improve the rigidity of the material in the elastic domain by transmission of stresses, but substantially reduces the mechanical characteristics in the large deformations domain.

Synthesis of Non-Isocyanate Polyurethanes by Reactive Extrusion

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Polyurethanes are some of the most versatile polymers in existence today. Despite its large application, increasing concerns related to its toxicity, moisture sensitivity and sustainability have stimulated the search for alternative synthetic strategies [1]. Non-isocyanate polyurethanes (NIPU) raised industrial and academic research curiosity, since their synthesis is achieved via polyaddition reaction between bis-cyclic carbonates and diamines, enabling the replacement of isocyanates employed in the classical polyurethane (PU) manufacture [2]. During the NIPU formation, hydrogen bonds are created between hydroxyl and carbamate groups, limiting the reactivity. Moreover, due to the rather low reactivity of most cyclic carbonates leading to low molecular weight NIPU, the synthesis often requires elevated temperatures, prolonged reaction times of several hours and the addition of catalysts [3]. In this work, different NIPU were synthetized optimizing the parameters of the reaction between different cyclic carbonate and diamines in solution medium as well as in bulk by reactive extrusion using a twin-screw microcompounder.

References

[1] Cornille A, Michaud G, Simon F, Fouquay S, Auvergne R, Boutevin B, et al. Promising mechanical and adhesive properties of isocyanate-free poly (hydroxyurethane). European Polymer Journal. 2016;84:404-20.
[2] Rokicki G, Parzuchowski PG, Mazurek M. Non-isocyanate polyurethanes: synthesis, properties, and applications. Polymers for Advanced Technologies. 2015;26:707-61.
[3] Delebecq E, Pascault J-P, Boutevin B, Ganachaud Fo. On the versatility of urethane/urea bonds: reversibility, blocked isocyanate, and non-isocyanate polyurethane. Chemical reviews. 2012;113:80-118.

Poly(ε-caprolactone) nanocomposites for tissue engineering applications

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Poly(ε-caprolactone) (PCL) is one of the most important polyesters in tissue engineering, due to its high biocompatibility and biodegradability. However, it is bio-inert, and fillers are essential in order to promote hydroxyapatite formation and bone regeneration [1].

In this work, two types of inorganic nanofillers were incorporated in PCL matrix via the *in situ* polymerization method in various contents (0.5, 1 and 2.5 %wt), and their effect on the thermal, mechanical, structural properties as well on the bioactivity were studied. More specifically, halloysite aluminosilicate clay nanotube (HNTs) and functionalized HNTs with the organosilane aminopropyltriethoxy silane (APTES) were the first type of nanofillers used. The second type of nanofillers were two nanosized bioglasses that were synthesized with hydrothermal methods. The bioglasses used were binary bioglass (bBG) with composition 76% SiO_2 and 24% CaO, and ternary bioglass with composition 76% SiO_2, 14% CaO and 10% P_2O_5.

The synthesized nanocomposites were characterized in terms of dispersion, mechanical and thermal properties, enzymatic degradation, bioactivity, MMT assay and cell viability. It was concluded that PCL nanocomposites are suitable for bone tissue engineering applications, as they were found to be biocompatible, bioactive and able to induce biomineralization.

1. Mkhabela, V. J. & Ray, S. S. Poly(ε-caprolactone) Nanocomposite Scaffolds for Tissue Engineering: A Brief Overview. *J. Nanosci. Nanotechnol*. 14, 535-545 (**2014**).

Photodegradation-Adsorption of Methyl Orange on Polyaniline/BiOBr Composites under Simulated Solar Light Irradiation

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Dyeing industries are major sources of environmental pollution [1]. Photocatalysis is often used as a technique to degrade dyes [2]. Conventionally, inorganic semi-conductors are used as photocatalysts [3, 4].
Recently, nanostructurization of conducting polymers and their composites emerged as a new field of research [5]. The purpose of the present study is to investigate the photocatalytic activity of Polyaniline modified BiOBr (PANI/BiOBr) in removal of methyl orange (MO) from aqueous media. Polyaniline modified BiOBr (PANI/BiOBr) nanocomposites were synthesized by solid state polymerization process at different content of BiOBr which was elaborated via solvothermal method. The as-synthesized BiOBr microspheres, PANI and PANI/BiOBr nanostructures were characterized by XRD, SEM coupled to EDX, TEM, UV–Vis DRS and BET. The application of PANI/BiOBr nanocomposites for the removal of methyl orange (MO) as a typical azo dye from aqueous solution under solar light irradiation were monitored by performing UV-visible spectral studies at different intervals of time. The effects of some operational parameters such as pH, catalyst dosage and initial concentration of MO have been evaluated. The results show that PANI/BiOBr nanostructures exhibit an efficient photocatalytic activity in the decomposition of (MO) which is mainly ascribed to the synergetic effect between polyaniline and BiOBr.

Key words: Conducting polymers, Polyaniline/BiOBr composite, Photocatalysis, Solar light, Adsorption, Degradation.

References

[1] K. Thangavadivel, G. Owensb, K. Okitsu. Removal of Methyl Orange from Aqueous Solution Using a 1.6 MHz Ultrasonic Atomizer. RSC Adv. 2013, 3, 23370−23376.
[2] Y. Zheng, Y. Liu, A. Wang. Kapok Fiber Oriented Polyaniline for Removal of Sulfonated Dyes. Ind. Eng. Chem. Res. 2012, 51, 10079−10087.
[3] Krishnan R., Abegayl T., Csaba J. Photocatalytic Activity of Inorganic Semiconductor Surfaces: Myths, Hype, and Reality. J. Phys. Chem. Lett. 2015, 6 (1), 139-147.
[4] T. Hisatomi, J. Kubota, K. Domen. Recent advances in semiconductors for photocatalytic and photoelectrochemical water splitting. Chem. Soc. Rev. 2014, 43, 7520-7535.
[5] J. Yang, Y. Liu, S. Liu, L. Li, C. Zhang, T. Liu. Conducting polymer composites: material synthesis and applications in electrochemical capacitive energy storage. Mater. Chem. Front. 2017, 1, 251-268.

Accelerated environmental aging process of alfa fibres treated with enzymes

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The plant fibres, used as reinforcement in composite materials, are effectively sensitive to moisture. This affinity for water results in dimensional variations, which can alter the resistance at the interface between the fibres and the matrix, and thus the performance of the composite material [1].
The natural aging process is very long. It is often better to resort to aging laboratory (accelerated aging), which thus reduces the experimental time. The goal of accelerated aging is to predict the natural aging behavior of materials (physical and chemical change [2].
The evaluation of the durability of alfa fibres necessarily requires the use of accelerated aging protocols in order to evaluate the levels of degradation of the fibres over a short period. The fibres used for the aging test are the fibres treated with the enzyme pectinase. These fibres have very interesting mechanical properties. The alfa fibers were immersed in water for more than 30 days at 70 ° C, during which weight loss and mechanical properties were followed respectively by electronic balance and uniaxial tensile tests. It was found later that alfa fibres are very sensitive to changes in temperature and humidity [Fig1].

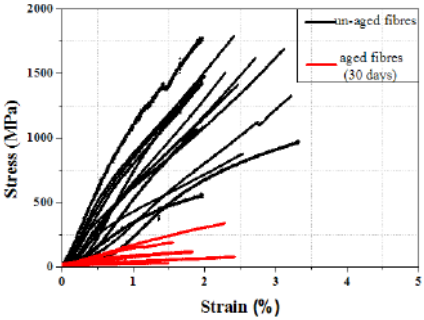

Fig1. Tensile curves of un-aged fibres and aged fibres for 30 days

Key words: Alfa fibres, accelerated aging, mechanicals properties, enzymes

References

[1] Mokhotu T.H, Jacob John M. (2015) Review on hygroscopic aging of cellulose fibres and their biocomposites. *Carbohydrates Polymers* **131**, 337-354.
[2] Scida D., Assarar M., Poîlane C., Ayad R. (2013) Influence of hygrothermal ageing on the damage mechanisms of flax-fibre reinforced epoxy-composite. Composites: Part B 48, 51-58.

Alfa fiber/polypropylene composites: Effect of fiber extraction method on the interfacial adhesion

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Extraction methods improve the adhesion between fibers and matrix in natural fiber reinforced composites due to the removal on non cellulosic materials [1,2]. Moreover, the density and the water uptake can be good indicators of the quality of the interface since the latter can accommodate air and moisture [2]. Alfa fiber/polypropylene composites were manufactured using twin-screw extrusion. The fibers were extracted from stems using alkaline and steam explosion methods. The effect of fiber extraction method on the interfacial adhesion was studied by the means of Fourier Transform Infra Red spectroscopy, density, water uptake and Scanning Electron Microscopy (SEM). The experimental study has shown that the two studied extraction methods were efficient in the removal of the non cellulosic materials and significantly reduced the water uptake of composites evidencing stronger interface. Besides, composites with steam exploded fibers led to higher density and less water uptake than composites with alkaline extracted fibres.

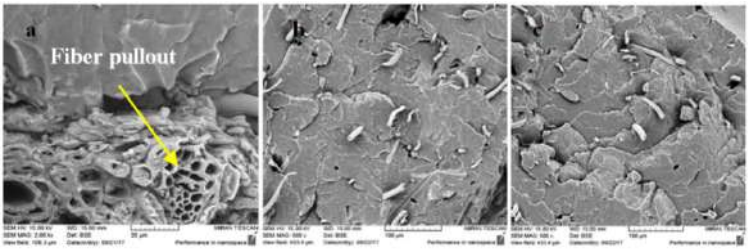

Figure 1. SEM micrographs showing the fracture regions of composites with (a) raw (b) alkaline extracted and (c) steam exploded fibers

Keywords: Alfa fiber; Esparto grass; Polypropylene; Natural fiber composites; Fiber extraction

Reference

1. Paul SA, Joseph K, Mathew GDG, et al. Influence of polarity parameters on the mechanical properties of composites from polypropylene fiber and short banana fiber. *Compos Part A Appl Sci Manuf* 2010; 41: 1380-1387.
2. El-Abbassi FE, Assarar M, Ayad R, et al. Effect of alkali treatment on Alfa fibre as reinforcement for polypropylene based eco-composites: Mechanical behaviour and water ageing. *Compos Struct* 2015; 133: 451-457.

INCORPORATION OF NATURAL ADDITIVES AS THERMAL STABILIZERS IN LOW DENSITY POLYETHYLENE. A POTENTIAL APPLICATION IN FOOD PACKAGING INDUSTRY

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Awareness among the consumers regarding health risks associated with food products is increasing day by day. On this subject, food packaging industry established a separate stream of research devoted to exploring the incorporation of natural molecules aimed to substitute synthetic additives in their formulas.

The present research work validates the potential antioxidant activity of flaxseed Oil (FSO) and the effect of incorporating natural molecules i.e. α-tocopherol and ascorbic acid, on the thermal stabilization of a Low Density Polyethylene (LDPE) for food packaging applications. Three major objectives were defined: 1. FSO selection (different industrial extraction methods), 2. Incorporation of different antioxidant blends into the polymer matrix (LDPE), 3. Thermal stability in multi-extrusion cycles, a comparison analysis with a commercial LDPE grade (control).

UV-Vis Spectrophotometry and Thermogravimetric analysis were performed to evaluate the thermo-oxidative stability of flaxseed oil. Antioxidant incorporation into LDPE was carried out in a 640 mm co-rotating twin extruder. Dynamic thermo-oxidative analyses were performed by Differential Scanning Calorimetry (DSC) and melt flow index (MFI) measurements.

Onset oxidation temperature (OOT) on LDPE stabilized with a tertiary antioxidant blend: FSO/ α-Tocopherol/ Ascorbic Acid after 9 sequential extrusion cycles had shown a better performance (p >0.05) as compared to a commercial LDPE.

Key words: Flaxseed Oil, LDPE, Food Packaging, Extrusion, Onset Oxidation Temperature

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Study of the reactivity of various phosphorous monomers under e-beam radiation to improve the flame retardancy of flax fabrics

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Many natural fibers have been used for a long time in textile industry as cotton and flax [1]. Moreover, natural fibers are getting more importance in composites industry as a substitute for glass, carbon, or aramid fibers [2, 3]. However, they must be modified to overcome some disadvantages such as flammability [4]. In many previous studies [4, 5], phosphorous flame retardants were grafted by e-beam radiation. The P-monomers can be grafted directly on the flax components or can homopolymerize inside the fibers. In the present study, the reactivity of the double bond C=C of the P-monomers was studied to control the grafting yield of various FRs. Phosphorus content reached 1.4 wt% using vinyl phosphonic acid. Grafting efficiency was assessed by X-ray fluorescence and Energy Dispersive X-Ray Analysis (EDX) / Scanning Electron Microscopy (SEM). Fire behavior of the modified fabrics was studied using thermogravimetric analysis, pyrolysis combustion flow calorimetry and a preliminary fire test. Fireproof fabrics were successfully developed.

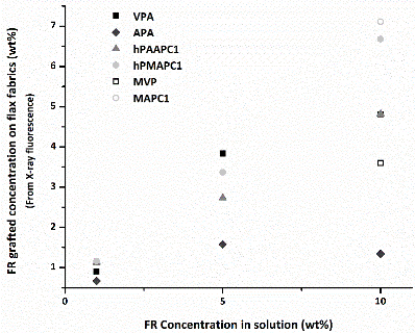

Figure 1 : FR concentration on flax fabrics (from X-ray fluorescence) for different concentrations in aqueous solution after irradiation at a dose of 50 kGy and washing by water.

References:

[1] R. M. Kozasowski, M. Mackiewicz-Talarczyk, and A. M. Allam, *Bast fibres: flax*. Woodhead Publishing Limited, 2012.
[2] M. Zimniewska and M. Wladyka-Przybylak, "Natural Fibers for Composite Applications," S. Rana and R. Fangueiro, Eds. Singapore: Springer Singapore, 2016, pp. 171-204.
[3] O. Faruk *et al.*, "Biocomposites reinforced with natural fibers: 2000-2010," *Progress in Polymer Science*, vol. 37, pp. 1552-1596, 2012.
[4] R. Sonnier *et al.*, "Improving the flame retardancy of flax fabrics by radiation grafting of phosphorus compounds," *European Polymer Journal*, vol. 68, pp. 313-325, 2015.
[5] R. Hajj *et al.*, "Grafting of phosphorus flame retardants on flax fabrics: Comparison between two routes," *Polymer Degradation and Stability*, vol. 147, pp. 25-34, 2018.

Encapsulation of anticancer drug Doxorubicine inside dendrimers

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The drug molecule vectorization is a very promising approach in terms of both medical and economical factors for the delivery of active substances with low bioavailability[1]. Symmetrical and branched macromolecules such as star polymers and dendrimers, seem to be more attractive solutions. Indeed, these structures can effectively combine a high stability in biological media and the ability to encapsulate active ingredients. Thanks to the well-defined architecture, they can achieve a high level of reproducibility, while avoiding the problem of polydispersity[2]. In recent years, many dendritic structures have been proposed; however, the design of new effective dendritic nanocarriers is still relevant. This is due to many reasons such as related to biocompatibility, encapsulation efficiency of therapeutic agents, as well as economic reasons. Considering this, we present theoretical results based on density functional theory to study the encapsulation drugs by dendrimers .

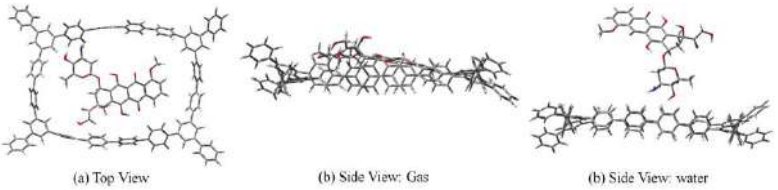

Fig 1: Top and Side Views of optimized structures of doxorubicine inside dendritic cavities from b3lyp/6-31G theory Gas and water phase.

Key words: DFT, Drug, Dendrimers, Gaussian, theoretical study..

References

[1] Jensen A. W., Wilson S. R. and Schuster D. I., Biological Applications of Fullerenes, Bioorganic and Medicinal Chemistry, **1996**, 4(6), 767-779
[2] B. Sumer, J.M. Gao. *Nanomedicine*3 (2008) 137-140.

Study of polymer-surfactant interaction in volume and confined medium

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The behavior of polymers in confined medium represents an emerging area, with recent advances on nanoparticles manufacturing **[1]** and the control of enzymatic reactions **[2]**. For this reason, studying various physical properties of confinement of polymers in reverse micelles as nanometrics systems have presented a significant challenge in our laboratory. In fact, our interest has been focused on the physical aspects of confinement of Polyvinylpyrrolidone (PVP), a neutral polymer known by its similarities to albumin class of proteins **[3]**, in water/AOT/isooctane reverse micelles system. Accordingly, we have started by a conformational analysis of PVP in water, a coil to globule transition of PVP chain was observed at well-defined temperature. Then, we have performed a conductometric study of PVP-AOT system which reveals the formation of polymer-surfactant (PVP-AOT) complex. Moreover, we have proved through viscometric measurements that the complex PVP-AOT behaves like " pseudo-polyelectrolyte". Finally, the investigation of water/AOT/isooctane reverse micelles by electrical conductivity measurements have shown a significant effect of PVP confinement on reverse micelles percolation phenomena.

References

[1] B. Sadeghi, M.A.S. Sadjadi, A. Pourahmad, Effects of protective agents (PVA & PVP) on the formation of silver nanoparticles, (2008) 3-12.

[2] A. Küchler, M. Yoshimoto, S. Luginbühl, F. Mavelli, P. Walde, Enzymatic reactions in confined environments, Nat. Nanotechnol. 11 (2016) 409-420.

[3] M. Guettari, A. Aschi, R. Gomati, A. Gharbi, Structural transition of a homopolymer in solvents mixture, Mater. Sci. Eng. C. 28 (2008) 811-815.

Neutral polymer - surfactant complexation: Effect of polymer regime concentration

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The interaction between neutral polymer-surfactant has been extensively studied for its widespread applications [1] such as industry, medicine, cosmetic, food, paint and enhanced oil recovery. In this work, we have studied the effect of the addition of the sodium bis (2-ethylhexyl) sulfosuccinate (AOT) on the viscosity of polyvinylpyrrolidone (PVP) aqueous solutions in dilute and semi dilute regimes. The behavior of AOT–PVP system was found to be dependent on both surfactant and polymer concentrations. Firstly, we have studied the viscosity behavior of PVP-AOT system for selected AOT concentrations. Different behaviors were detected in the dilute regime under the AOT addition [2]: a neutral polymer behavior, the PVP-AOT complex can be quantified as a pseudo-polyelectrolyte. Thus, two different behaviors appear which depend on the increase of free AOT micelles concentrations. In a second part, the chain conformation of polyvinylpyrrolidone in the semi dilute aqueous solution was estimated basic on the Lin and Cheng method [3]. In presence of surfactant, we found that the PVP adopts a flexible chain in solvent theta.

Keywords: Polymer, surfactant, micelles, viscosity, dilute, semi dilute regime.

References

[1]. Mohammad Yunus Khan, Abhijit Samanta, Keka Ojha and Ajay Mandal: Interaction between aqueous solutions of polymer and surfactant and its effect on physicochemical properties. *Asia-Pac. J. Chem. Eng.* (2008).

[2] El Aferni A, Guettari M, Tajouri T: Effect of polymer conformation on polymer-surfactant interaction in salt-free water. Colloid and Polymer Science (2016).

[3] Horng-Long Cheng and King-Fu Lin :Counterion Dissociation Dependence of Chain Conformation for Poly(xylylene tetrahydrothiophenium chloride) in Semidilute Aqueous Solution. Macromolecules (2003).

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Olive Stone Oil Based Ink Resins Synthesis and Characterization

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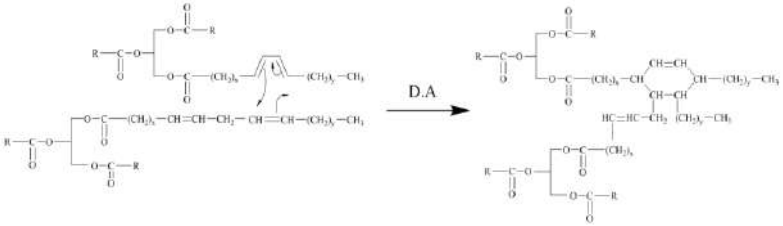
Within the last decade, the synthesis of polymers from renewable raw materials has attracted an increasing interest[1]. Bio-based ink resins prepared by heating vegetable oils have shown to exhibit properties comparable to those obtained from petrol [2]. The present work aims at studying the possible use of inedible olive stone oil as raw material for ink resins. A resin was prepared following the same procedure with previous ones[3]: heating at high temperatures in inert atmosphere. Elevation of viscosities has been noticed and analytical techniques (^{1}H NMR, FT-IR) proved that Diels-Alder reaction could be postulated as the most probable mechanism of the processes of heat bodying. Studies are now in progress to explore the mechanical properties of natural resins and synthetic ones obtained by chemical modifications of olive stone oil.



Key words: Bio-based, Heat bodying, Resin, Diels-Alder.

References

[1] E. Sharmin, F. Zafar, D. Akram, M. Alam, S. Ahmad. *Industrial Crops and Products*, **2015**, 76, 215-229.
[2] T. Robert, "Green ink in all colors"—Printing ink from renewable resources, *Prog. Org. Coat*. **2014**.
[3] V.M. Mello, G.B.C. Martins, M.A. Montenegro, P.A.Z. Suarez. *Industrial Crops and Product*, **2015**, 66, 255-261.

A one step route synthesis of polyurethane newtwork from epoxidized rapeseed oil

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Over the last decade, there has been a growing interest for biobased polymers derived from renewable biomass due to the increasing awareness of environmental issues, depleting of petroleum resources in the near future and the need for sustainable resource without compromising food security. In this context, vegetable oils are highly suitable starting materials for polymers due to their ready availability, inherent biodegradability and low toxicity. Vegetable Oil can be used as a precursor to create large oligomeric macromonomers, or through controlled cross-linking, and even to prepare polymers through olefin cross-metathesis. Polyurethane (PU) is one of the most widely investigated classes of synthetic polymers, exhibiting versatile properties suitable for use in practically all fields of polymer applications foams, elas-tomers, thermoplastics, adhesives, coatings, sealants, fibers, and soon. Biobased polyurethane networks were prepared by a one step curing epoxidized rapeseed oil (ERO) with isophorone diisocyanate (IPDI) as a hardener at 130◦C. The in-situ monitoring of the curing process by FTIR has confirmed the progressive consumption of the oxirane ring and the isocyanate function along with the emergence of the urethane groups. Investigation of model systems using phenyl isocyanate confirmed the ring opening of oxirane during the reaction between ERO and the isocyanate. Based on the spectroscopic investigation, it was hypothesised that the reaction started by the condensation between hydroxyl groups of ERO and isocyanate. Then, the oxirane was ring-opened by the urethane group and the hydroxyl group further reacted with isocyanate. The glass transition of the polyurethane networkas well as the stiffness and strength were shown to be strongly dependent on the ratio between ERO and IPDI. Polyurethane film from ERO/IPDI in a ratio 80/20 results in a transparent elastic film with a Tg around −20◦C and a tensile modulus and strength of 1.5 and 9.4 MPa, respectively.

Synthesis, characterization of acrylamide grafted chitosan and its use in removal of methylene blue and methyl orange from water

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Dyes are considered as one of the most important group of water contaminants and are characterized by their harmful effects on both environment and humans. Effluents containing these compounds resist many types of treatments due to their molecular complexity [1]. Various techniques have been used for their elimination such as adsorption [2,3], chemical treatment [4] and membrane separation [5]. Chitosan based adsorbents have received a lot of attention for adsorption of dyes. Various modifications of this polysaccharide have been investigated to improve the adsorption properties as well as mechanical and physical characteristics of chitosan. In this work, we propose to evaluate the decolorization efficiency of methylene blue and methyl orange from wastewater by chitin (contains acetamido and hydroxyl groups) and chitosan-graft-polyacrylamide (contains hydroxyl, amide and amino groups) as a chitosan derivative. The presence of these chelating groups is responsible for both dye removal, in addition these materials are eco-friendly, low cost adsorbents and used under easy and suitable conditions. Experimental conditions namely pH, concentration of MB and MO in water solution, contact time, temperature and adsorbent dosage, were investigated. The kinetics and thermodynamics of MB and MO decolorization by CH and CS-g-PAM were also studied.

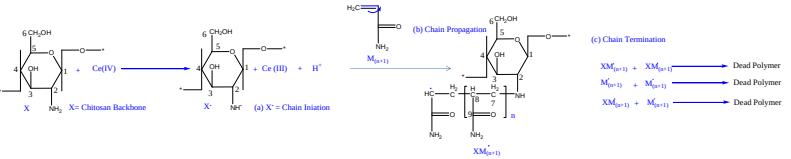

Fig. Mechanism of the graft copolymerization of acrylamide on chitosan backbone, where: (X) represents chitosan and (M) represents acrylamide monomer.

Keywords: Graft Copolmerization, chitosan, adsorption, Dye, wastewater treatment.

References

[1] A. Mittal, A. Malviya, D. Kaur, J. Mittal, L. Kurup, *J. Hazard. Mater*. 148 (2007) 229-240.

[2] E. Alventosa-de Lara, S. Barredo-Damas, M.I. Alcaina-Miranda, M.I. Iborra-Clar, *J. Hazard. Mater*. 209-210 (2012) 492-500.

[3] N. Mohammadi, H. Khani, V.K. Gupta, E. Amereh, S. Agarwal, *J. Colloid Interface Sci.* 362 (2011) 457-462.

[4] S. Raghu, C.W. Lee, S. Chellammal, S. Palanichamy, C.A. Basha, *J. Hazard. Mater*. 171 (2009) 748-754.

[5] J. Miao, L.C. Zhang, H. Lin, *Chem. Eng. Sci.* 87 (2013) 152-159.

Interpenetrating polymer networks based on cellulose gels and HydroxyEthylMethAcrylate: Synthesis, characterization and swelling behavior.

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In order to prepare interpenetrating polymers network based on the biopolymer cellulose and the polyacrylate hydroxyethylmethacrylate, we used two steps: the first was to develop the cellulose aerogel with different cross-linking agent (epichlorohydrin) ratio and the second step was conducted to swell these aerogels in a reactive solution composed by hydroxyethylmethacrylate cross-linking agent (HDDA) and photo-initiator Darocur. The mixture was polymerized then under UV radiations. The obtained aerogels and the interpenetrating polymers network were characterized by FTIR spectroscopy, and swollen in a pH=7 and pH=14 at room temperature. These new materials may have an important application in the environment for sustainable development.

Key words: cellulose, poly-HEMA, UV-polymerization, interpenetrating polymer network, cross-linking, swelling kinetic, pH, FTIR.

Synthesis and Characterization of novel Carbazole-based Block copolymer for applications in solar cells

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Research in organic materials for application in organic solar cells has increased in recent years. Organic solar cells have many advantages when compared with inorganic solar cells. The organic solar cells offer low cost, flexible substrates, very high speed of processing. The focus of the work is development and characterization the new low band gap polymer. These low band gap polymers can then be mixed with fullerenes derivatives such as PCBM to make bulk heterojunction devices. The polymer has been synthesized for applications in solar cells. Donor/acceptor carbazole block copolymer comprising alternating poly(3,6-difluoro-9-(1-octyl-nonyl)-9H-carbazole-2,7-diyl-alt-(5',7'-di-2-thienyl-2',3'-bis-[4-(2-ethyl-hexyloxy)-phenyl]-thieno[3,4-b]pyrazine)-5,5-diyl)-alt-2,2'-(5,5'-bithienylene)]) P1. Block copolymer P1 have been synthesized following Suzuki cross coupling polymerization methods. The polymer was characterized by ^{1}H NMR, ^{13}C NMR and Elemental Analysis. Molecular weights were estimated using gel permeation chromatography (GPC). The thermal stability behavior for polymers was investigated using thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). The photophysical and electronic properties were investigated using UV-Vis spectroscopy and cyclic voltammetry (CV). Electrochemical and optical absorption show that the band gaps for **P1** is 1.58 eV[1-6].

Reference

1. Peet, J.; Kim, J. Y.; Coates, N. E.; Ma, W. L.; Moses, D.; Heeger, A. J.; Bazan, G. C. *Nat. Mater.* **2007**, *6*, 497.
2.Kim, J. Y.; Lee, K.; Coates, N. E.; Moses, D.; Nguyen, T.-Q.; Dante, M.; Heeger, A. J. *Science* **2007**, *317*, 222.
3.Park, S. H.; Roy, A.; Beaupre, S.; Cho, S.; Coates, N.; Moon, J. S.;Moses, D.; Leclerc, M.; Lee, K.; Heeger, A. J. *Nat. Photonics* **2009**, *3*, 297.
4. Y. liang.; J. B. Xia.; S. Tasi.; Z. Xu.; G. Li.; C. Ray.; L. Yu., *Adv. Mater* **2010**, 22, E135-E138
5. *A. A. B. Alghamdi1, A. Imragaa, E. S. A. Halim and A. Iraqi ., Int. J. Electrochem. Sci.,* 11 **(2016)** 5111 - 5127
6. A. Imragaa, F. B. Eltaboni, K. Edbey, A. A. Elgazail, A. A. Ghamdi and A. Iraqi, *Physical Science International Journal 10(2): 1-8, 2016*

The Effect of Polymeric Hydrogel Application on Germination of Barley Under Saline Irrigation Water

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In sustainable agricultural production, water quality and salinity of the plant root zone are important issues to be considered together. In recent years, water resources have been under great pressure due to the adverse effects of climate irregularity and also from increased demands. Water resources are deteriorating day by day in terms of quality and quantity. This deterioration is particularly pronounced in arid and semi-arid regions. As is known, it is transported to the soil along with the dissolved salts in irrigation. Depending on the nature of the water source, the problem of salinity and alkalinity in irrigation area can occur in time. If precaution is not taken, it can reach levels that will restrict or even eliminate agricultural production. In this respect, irrigation water quality is the leading factor limiting crop production. As the total salt content of the water can be increased problems of soil and plant production. Depending on the technology that has developed in recent years, the use of polymeric hydrogels is increasing. One of them is agricultural practices. Polymeric hydrogels have been used extensively to increase the water holding capacity of the soil in recent years. In this study, the effect of the polymeric hydrogel used in agricultural application on saline irrigation water conditions was investigated. As a result of the applications, it was determined that polymeric hydrogel had no effect on barley germination under saline irrigation water conditions.

Key Word: Polymeric hydrogel, saline irrigation water, barley

Synthesis of polyundecylenate-Encapsulated Magnetic Nanoparticles: Adsorbents for Isolation and Preconcentration of Aromatic Amines

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In recent years, magnetic nanoparticles (MNPs) have attracted a considerable amount of attention due to their outstanding properties[1]. Several different applications have been proposed in fields such as biomedicine, water remediation and in analytical chemistry as magnetic solid-phase extractants (MSPE)[2].
Oligomeric micelles from sodium undecylenate (oSUD) were chemisorbed to magnetic iron oxide nanoparticles (MNPs) through a single-step synthetic route involving the simultaneous nanoparticle formation and functionalization in an aqueous solution. The high density of micelles and variety of interactions provided by this sorbent rendered it highly efficient for the extraction of aromatic amines in a wide polarity range (log Kow from -0.80 to 4.05) from textiles, urine and wastewater. Extraction took 5 min, no cleanup or evaporation of the extracts was needed and the method, based on LC-MS/MS quantitation, proved matrixindependent. Recoveries for 17 aromatic amines in samples were in the range 93-123% while those with negative log Kow values were in the range 69-87%. Detection limits for aromatic amines in textiles (0.007-2 mg kg-1) were well below the EU legislated limits (30mg kg-1) and those in urine and wastewater (0.004-1.5 μg L-1) were at the level usually found in real-world.s medium[3].

References

[1] Asgharinezhad, A.A. and Ebrahimzadeh, H., 2016. *Analytical and bioanalytical chemistry*, *408*(2), pp.473-486.
[2] Xu, K., Wang, Y., Ding, X., Huang, Y., Li, N. and Wen, Q., 2016. *Talanta*, *148*, pp.153-162.
[3] Muz, M., Dann, J.P., Jager, F., Brack, W. and Krauss, M., 2017. *Environmental Science & Technology*, *51*(8), pp.4681-4688.

Preparation of modified biopolymers by zinc chloride and its application for hexavalent chromium removal

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Biopolymers have an increasing interest as new materials for pollutants removal form wastewater. The hexavalent chromium is a major contaminant of water as it is widely used in industrial processes such as metallurgy, tanning industries, refractories and foundries. This element is harmful for environment and threatens the human health as it is a carcinogen element. The World Health Organization (WHO) fixed a maximum value of 0.05 mg L^{-1} in drinking water. In this study, banana peels were used as precursor for biochars synthesis by chemical modification with zinc chloride $ZnCl_2$. The impregnated biopolymers were carbonized at 500 and 600°C. The yield was calculated and it reached 30%. Fourier transform infrared spectroscopy (FTIR), Scanning electron microscope (SEM), Thermogravimitric analysis (TGA) and BET were used to characterize the modified biopolymer. The efficiency of this material for hexavalent chromium removal was studied in this work. The obtained results showed that the adsorption uptake of Cr (VI) reached 90%.

Key words: Biopolymers, banana peels, Chemical modification, Zinc chloride, Hexavalent chromium removal.

Dual E-platform based on MIPs for simultaneous detection of Chem-biomarkers in biological fluids

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The research in the field of molecular recognition has attracted great concern involving several research teams. Most of the research areas are devoted to the development of new polymeric materials modified by molecular imprinting technique and has a specific affinity for certain compounds of interest [1]. These polymers (MIPs) have already shown all their potential in biosensing and have been successfully applied in ultra-sensitive diagnostics and analysis in an often complex matrix. In this context, combining the sensitivity of electrochemical methods and the high selectivity of molecular imprinting technique has been proved to be a rapid, fast and powerful analytical tool in biosensing [2]. Here an electrochemical sensor based on nano-structured conductive polymer was investigated for in-vitro detection of several antiemetics in plasma. The synthetized sensor was characterized by several analytical techniques, such as SEM, AFM, FTIR,etc. The MIP sensor, under optimized conditions, has shown a very good stability and high sensitivity and selectivity toward the different target molecules. The obtained results have presented an excellent recovery rate (<3%) proving the promising applicability of the sensor in real matrix without any interference recorded.

References :

1. T. Alizadeh, A. Akbari, Biosens. Bioelectron., 2013, Vol.43, 321-327.
2. Z. Fu, G. Li, Anal. Methods, 2015, Vol.7, 4590-4595.

Environmental applications of biopolymers for electrochemical sensing of heavy metals

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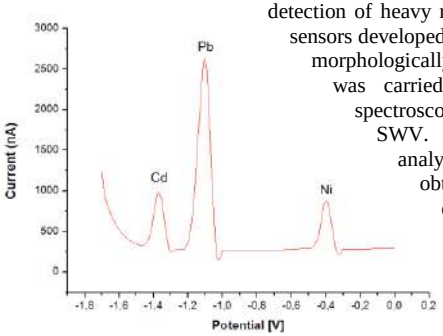
In natural aquatic ecosystems, heavy metals are found at low concentrations, usually in the nanogram or microgram per liter range. In recent times the presence of heavy metals contaminants and at concentrations higher than natural loads has become a growing concern.
Different analytical techniques for heavy metals detection have been deposited such as atomic absorption spectrometry. These analyzers are generally relatively complex systems combining different mechanical, chemical and electrical elements. The set is often expensive, cumbersome and energy-intensive, which makes them unsuitable for *on-site* measurements. Moreover, these instruments are often afflicted by a long response time either by the detection technique itself or by the need to manipulate the samples.
Chemical or biochemical sensors are generally simple systems, consisting of a sensitive layer allowing the recognition of the species with which it interacts, and a transducer system transforming the chemical interaction into an electrical signal.
In this work, we used biopolymers, from vegetable waste, transforming them as a gel and finally using them as a sensitive part in miniaturized electrochemical sensors for the *in-situ* detection of heavy metals in water environments. The new sensors developed are characterized electrochemically and morphologically. The electrochemical characterization was carried out by electrochemical impedance spectroscopy EIS and square wave voltammetry SWV. Other morphological and structural analyzes were carried out. The results obtained showed the high sensitivity of the developed device (detection limit up to 10^{-10} M) as well as the possibility of detecting several heavy metals at the same time in a highly selective manner for each metal.



DPASV obtained with the biopolymer modified electrode, on a standard solution of Cd (25 nM), Pb (75 nM), and Ni (5,5nM) in 0.1 M potassium citrate/HCl buffer, pH 2

Keywords: Heavy metals; Electrochemical sensors; SWV; EIS; biopolymers.

References

[1] Z. Ali, R.N. Malik, A. Qadir, *Chem. Ecol*., **2013**, *29*, 676.
[2] A. Zazoua, C. Dernane, I. Kazane, M. Belghobsi, A. Errachid, N. Jaffrezic-Renault, *Sensor Letters*, **2011**, *9*, 2283.
[3] A. Zazoua, R. Kherrat, M.H. Samar, A. Errachid, N. Jaffrezic-Renault, F. Bessueille, D. Léonard, *Mat. Sci. Eng C*., **2008**, *28*, 1014.
[4] B. Khadro, A. Sikora, A.S. Loir, A. Errachid, F. Garrelie, C. Donnet, N. Jaffrezic-Renault, *Sensors and Actuators B*, **2011**, *155*, 120.

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Preparation and Characterization of Orange and Mandarin Essential Oil Incorporated Poly (Lactic acid) Film

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Orange and mandarin peel oils in the fruits grown in the vicinity of Canakkale region were extracted by clevenger apparatus. A detailed orange and mandarin peel oils characterizations were made through GC-MS analysis. Then the predetermined amount of extracted essential oils was incorporated in poly (lactic acid) matrix and orange and mandarin peel oils containing poly (lactic acid) films were prepared via solution casting method. The Antioxidant effect was examined by DPPH method and the changes in thermal properties of polymer films were evaluated by differential scanning calorimeter (DSC), thermogravimetric analysis (TGA).

The Effect of Some Essential Oil Compounds which applied by means of Poly (Lactic Acid) on the Germination of *Triticum spelta*

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Essential oils are vital materials for plants. Essential oils also have important activities, including antimicrobial, antifungal, antioxidant, and antidiabetic. Research about the effects of essential oils on plants gained importance in recent years. The difficulty application of essential oils in aqueous media, PLA can be used as carrier materials. In this study, the usability of Poly(Lactic acid) (PLA) in plant germination studies and the effects of some essential oil compounds on germination ratio and seedling dry weight of spelt wheat were investigated. For this purpose, a factorial trial with two factors was conducted. The main factor was application form of essential oil compounds (mixed in PLA or dripped onto PLA surface). The second factor was the type of essential oil compounds (Carvacrol, Thymol, Geraniol, and Control). The essential oils were applied as two applications. First; essential oils were added to polymer solution as resulted in 0.5 µl /cm^2, and polymer films were prepared. Second, essential oils were dripped onto PLA film surface as 0.5 µl /cm^2. These films were prepared for different essential oils. Resulted PLA films were put into Petri dishes after seeding. Germination rates were investigated at the end of the fifth day. The dry weights of dried seedlings were investigated. As result of the comparison, the effects of carvacrol and geraniol on the germination ratio (respectively 81.33 and 45.33 %) and seedling dry weight (respectively 0.2796 g and 0.3030 g) of spelt wheat were statistically significant at a significance level of 0.01 according to control (100 % and 0.3300 g). But thymol (100 % and 0.3430 g) was not statistically significant. And also it was found that application type of essential oil compounds was statistically different at a significance level of 0.01 for germination ratio. The germination in the application of PLA mixed essential oil compound was higher than the application of PLA dripped essential oil compound (respectively 89.17 and 74.17 %). But the form of essential oil compounds was not statistically different for seedling dry weight. These results suggest that PLA can be used as a carrier for essential oil compounds in the germination experiment. Essential oil compounds can be used as bio-herbicide.

Keywords: Poly(lactic acid), spelt wheat, germination, carvacrol, thymol

Layer-by-layer coating of polyethylene terephtalate textile with chitosan and sulfated polysaccharide for biomedical applications

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Polyethylene terephtalate (PET) is widely used in biomedical applications such as wound dressings and implants. The aim of this study is to modify the surface of PET nonwoven textile in order to improve its biological properties for future drug delivery purposes. In this work the surface of the PET textile has been modified with successive steps: i) Activation of the PET surface by creating carboxylic groups, ii) Covalent immobilization of chitosan via carbodiimide functionalities, iii) Ionic immobilization of cationic and anionic natural polyelectrolytes via layer-by-layer (LbL) technique. Chitosan very well known for its antimicrobial properties and sulfated polysaccharide with very interesting anti-inflammatory activity are used as the two polyelectrolytes with opposite charges.

Solution parameters for activation of the PET surface such as concentration, temperature and time were optimized. pH and ionic strength of solutions used for multilayer system were also discussed. The multilayer modification was monitored by SEM, gravimetry, ATR-FTIR spectroscopy, contact angle, colorimetric titrations, conductimetry and elementary analysis. Results proved the successful modification of the textile surface. The new material could be very interesting for biomedical applications.

Keywords: PolyEthylene Terephthalate, surface modification, chitosan, sulfated polysaccharide, multilayer system, and bioactive polymers.

Characterization, antioxidant and antiglycation properties of polysaccharides extracted from the medicinal halophyte *Carpobrotus edulis* L

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In this study, Box-Behnken design was used to optimize the ultrasonic extraction of *Carpobrotus edulis* polysaccharides (CEP), and the effect of time, extraction temperature and water to material ratio was evaluated. Optimum conditions were 1.77 h, 78.0 °C and 33.04 mL/g to improved CEP yield (7.84%), which is in good agreement with the predicted yield 7.77%. Then, the physico-chemical, antioxidant and antiglycation properties of optimized CEP were studied, and the total sugar and galacturonic acid content were 89.7 and 63.2%, respectively. The composition of neutral monosaccharide was arabinose, xylose, rhamnose and mannose in the molar percentage of 71.84, 14.80, 8.57, and 4.79%, respectively. In addition, (1H, and 13C) NMR and FTIR analyses confirmed the presence of uronic acids in the free and methyl ester forms with a degree of esterification of 31.27%. Therefore, this finding showed that CEP is a low methoxyl pectic polysaccharide, with an average molecular weight about 65,000 g/mol. Finally, the results indicated that CEP presents strong antioxidant activities *in vitro* (DPPH, chelating ability and reducing power), and significantly inhibits lipid peroxidation and the formation of fluorescent advanced glycation end products in glucose-BSA system model.

Enzymatic extraction and pharmacological activities of sulphated polysaccharides from eggs of sea urchin *Paracentrotus lividus*

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In this study, we report the physico-chemical characterization and the pharmacological evaluation of sulfated polysaccharide from the Mediterranean specie of sea urchin, *Paracentrotus lividus*. Sulfated polysaccharide (SP) from the eggs of sea urchin *Paracentrotus lividus*, extracted by papain digestion, was characterized by size exclusion chromatography coupling on-line with light scattering and viscosity detectors (SEC/MALS/VD/DRI), gas chromatography coupled to mass spectrometer (GC–MS),and Fourier transform infrared spectroscopy (FTIR) analysis. The native molecular mass of the extracted polysaccharide is high (≥22 000 KDa) and it is composed mainly of arabinose, accompanied by other monosaccharides (mostly galactose, glucose and fucose), significant amounts of uronic acids (18.4%) and relatively high proportions of sulfate (22.4%).
The pharmacological evaluation of SP showed a significant *in vivo* anti-inflammatory activity, the edema inhibition was 75.8% at the dose of 100 mg/Kg. In addition, the gastric ulcer inhibition was 69.7%, at the dose of 100 mg/Kg. The present investigation provides information about the enzymatic extraction. Biochemical composition indicates that this sulfated polysaccharide is a good source of neutral sugar and has a high sulfate content. Moreover, this study revealed the anti-inflammatory potential of this sulfated polysaccharide associated to a gastroprotective effect.

Keywords: *Paracentrotus lividus*, sulfated polysaccharide, physico-chemical characterization, pharmacological activities

Linear Polyamidoamines as Novel Biocompatible Intumescent Flame Retardants for Cotton

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Since the middle of the last century, many industrial and academic researchers have devoted a lot of effort to the development of safe and effective flame-retardants (FR). As regards cotton, phosphorylated compounds were the predominant FR for several decades [1] despite many of them had been shown to be bioaccumulative.[1] Recently, biomolecules including proteins have been proposed as FR.[2] Many linear polyamidoamines (PAAs), a family of synthetic polymers with exceptional structural versatility,[3] have high thermal stability coupled with chain structure and side substituents reminding those of proteins.[4] These features suggested that PAAs could act as FR. This presentation reports on the results obtained with a library of eight PAAs applied as coatings on cotton fabrics from aqueous solutions. All tested PAAs warrant remarkable potential as surface-confined intumescent FR. In ignitability tests, six of them exposed to direct flame for 10 s do not burn, but produce carbonaceous crusts sheltering the underneath sample. Thermogravimetric analyses show that at $T \geq 400$ °C all PAAs leave in air substantial char residues that oxidize at $T > 500$ °C. At 450 °C they form porous carbonaceous structures indicating the tendency to intumesce. In horizontal flame spread tests, cotton stripes impregnated with most PAAs extinguish flame at add-ons ranging from 4 to 20%, whereas untreated cotton vigorously burns without leaving residues. Upon 35 kW/m^2 heat flux, all PAA-treated samples significantly reduce the main combustion parameters.

References

[1] R. A. Horrocks, *Polym. Degrad. Stab.* **2011**, *96*, 377.
[2] L. Costes, F. Laoutid, S. Brohez, P. Dubois, *Mater. Sci. Eng. Report, R.* **2017**, *117*, 1.
[3] P. Ferruti, *J. Polym. Sci, Part A: Polym. Chem.* **2013**, *51*, 2319.
[4] F. Danusso, P. Ferruti, *Polymer* **1970**, *11*, 88.

A FLAME RETARDED BIOBASED-CHITOSAN BINDER FOR INSULATING MISCANTHUS/RECYCLED TEXTILE FIBERS REINFORCED BIOCOMPOSITES

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The main objective of this study is devoted to the development of new insulating and ignifuged miscanthus fibers/recycled textile fibers reinforced biocomposites using chitosan as polysaccharide bio-based binder and aluminum hydroxide (ATH) fillers while focusing on the fire behavior. To achieve our goal, a preliminary study was carried out on flame retarded chitosan based films with various ATH-filler ratios (20, 33, 50 and 60 wt%). ATG and PCFC analysis showed significant improvement of chitosan thermal behavior with the addition of 33 wt% and above of ATH. Mechanical properties of films were however degraded. Thereafter and based on a previous work[1], different ratios of miscanthus/recycled textile fibers reinforced biocomposites (fibers content up to 89.5-90 wt%) were elaborated through thermocompression process using neat chitosan and chitosan/ATH (65/35 wt%) as a binder. Mechanical, thermal, and fire behavior were evaluated. Higher mechanical properties were found for hybrid materials containing both recycled textile and miscanthus fibers in comparison to those containing only recycled textile or miscanthus fibers. Fireproof biocomposites (E rating: according to the NF EN ISO 11925-2), with thermal conductivity values between 0.07-0.09 W $m^{-1}K^{-1}$ and density range between 270-299 kg/m^3 were successfully elaborated. The results of this study show a promising use of the chitosan/ATH system as flame retardant for bio-based insulating building materials.

References:

[1] P. Lacroix, A. Bergeret, S. Corn, C. Lacoste, R. El Hage, FR patent 3030538-A1 (**2016**)

Constitutive modeling of strain-induced phase transformation in Poly-Lactic Acid

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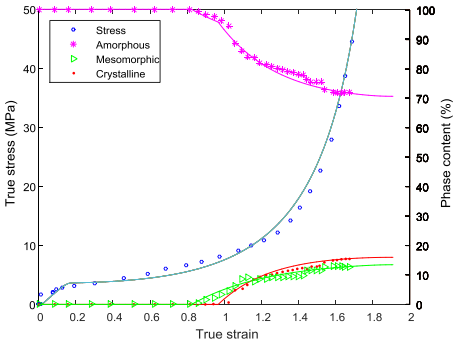
Poly-Lactic Acid (PLA) is a linear aliphatic thermoplastic polyester derived from renewable agricultural resources. One of the most important feature of this biomaterial is its ability to develop a phase transformation under straining. Two strain-induced phases can potentially develop, namely mesomorphic and crystalline, whose respective occurrence is highly temperature and rate-dependent. The aim of the present contribution is to provide a quantitative predictive modeling of this phenomenon. A large-strain constitutive model is proposed to describe the strain-induced phase transformation in PLA along with the stress-strain behavior over a wide range of straining temperatures across the glass transition. The material response is decomposed into two physically distinct sources, an elastic-viscoplastic intermolecular resistance and a viscohyperelastic molecular network resistance. The effective contribution of the amorphous, mesomorphic and crystalline phases to the intermolecular resistance is treated in a composite framework considering a three-phase representation of the microstructure. The phase transformation kinetics are designed using experimental data of an initially amorphous PLA strained over a wide range of temperatures and two strain-rates. The constitutive model is found to successfully capture the important features of the experimental observations in terms of strain-induced phase transformation and mechanical response over a large strain range.



Strain-induced phase transformation and stress-strain response under a straining temperature of 70°C and a strain-rate of 0.01 /s (symbols: experiments, lines: model)

Keywords: Poly-Lactic Acid, strain-induced phase transformation, mesomorphic/crystalline phases, constitutive modeling

Essential Oils Effects On Nanospheres and Nanofibers Morphology Preparing via Electrospinning Technique

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Nanoparticles are of interest because of the new properties (such as chemical reactivity and optical behavior) that they exhibit compared with larger particles of the same materials. Among all nanoparticles, polymeric nanoparticles gain more attention due to their stability, easily and cheaply fabrication, modification ability. The special application areas make Biopolymeric matrices attractive materials for plastic industry. In this study, chitosan was used for preparation polymeric nanoparticles because it's one of the most abundant natural polymers.

Chitosan nanofibers and nanospheres were prepared by using electrospinning and electrospraying methods respectively. The effect solvent and the parameters related to methods on morphologies of these nanofibers and nanospheres were evaluated. Additionally, Chitosan nanofibers and nanospheres were prepared within the presence of a natural essential oil, so that the effects of this essential oil on morphology were evaluated. The structures of obtained materials were characterized by Scanning Electron Microscopy (SEM) and FTIR.

Keywords: Chitosan, Phenylethyl alcohol, nanofiber, nanobead

Development of new materials derived from polydimethylsiloxane for the extraction of pollutants in wastewater

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Organic pollutants are increasingly released into the wastewater due to the human activities of industrial and agricultural production such as pesticides, phenols, plasticizers, hydrocarbons, detergents, oils, greases, pharmaceutical and proteins carbohydrates which all result in the contamination of soil and water environment. Among the possible techniques, which are developed for the water treatments, the adsorption process shows a potential as one of the most efficient method for the removal of organic contaminants from water.[1] Owing to its interesting physico-chemical properties, polydimethylsiloxane (PDMS) gained importance with its application as extracting adsorbent on which the analytes are retained.[2] The Stir bar Sorptive Extaction (SBSE) is the most analytical technique widespread one, since it's known to be cost-efficient, simple design, rapid and reproducible and works without addition of chemicals or UV-irradiation.[3-5] In spite of the great enrichment capacity and outstanding performance to operate at the ultra-trace level, this remarkable static sorption-based method is already not quite effective for some complex systems, in particular to monitor the large group of polar organic compounds. In this study we report the synthesis of novel PDMS materials expected to be applied as novel adsorption solid phase for SBSE with high performance extraction. Such synthesis relies on the crosslinking of functional commercial PDMS via hydrosilylation reaction with addition linear polymers.

Key words: Pollutants, SBSE, PDMS, Hydrosilylation, Cross-linking

References:

[1] I. Ali, V. K. Gupta, Nature Protocols, 2006, 1, 2661-2667.
[2] S. Seethapathy, T. Goreck, Analytica Chimica Acta, **2012**, 750, 48- 62.
[3] F. J. C. Sánchez, R. R. Gómez, A. Z. Gómez, A. S. Fandila, J. L.Vílchez, Talanta, **2014**, 130, 388-399.
[4] Saber Chatti, Hervé Casabianca, Régis Mercier. *Patent under examination* (*submitted* 12/2017- *B2634FR00*).
[5] Aurélie Cortéjade, Audrey Buleté, Laura Prouteau, Saber Chatti, Cécile Cren, Emmanuelle Vulliet. *Analytical Methods*, 23, 2017.

Poster Communications' List

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A. Oral, I. Başaran, E. Yeldir Karacan *Çanakkale Onsekiz Mart University, Turkey* Synthesis of gelatin-co-poly(methyl methacrylate) via Type II photopolymerization	**PC 64**
F. Oughlis Hammache, O. Senhadji-Kebiche, M. Skiba, M. Lahiani-Skiba, M. Benamor *Université du 20 Août 1955-Skikda- Algérie* Membranes based on poly(vinyl alcohol)/water insoluble β-cyclodextrin polymer blends in the transport of organic molecules	**PC 65**
R. Ouhichi, A. Bougarech, T. Robert, S. Abid, M. Abid *FSS - Sfax* Synthesis of cross-linked poly (ester-amide) based on itaconic acid: Application to the preparation of biobased inks	**PC 66**

Communicatings' Names	Ref
Z. Rehimi, S. Halladja, R. Boulghab, H. Ayadi *University 20 Août 1955, Skikda, Algeria* Removal of bromocresol purple dye from aqueous solutions using magnetite multi-walled carbon nanotubes composite	**PC 67**
Z. Saadoune, H. Laaribi *University of Blida, Algeria* Grape pomace polyphenols encapsulated in chitosane microbeads	**PC 68**
M. Sboui, S. Bouattour, L.F. Liotta, V. La Parola, M. Gruttadauria, G. Marcì, S. Boufi *FSS - Sfax* Hybrid paper-TiO_2 anatase prepared under mild conditions with high photocatalytic activity under sunlight	**PC 69**
F. Sebti, N. Charef *Ferhat Abbas University, Setif 1, Algeria* Purification of human plasma using new polystyrene supported acetylacetone bis(3-aminopropyl)amine Schiff base resin toward some divalent metal ions	**PC 70**
F. Sebti, F. Djerboua *Ferhat Abbas University, Setif 1, Algeria* Vulcanization and characterisation of the synthetic nitrile rubber NBR_{18}/ fumed silica	**PC 71**
V. Sessini, C. Samuel, P. Dubois, J.M. Raquez *University of Mons, Belgium* Piezoelectric biotextiles for energy harvesting applications	**PC 72**
F.Z. Talhi, M. Bellout *University of Bouira, Algeria* Accelerated aging of high density polyethylene potable water pipes	**PC 73**
I. Tas, Y. Coskun, T. Tutenocakli, M. Akcura, A. Oral *Canakkale Onsekiz Mart University, Turkey* Effects of thyme essential oil chemicals on germination of arley	**PC 74**
M. Tasdelen, M. Raihane, M. Lahcini, R. Blažic, E. Vidović, A. Jukić, Y. Yagçi *University of Yalova, Turkey* Fluorinated copolymers/Moroccan Beidellite clay nanocomposites prepared via in situ radical copolymerization: Structure and characterizations	**PC 75**
M. Triaki, A. Benmounah *University M'hamed Bougara of Boumerdes, Algeria* Studying the effect of nanoclay on the mechanical properties of HDPE/PS nanocomposites	**PC 76**

Communicatings' Names	Ref
M.M. Yahoum, S. Lefnaoui, N. Moulai-Mostefa *University of Médéa, Algeria* Formulation and characterization of piroxicam emulgel based on xanthan gum	**PC 77**
S. Zaidi, A. Bougarech, A.J.D Silvestre,S. Abid, M. Abid *FSS - Sfax* Grafting ionic bio-based oligomers from cellulose fibers for in biomedical application	**PC 78**
W. Zerguine, F. Habelhames *Ferhat Abbas University, Sétif 1, Algeria* Incorporation effect of semiconductor (TiO_2, ZnO) on the electrical and photoelectrochemical properties of organic conducting polymers	**PC 79**
W. Zerguine, F. Habelhames, M. Lakhdari, Abdelhak Ferhat Hamida *Ferhat Abbas University, Sétif 1, Algeria* Elaboration and characterization of poly(3-hexylthiophène)/n-ZnO heterojunction devices	**PC 80**

Posters Communications' Abstracts

Development of polymeric materials for the extraction of analytes of interest in complex matrices

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Analytical chemistry laboratories are daily confronted with the problem of sample preparation to obtain physicochemical data crucial for many industrial sectors' and / or societal activities. This key step in the process of the analytical methodology consists in obtaining a representative sample of the entities to be analyzed (identification, dosage) in adequacy with the envisaged analytical system.

At present, the analytical demands are directed towards the non-targeted search for constituents present in a sample matrix. As a result, sample preparation must be a non-discriminatory step in obtaining the entities to be observed and becomes a real challenge for laboratories. Another aspect is also to take into account the will for laboratories to use less solvents (reduction of costs and waste) and to reduce the risk of exposure of the manipulators to these products (often very toxic: Dichloromethane, Methanol ...). A real innovation lies in developing a sample preparation methodology consisting in extracting, pre-concentrating, and obtaining an extract compatible with the analytical systems while targeting all the constituents of the complex matrix (obtaining molecules regardless of their polarity and size). Moreover, as with any development of new methodology, the approach must respect two criteria essential to an analytical methodology: accuracy and precision.

Moreover, the project includes an approach using, as far as possible, raw materials derived from green chemistry (valorization of agricultural grains) in order to produce new materials that are partly "bio-sourced". Indeed, many polymeric materials derived from polyorganosilanes (polydimethylsiloxanes or PDMS) or other halogenated polymers (PVC) do not have an important biodegradability character inducing that users of these materials (industrial, analytical laboratories) do not participate in an eco-design of the used methodologies. Finally, the project aims to develop new thermostable materials in order to first use thermal desorption (TDU) as an analytical methodology.

Effect of a polymer addition on the interaction between unlike molecules in a Critical binary liquid mixture

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The objective of this work is to study the effect of a polymer addition on the interaction between unlike molecules in a critical binary liquid mixture. In fact, the interaction between unlike molecules in the presence of an impurity is quantified by a pseudo Grunberg-Nissan constant and the ternary system is considered as a quasi-binary when the polymer is considered as an impurty. Several quantities are introduced such as the deviation of the Grunberg-Nissan and the increment of the deviation of the Grunberg-Nissan constant increment under temperature effect. Near the critical region, where the viscosity of the medium is characterized by a scaling law without and in presence of impurity, the quantities previously defined are connected to the viscosities activation energy of the liquids.

Keywords : Polymer, impurity, critical binary liquid mixture

2-Aminothiazole-functionalized triazine-modified polystyrene decorated with gold nanoparticles as composite catalyst for the reduction of 4-nitrophenol

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Herein, polystyrene (PS) bearing di(2-aminothiazole)-substituted triazine as chelation unit for both Au(III) ions and Au(0) nanoclusters was prepared through successive chemical modification of native polystyrene including nitration (treatment with HNO_3/H2SO_4), reductive amination (treatment with $SnCl_2$/HCl), and successive grafting of 2,4,6-trichloro- 1,3,5-triazine and 2-aminothiazole. The derived gold nanoparticles- (AuNPs-) containing composite material was obtained through chelation of the nanogold precursor, namely hydrogen tetrachloroaurate, and subsequent *in situ* hydride-assisted reduction providing gold nanoparticles with low size (about 14 nm) and spherical shape. It is shown that the presence of 2-aminothiazole-grafted triazine units on the phenyl side groups of PS enables the stable anchoring of the AuNPs while preventing agglomeration. Chemical structure of the PS derivatives was confirmed after each synthesis step by a combination of experimental methods such as infrared and energy dispersive X-ray spectroscopies, elemental analysis, Xray diffraction and scanning electron microscopy. To highlight the catalytic potential of the so-designed nanostructured catalyst, the reduction of 4-nitrophenol was considered in the presence of a large excess of sodium borohydride as reductant specie. UV-visible spectroscopic monitoring of the progress of the reaction confirmed the pseudo-first order kinetic profile associated with a rate constant as high as 3.07 × 10-2 s-1.

A Merrifield resin functionalized by 2-(aminomethyl)-15-crown-5. Inductively coupled plasma study of the extraction of Li(I) and Cd(II) by modified polymer.

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Recently, the solid phase extraction has been shown to be an excellent separation technique due to immiscibility of resins with aqueous phase and minimum release of toxic organic solvents [1, 2]. In this context, grafted resins have been used in separation of hazardous metallic ions in industrial effluents [3, 4]. The aim of this study was to evaluate the efficiency of a new polymer obtained by functionalization of a Merrifield resin (MR reticulated by 2% divinylbenzene, 200-400 mesh, 2.1 mmol $Cl \cdot g^{-1}$) by grafting 2-(aminomethyl)-15-crown-5 (Fig.1) groups to extract some metal cations from aqueous solutions. The structural properties of the polymer were systematically investigated by different analytical methods; namely elemental analysis (EA), differential scanning calorimetry (DSC) and infrared spectroscopy (FT-IR). The percentage of extraction was determined by inductively coupled plasma-atomic emission spectrometry (ICP-AES). The obtained polymer gave an extraction ratio of Cd^{2+} = 73.33 % which highlight the importance of the substitution of chlorine atoms by amino groups.

Keywords: Merrifield resin; Functionalization; 2-(aminomethyl)-15-crown-5; Metal cations; Extraction; Inductively coupled plasma- atomic emission spectrometry.

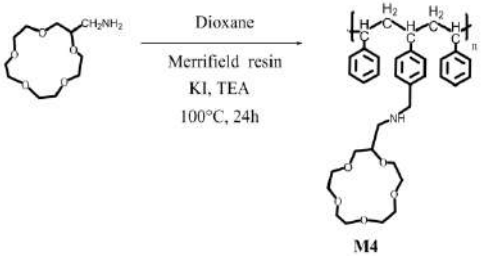

Fig. 1. Synthetic scheme of aminomethylcrown-Mer (M_4).

References:

[1] Mester, Z.; Sturgeon, R.; Pawliszyn. *Journal of Spectrochimica Acta Part B*, **2001**, 56, 233-260.

[2] Merdivan, M.; Duz, M. Z.; Hamamci, C. *Talanta*, **2001**, 55, 639-645.

[3] Liu, P.; Liu, Y.; Su, Z. *Industrial and Engineering Chemistry Research*, **2006**, 45, 2255-2260.

[4] Moawed, E. A.; Zaid, M. A. A.; El-Shahat, M. E. *Analytical Letters*, **2003**, 36, 405-422.

Montmorillonite doped conducting polymers for supercopacitors

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Supercapacitors with high stability and high resistance voltaic were prepared by using poly (N-methylpyrrole) (PNMPy) and nanocomposites composed of poly (N-methylpyrrole) and montmorillonite clay (MMT), as an intermediate layer between layers of 3,4 - ethylenedioxythiophene (PEDOT). The whole forms a three-layer plate capacitor. The armatures (conductive portion) are PEDOT films, and the dielectric (insulating part or much less conductive) is PNMPy nanocomposite. The influence of the clay on the properties has been investigated as function of the thickness of the internal and external PEDOT layers, which has been controlled through the polymerization time. The results show that the incorporation of MMT has an important impact for the activation of the electrochemical properties (i.e. electroactivity, electrostability and specific capacitance) of the layered conducting polymers. The ability to exchange charge reversibly and the electrochemical stability of films with MMT are higher than those of films without clay. These effects being more pronounced for films with micrometric PEDOT layers. The clay at the intermediate layer improves the specific capacitance of micrometric films and, most importantly, protects the capacitive behaviour against electrochemical degradation in all cases. The external layers of the multilayer system was formed by poly (3,4-ethylenedioxythiophene) and prepared by anodic electropolymerization for different polymerization times. The structural, properties of the obtained material are explored using scanning electron microscopy (SEM) and tapping-mode atomic force microscopy (AFM).

References:

Damia Amoura, Margarita Sánchez-Jiménez, Francesc Estrany, Laid Makhloufi, Carlos Alemán (2015). Clay incorporation at the dielectric layer of multilayer polymer films for electrochemical activation. European Polymer Journal 69, 296-307.

Elaboration and Thermal study of composites from used low density polyethylene

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Recycling is a waste treatment process that consists of reusing all or part of a waste to make a new product; it allows reintroducing materials in another cycle of production.
Recycling has two major ecological consequences:

- Reduction of the volume of waste and the fight against environmental pollution.

-The preservation of natural resources, since the recycled product is used instead of the virgin material.

The objective of this work is in the context of the valorization of natural resources very abundant in Tunisia such as calcite which is used for the elaboration of polymer matrix composites with better physicochemical properties than their precursors. In addition, the search for a new mode of treatment and recovery of plastic waste and more specifically low density polyethylene (LDPE) which is fragile and has a low chemical resistance requires the use of reinforcements and additives in most applications. To improve their performance, the Tunisian calcite (CaCO3) supplied from the Gabes region was used for the production of low density polyethylene-calcite (LDPE-CaCO3) composites synthesized by introducing three different concentrations of calcite into the used LDPE matrix. The LDPE / calcite composites were prepared by the method (voie solvent). Composite (LDPE / calcite) series synthesized were characterized by X-ray diffraction (XRD), infrared absorption spectroscopy (IR), and photoluminescence (PL).

The results of the composites characterizations suggest the existence of a possible interaction between the polymer matrix and the calcite

The results of the composites characterizations were supported by the thermal properties study, by DSC and TGA which indicates that the thermal stability of LDPE / $CaCO_3$ is better than that of the LDPE matrix.

The temperature onset is increasing for these composites to a percentage of 6% calcite, and the decomposition temperature increases significantly with the percentage of calcite introduced and is greater than that of polyethylene LDPE (Td = 448 ° C).

Elaboration and characterization of a new composite material polypyrrole-functionalized multi wall carbon nanotubes

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Polypyrrole (PPy), is one of the most studied conducting polymers due to its important properties. In order to improve the physical properties of PPy, various composites of PPy have been synthesized [1-3]. Carbon nanotubes (CNTs) have received important concentration for their unique mechanical, electrical, thermal, and magnetic properties that have been used in the field of nanocomposites materials, nanodevices, and so on [4]. The large specific area and aspect ratio of multiwall carbon nanotubes (MWCNTs) have made them efficient as conductive fillers in polymers [5].

In this work, polypyrrole (PPy) functionalized multiwall carbon nanotubes (PPy-MWCNT) nanocomposites were electrochemically synthesized by direct polymerization of pyrrole onto surface of functionalized multi-walled carbon nanotubes which electrodeposited on indium thin oxide (ITO) substrates. All this were performed in 0.1 M aqueous solution of lithium perchlorate used as supporting electrolyte in conventional three electrode cell, using ITO as working electrode, platinum plate as auxiliary electrode and the saturated calomel as reference electrode.

The obtained nanocomposite films were characterized to study electrochemical performances, (resistance, capacitance…), morphology and surface properties.

To accomplish this, the samples have been characterized by cyclic voltammetry, electrochemical impedance spectroscopy, and scanning electron microscopy.

The electrochemical results showed that PPy-MWCNT nanocomposites were successfully synthesized by polymerization method, and also, the capacity of nanocomposites was increased on MWCNT compared with PPy electropolymerized on ITO surface.

SEM experiments bring the evidence that the MWCNTs are well dispersed at the electrode surface and the PPy is covering the MWCNTs.

The nanocomposite material prepared here opens a new approach for simple, low cost, effective and provide a promising potential in supercapacitor applications.

References

[1] Y.C. Liu, C.J. Tsai, J. Electroanal. Chem. 537 (2002) 165.
[2] S. Sinharay, M. Biswas, Mater. Res. Bull. 34 (1999) 1187.
[3] Y.C. Liu, C.J. Tsai, Chem. Mater. 15 (2003) 320.
[4] Chakraborty, G, Gupta, K, Meikap, AK, Babu, R, Blau, WJ: Synthesis, electrical and magnetotransport properties of polypyrrole-MWCNT nanocomposite. Solid State Commun 152(1), 13-18 (2012)
[5] Walters, DA, Casavant, MJ, Qin, XC, Huffman, CB, Boul, PJ, Ericson, LM, Haroz, MJ, O'Connell, K, Smith, K, Colbert, DT, Smalley, RE: In-plane-aligned membranes of carbon nanotubes. Chem Phys Lett 338(1), 14-20 (2001)

ZnO-Fluorescein hybrid nanocomposites for organic electronics: Elaboration and photophysical properties

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Recent research has been interested in the hybrid organic-inorganic semi-conducting nanocomposites due to their potential optical, electrical, and solar cells applications. In particular, the incorporation of inorganic semi-conducting nanoparticles into optically active polymer matrices is efficient to produce stable and high performance devices. In particular, Zinc oxide (ZnO) nanostructures (nanoparticles nanorods…)/polymer hybrid junctions are very interesting for OLED and photovoltaic applications either in bilayer or composite structures.

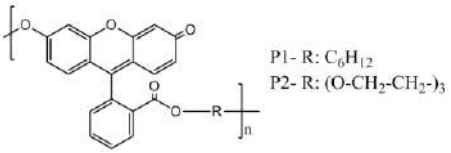

Figure 1: Structures of the FL based polymers

In this contribution, we report the synthesis of two fluorescent polymers containing the fluorescein dye moiety. The second part of the work is about filling these optical active polymers with different ratios of ZnO nanoparticles, before spin coating them onto glass substrates. The morphological and optical properties of the obtained nanocomposite films were then investigated films in order to understand the optical phenomena that occur in the hybrid organic/inorganic structures and to delineate the optimal loading percentages of ZnO nanoparticles in the composite film. Photoluminescence spectra indicated that the optimum n-ZnO concentration was about 4.2 wt% for P1 and 2.7 wt% for P2 to achieve photoluminescence quenching. We established good correlations between the investigated properties.
From the results below we can say that our new nanocomposite-based polymer and n-ZnO could form a good donor-acceptor couple as a promising candidate for applications in optoelectronic devices.

Keywords: Fluorescein; zinc oxide nanoparticles; nanocomposite materials; organic thin layer; optical properties.

References

[1] Y.-J. Choi et al. / Ceramic international 38S (2012) S525-S528
[2] C. Zhang et al. / Journal of power Sources 297 (2015) 16-22
[3] C. Ton-That et al. / Journal of Luminescence 128 (2008) 2031-2034
[4] I. Musa et al. / Synthetic Metals *162 (2012) 1756-1761*

Semi-conducting anthacene-modified β-cyclodextrins: Synthesis, characterization and optical properties

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In the last two decades, enormous progress was made in the investigation of organics semi-conducting compounds. The main advantage of using these materials is their low cost and easy processability in comparison with their inorganic analogues [1]. Anthracene was one of the first aromatic materials employed in organic light emitting diodes (OLEDs) [2].
In the aim to prepare new soluble anthracene-based semi-conducting materials, we choose the β-cyclodextrin (β-CD) as a low-cost bio-sourced macromolecule. It is a cyclic oligosaccharide produced from starch and formed by the association of seven glucose units. It presents a rigid conical amphiphilic structure with hydrophilic exterior, which allow it to be water-soluble due to a large numbers of alcoholic hydroxyl groups. Our purpose is to combine the structural advantages of the β-CD with the optical and electrical performances of anthracene, in order to acquire a new semi-conducting material with original properties.
Two new anthracene-modified β-CDs with different degree of substitution (DS) (β-CDAn$_1$; β-CDAn$_2$) were synthesized. These derivatives were obtained via the Williamson reaction using two bases: Tetrabutylammonium hydroxide (TBAOH) and sodium hydride (NaH); a higher anthrylation rate was reached with the NaH. The liposolubility of the modified cyclodextrin was improved with increasing the DS and good solubility in common volatile organic solvents was achieved. The macromolecular structures were investigated by NMR, FT-IR and MALDI-TOF spectroscopies. The TGA and DSC analyses showed a good thermal stability and an amorphous morphology in solid state. The optical properties of these organic materials were investigated by UV-visible absorption and photoluminescence spectroscopy. Their optical gaps were estimated from the absorption edge thin films (E_g = 2.76 for β-CDAn$_1$ and E_g = 2.70 for β-CDAn$_2$). They exhibit a blue photoluminescence in dilute solution; whereas, a green emission was observed in the solid state, due to the π–π interaction in the anthracene moieties. The HOMO and LUMO levels were estimated using cyclic voltammetry analysis. We note a decrease in the optical and electrochemical gap by increasing the anthrylation rate.

References

[1] A. Kivrak, O. Faruk Er, H. Kivrak, Y. Topal, M. Kus¸, Y. Çamlısoy, Optic. Mate. 75 (**2017**) 206-212.
[2] K. Hriz, N. Jaballah, J-L. Fave, M. Majdoub J. Mate. Sci. 47 (**2012**) 8067-8075.

SYNTHESIS AND CHARACTERIZATION OF A NOVEL NANOBIOCOMPOSITE ALGINATE XEROGEL BEADS WITH IMPROVED SWELLING PROPERTIES

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In this work, eco-friendly interpenetrating strategy has been used to develop novel nanobiocomposites xerogels beads as highly-efficient bioadsorbant, in the aim to improve swelling capacities of the system. The nanobiocomposites beads were synthetized via in-situ incorporation of monomer inside pretreated nanobiocomposite beads. The properties of resulting beads were characterized by different techniques. FTIR indicate that monomer has been grafted onto nanobiocomposites beads and sepiolite needles participated in polymerization reaction. The obtained interpenetrating network xergoel beads were also confirmed by SEM analysis. X-ray diffraction (XRD) analysis revealed that exfoliated nanocomposite beads with the absence of any d_{110} reflection in the XRD. The thermogravimetric ATG analysis indicated that introduction of NaSEP to the beads nanobiocomposites resulted in an increase in thermal stability for synthetized beads. The influences of two reaction variables including the content of Na-sepiolite and APS, on the swelling properties of the IPN xerogel beads in deionized water were investigated. It was found that the equilibrium swelling degree by 242 %. Also, it was shown that the incorporation of high amount NaSEP in alginate matrix enhanced the swelling properties of the beads (from 300 g/g to 530 g/g). Further, swelling results indicated that the inclusion of proper amount of initiator (APS) induced enhanced swelling capability (from 300 to 1000g/g).

MORPHOLOGY AND MECHANICAL PROPRITES OF BLEND POLYMERS PC/SAN

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Blends of styrene-acrylonitrile (SAN) with Polycarbonate (PC) with and without (SEBS-g-MAH) as compatibilizers were studied. One series of blends was prepared in composition 90/10, 80/20, 70/30, 50/50. The second and third series of blends was prepared with the addition of 5; 10 wt% of (SEBS-g-MAH). Their morphology and thermal behaviour were inspected by scanning electronic microscopy (SEM) and dynamic mechanic analysis (DMA), respectively.

The results of morphological observations revealed that the addition of a small percentage of compatibilizer decreases the domain size of the dispersed phase and the compatibility of the blends was enhanced. The shifts of values of glass temperatures (*Tg*) in the examined blends also indicate that with addition of compatibilizer miscibility between SAN and PC is improved.

Keywords - blends; polycarbonate; SAN copolymers

References

[1] Coleman MM, Graf JF, Painter PC (1991) Specific Interactions and the Miscibility of PolymerBlends.TechnomicPubl,Lancaster

[2] Conder JR, Young CL (1979) Physicochemical Measurement by Gas Chromatography. Wiley, Chichester (vol 1, chap 5, p 154)

Formation of recognition sites in an acrylic polymer by the molecular imprinting technique

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The technique of molecular imprinting has undergone remarkable development over the last decades and this technology has increased tremendously during the last years. The recognition capabilities of molecularly imprinted polymers (MIPs) are being successfully exploited in many application areas such as sensors, separations and extraction of chemical compounds, drug development, and drug delivery [1-3].

The aim of this work concerns the elaboration and the characterisation of MIPs by Non-covalent approach in presence of a target molecule. The MIP materials were prepared by radical photopolymerization of mixture containing the n-butylacrylate (BuA) as monomer, 1,6-hexanedioldiacrylate (HDDA) as crosslinker and 2-hydroxy-2-methyl-1-phenyl-propan-1-one as photoinitiator. The printed molecule chosen is 2-phenoxypropionic acid (APP) analogous to (2, 4-Dichlorophenoxyacetic acid) herbicide. Non- imprinted materials (NIPs) and imprinted materials (MIPs) were characterized by infrared spectroscopy (FTIR), and differential scanning calorimetry (DSC). The Infra-Red (IR) analysis confirmed the presence of non-covalent hydrogen-binding between the target molecule and the monomer in pre-polymerisation mixture. The extraction of the target by several washes was confirmed by UV spectroscopy. The recognition properties of the NIP and MIP materials obtained toward APP were evaluated by GC assays of the batch rebinding solutions. The results show a specificity of printed materials.

References:

[1] Kerstin G., Nicholls I. A.The effect of crosslinking density on molecularly imprinted polymer morphology and recognition, EuropeanPolymer Journal. 75 (2016) 423-430.
[2] Hao,Q, Lin Gao, Jixiang Wang, Jianming Pan, Yongsheng Yan,. A precise and efficient detection of Beta-Cyfluthrin via fluorescent molecularly imprinted polymers with ally fluorescein as functionalmonomer in agricultural products XifengZhangFood Chemistry. 217 (2017) 620-627.
[3] Meischla,F, Dieter Schemetha, Matthias Hardera, Norbert Köpfleb,RichardTessadric, Matthias Rainera,Synthesis and evaluation of a novel molecularly imprinted polymer forThe selective isolation of acetylsalicylic acid from aqueous solutions*Journal of Environmental Chemical Engineering. 4 (2016) 4083-4090.

STUDY ON THE INTERFACE MODIFICATION OF POLYVINYL CHLORIDE/ OLIVE RESIDUE FLOUR COMPOSITE BY GAMMA IRRADIATION

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Polyvinyl chloride (PVC) is a thermoplastic polymer which is characterized by the good resistance to moisture and fire. In terms of tonnage and consumption, it is classed the second after polyethylene in the plastics industry [1]. The long time between the consumption of PVC and the accumulation of waste of the latter, from the long life of PVC products, that can go up to 50 years, poses a number of problems, for the environment, due in particular to the use of some additives (lead, cadmium and phthalate) and PVC waste management [2]. This waste problem PVC-based can find an adequate solution in the substitution of a quantity of basic product by a natural load. Despite the advantages of cellulosic fibers in thermoplastics, the preparation of composite materials based on thermoplastic matrices reinforced by natural loads is handicapped by the strongly hydrophilic nature of these filler, which is associated to a poor compatibility with hydrophobic polymers, as well as a loss of mechanical properties after moisture absorption [3-5].

In this study, thin films of poly (vinyl chloride) (PVC)/ olive residue flour (ORF) composites prepared in ratios of 10/90 and 20/80 (ORF wt%/PVC wt%) were irradiated at doses of 10 and 70 kGy. The mechanical properties and thermal stability of the samples were followed by dynamic mechanical analysis (DMA) and thermogravimetric analysis respectively. The changes of surface properties were monitored by contact angle measurements allowing for calculation the surface free energy as well as its polar and dispersive components. These treatments cause surface oxidation of PVC/ORF films, as revealed by Fourier transform infrared (FTIR) spectroscopy analysis.

Good dispersion of the filler and better mechanical and thermal properties of the PVC / FGO composites were obtained after the treatment. Also, this treatment cause surface oxidation of PVC/ORF films, which is confirmed by a decrease of the contact angle of water on the surface of a composite irradiated.

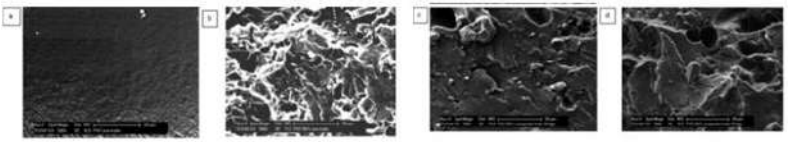

FIG. 1. SEM of PVC/ ORF: (a) 100/0; (b) 80/20; (c) 80/20 treated at 10 kGy; and (d) 80/20 treated at 70 kGy

References

1. Shojai-S.M., Bakhshandeh- R.G., Recycling of PVC wastes, Polymer Degradation and Stability, 96 (2011) 404 - 415.
2. Yarahmadi N., Jakubowicz I., Martinsson L., PVC floorings as post-consumer products for mechanical recycling and energy recovery, Polymer Degradation and Stability, 79 (2003) 439-448.
3. Tıhmınlıoglu F., Demir H., Atikler U., Balkose D., The effect of fiber surface treatments on the tensile and water sorption properties of polypropylene-luffa fiber composites, Composites: Part A, 37 (2006) 447-456.
4. Rong M.Z., Zhang M.Q., Liu Y., Yang G.Ch., Zeng H.M., The effect of fiber treatment on the mechanical properties of unidirectional sisal-reinforced epoxy composites, Composites Science and Technology, 61 (2001) 1437-1447.
5. Monteiro S.N., Calado V., Rodriguez R.J.S., Margemc F.M., Thermogravimetric behavior of natural fibers reinforced polymer composites - An overview, Materials Science and Engineering, A 557 (2012) 17-28.

Characterization of molecularly imprinted polymers for the selective extraction of urinary biomarkers

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Molecular imprinted polymers (MIP) are promising and attractive materials offering selective extraction properties, high stability and simplicity in preparation. Owing to their recognition sites, this separation method was applied in this study to extract metabolites from human urines. o-Cresol is widely used as a biomarker for the biomonitoring of occupational toluene exposure. The effect of the functional monomer, the porogen solvent and the ratio between the crosslinker and the monomer were conducted in this study. The molecular imprinted polymer (MIP) and non imprinted polymer (NIP) were characterized using the infrared spectrometry, scanning electron microscopy, thermogravimetric analysis and x-ray diffraction. The obtained results showed that the best solvent is the acetonitrile. The maximum retention capacity was observed for the 4-vinylpyridine as a functional polymer.

Key words: Molecularly imprinted polymers, o-cresol, toluene biomarker, functional monomer, porogen solvent.

Effect of treatment with dimethoxydimethylsilane on chemical structure and thermal stability of date stone

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In recent years, the incorporation of lignocellulosic materials as reinforcing agents or as fillers in polymer composites has received an increased attention. The addition of fillers has a high impact upon economics for thermoplastics, while a general improvement in certain properties is also achieved. Lignocellulosic materials exhibit a number of attractive features including low density, low requirements on processing equipment, and no abrasion during processing, abundance and certainly biodegradability. The main advantage of lignocellulosic materials upon mineral fillers is their environmental friendliness. In general, polymer waste is disposed in large landfills causing serious problems on the environment, while biodegradable materials are envisaged to be an excellent alternative to tackle this problem, by reducing the waste volume. Hence, for these reasons it has not been surprising that the use of lignocellulosic materials in the production of composites has gained significant importance both in technical applications such as in automotive industry, as well as in the packaging industry for applications where strength is not an issue. The main disadvantage encountered during the incorporation of natural lignocellulosic materials into polymers is the lack of good interfacial adhesion between the two components, which results in poor properties of the final material. The polar hydroxyl groups on the surface of the lignocellulosic materials have difficulty in forming a well bonded interface with a non-polar matrix, as the hydrogen bonds tend to prevent the wetting of the filler surfaces. There are various methods for promoting interfacial adhesion in systems where lignocellulosic materials are used as fillers, such as esterification, silane treatment, graft co-polymerization, use of compatibilizers, plasma treatment, and treatment with other chemicals. These methods are usually based on the use of reagents, which contain functional groups that are capable of bonding to the hydroxyl groups of the lignocellulosic material.
The aim of the present work was to determine the chemical composition according to method TAPPI Test, and to study the effect of chemical modification of the surface of local date stones on their physical and thermal properties. The use of dimethoxydimethylsilane, and alkaline pretreatment followed by treatment with dimethoxydimethylsilane fibers leads to an improvement of the thermal stability of the fibers and a reduced absorption of water, which allows us to recommend the use of its flour as fillers or reinforcements in the development of Wood Plastic Composites.

Key word: date stone, chemical composition, silane.

Dynamic mechanical and thermal properties of a chemically modified polypropylene/natural rubber thermoplastic elastomer blend

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Thermoplastic elastomers from blends of maleic anhydride-grafted natural rubber (NR-g-MAH) and maleic anhydride-grafted polypropylene (PP-g-AH) have been prepared by melt mixing in a Brabender plasticorder.

Grafting of each polymer was achieved in the molten state using dicumyl peroxide as the initiator. The effects on the dynamic mechanical and thermal properties were investigated over a wide range of temperatures.

DMA analysis showed an increase of the glass transition temperature by 5°C and a disappearance of the β transition peak for NR-g-MAH/PP-g-MAH with respect to the unmodified NR/PP blend.

The DSC analysis showed a slight increase of the fractional crystallinity of polypropylene for the dynamically vulcanized and grafted blends. These effects were attributed to the enhancement of the interactions that developed between the two polymers as a result of the grafting.

Keywords: Thermoplastic elastomers, grafting, maleic anhydride, natural rubber, Polypropylene.

Determination of the swelling time constant as a function of different parameters of polymer networks

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The synthesis of photochemical polymer networks was carried out by exposing a mixture composed by: the precursor monomer (2-phenoxyethyl acrylate (PEA)), the photoinitiator (Darocur 1173) and the crosslinking agent (HDDA) with UV radiation.
The networks obtained are characterized by studying the kinetics of swelling in different solvents. The curves obtained show a clearer transition between the high initial velocity and the slow velocity towards the end of the swelling process which must be explained. Voigt's model responds well to this question, it consists in applying a stress on a spring and a shock absorber in parallel. By associating the spring element with the resistance to network expansion and the damping element with resistance to diffusion of the solvent. Using the following equation:

$$Q(t) = Q_{\infty}\left[1 - \exp\left(\frac{t}{\tau_s}\right)\right]$$

In this equation, the swelling time constant τs (speed parameter) represents the measurement of the resistance to solvent permeation. The variation of this parameter has been studied as a function of the degree of crosslinking (% HDDA) so that the curves obtained are straight lines. The variation of the latter is completely different depending on the temperature, where it undergoes this time to the law of Eyring.

Keywords: swelling, time constant, Voigt's equation, degree of crosslinking…

References:

[1] H. Omidiana, S. A. Hashemia, P. G. Sammesb and I. Meldrum, *J. Polymer*. 39, 6697-6704 (1998)
[2] K. Kabiri, H. Omidian, S.A. Hashemi, M.J. Zohuriaan-Mehr, *J. European Polymer*, 39, 1341-1348 (2003)
[3] Xingli Liu, Xiaolan Li, Zhiyong Lu, Xinping Miao, Yujun Feng, *J. Polym Res* 18, 897-905 (2011)

Host-Guest Interactions Accompanying the Encapsulation of doxorubicin within dendritic macromolecular cavities.

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One of the reasons why supramolecular structures containing cavities represent an important branch of supramolecular chemistry [1] is because of the high tunability of the cavity size and shape that can be obtained by varying the nature of the constituting monomers and of their sequencing [2]. Cavities inside macromolecular structures can be rigid, like in cyclodextrins or cucurbiturils, or flexible, like in calixarenes, as a result of the complex pattern of intra- and inter-molecular interactions. In particular, non-rigid structures with readily functionalized end-groups are versatile systems for host-guest chemistry applications, particularly in the bio-medical field, where new and effective classes of active compounds with antiviral, bactericidal and anticancer activities can be prepared [3]. Falling in this category, dendrimers, or arborols, are a special class of flexible polymeric molecules with unique properties and structures, we present theoretical results based we present theoretical results based on density functional theory to study the encapsulation drug inside macromolecular cavities.

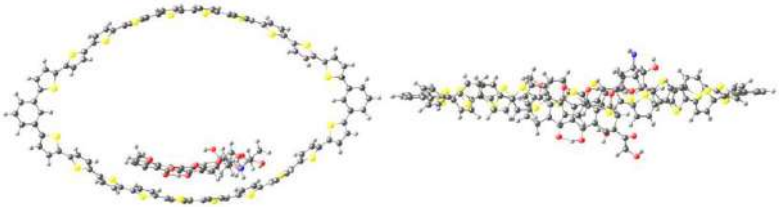

Figure: Encapsulation of Doxorubicine inside thiophene (phenyl-cored)dendrimer (C, O, H, N and S atoms are represented as: gray, red, white, blue, yellow).

Keywords : Dendrimers, DFT, anticancer drugs..

References

[1] X. Ma, Y. Zhao, Chem. Rev. 2015, 115, 7794-7839]
[2] K. Ariga, T. Kunitake, Supramolecular Chemistry - Fundamentals and Applications: Advanced Textbook, Springer Berlin Heidelberg, 2006
[3] A. Yousaf, S. A. Hamid, N. M. Bunnori, A. A. Ishola, .Drug Des. Dev Ther. 2015, 9, 2831-2838

Effect of reprocessing cycles on the structure and properties of silica reinforced polypropylene/ ethylene propylene rubber nanocomposites

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The effect of repeated extrusion processing cycles on the structure and properties of (polypropylene/ethylene-propylene-rubber) (PP/EPR)/silica nanocomposites was investigated. The recycling process was simulated by performing three extrusion runs, using a high shear twin screw extruder by varying the speed screw rotation (300; 800 and 1200 rpm), in order to get better understanding of the multi recycling effects. For comparative purposes, neat PP/EPR was also reprocessed under the same conditions as a reference material.

From the morphological analyses performed by scanning electron microscopy, multiple extrusions were found to be not only helpful for decreasing the EPR phase size, but also useful for ensuring a more homogenous dispersion of silica nanoparticles within the matrix. The physico-chemical properties analyses illustrate that the repeated cycles of extrusion processing provoke a decrease of the molar masses and an increase in the melt flow index. It was marked that, when going from the 1st to the 2nd extrusion cycle, on the one hand, and by increasing the rotation speed from 300 to 800 rpm at the same cycle, on the other, the mechanical properties were greatly enhanced. A substantial improvement of these properties was achieved after incorporating the silica nanoparticles and the maleic anhydride grafted polyethylene copolymer (MAPE).

EFFECT OF DIFFERENT TREATMENT OF WASTE WOOD FLOUR ON WATER ABSORPTION IN LDPE / WF BIO-COMPOSITES

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Protecting the environment has become a topical subject for researchers to find solutions to the tons of waste generated by the high consumption of common thermoplastics such as polypropylene and polyethylene. Among the solutions, the use of vegetable filler in the development of materials that once used, thrown into the environment will be degraded naturally. It is in this context that we are interested in the enhancement of plant waste wood flour (WF). One of the disadvantages of composites based on wood flour is the absorption of water. For this purpose we tested several formulations PEBD / WF and PEBD /WF treated with alkaline and thermic treatment. The structural analysis FTIR of wood flour treated shown that the alkaline treatment that is more marked by the disappearance of the band at 3500cm-1 due to the linked O-H groups of cellulose The evolution of water absorption is evaluated as a function of time at different temperatures. The results show that the rate of water absorption increases with the increase of the untreated and treated load wood flour. The thermal treatment at 150°C gives a better result of water absorption rate at the temperature of 40 ° C. The results show a rate of the order of 12% and 17% after 360 h at the temperature of 40 ° C and 25 ° C respectively. The temperature does not affect the water absorbed by PEBD / 30% WF heat-treated at 180 ° C. A rate of 12.9% and 12.4% is obtained after 190 min at the temperature of 40 ° C and 25 ° C respectively.

XR study and DFT analysis of a new polymeric hybrid material based on tin (II)

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4- Université Mentouri. Constantine
Sciences chimiques de Rennes', Université de Rennes1, France.

As a part of our ongoing studies into the reactions between amines and tin(II) fluoride (Boufas al., 2007), we have reacted benzidine with tin(II) fluoride in fluoridric acid. Few crystals were isolated from the reaction mixture and X-ray analysis proved them to be $(C_{12}H_{14}N_2)^{2+}$, $(Sn_2F_6)^{2-}$.

The title compound crystallizes in P-1 space group: a = 4.4190(30)Å, b = 5.2930(30) Å, c = 16.4440(70) Å, α = 93.821(4)°, β = 95.432(4)°, γ = 90.656(3)° and Z = 2. The tin site is surrounded by two terminal F atoms and two bridging ones. The presence of an additional secondary bond gives to tin (II) a distorted pseudo-trigonal-bipyramidal geometry with SnX5E environment forming infinite chains $(Sn_2F_6)n$. The overall structure is held by the presence of strong N-H…F hydrogen bonds in a three dimensional network. Mössbauer spectroscopy and conductivity measurements were applied.

The FT-IR and Raman spectra of the compound were recorded and analyzed. Theoretical calculations of the molecular structure and vibrational spectra of titled compound were performed using Density Functional Theory (DFT) with the B3LYP/LanL2DZ level of theory using Gaussian 09W program package. The data obtained from vibrational theoretical calculations are used to assign vibrational bands obtained in IR and Raman spectroscopy of the studied compound. The geometrical parameters of the title compound are in agreement with the values of similar structures.

References:

Boufas, S., Merazig, H., Moliterni, A-G and Altomare, A. Acta Cryst. (2007). C**63**, m315-m317.

2,5-Furandicarboxylic Acid Based Ionic-Copolyesters From Renewable Resources: Synthesis, Characterization And Degradation Study

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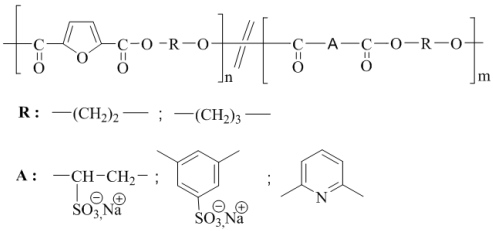
Polymeric materials synthesized from renewable monomers have already gained an established position among synthetic materials, both in academia and in industry. Recently, 2,5-furandicarboxylic acid (FDCA), as a HMF derivative, has gained particular attention as a suitable monomer for step-growth polymerization. Owing to aromatic structure and bio-based origin, FDCA can be considered as an excellent replacement for fossil fuel-based monomers like, for example, terephthalic acid (TPA)[1]. As a part of our research conducted in the frame of the biobased furanic copolymers, we report herein the synthesis of a new family of furanic copolyesters performed by melt polycondensation[2,3] between (FDCA), dimethyl 2,6-pyridinedicarboxylate (DEPy), dimethyl 5-sodiosulfoisophthalate (Na-DMSI),Sodium (sulfonated dimethyl succinate) (Na-DMSS), and various diols such as ethanediol (ED) and propanediol (PD). The microstructure of the resulting copolyesters was investigated and the statistic repartition of monomer units was evidenced by NMR analysis. As introduction of pyridinic, sulfonated moiety into furanic copolyesters backbone modify the polymer properties, a study on the relationship between the copolyesters structure and their physicochemical properties was achieved. Thus, thermal properties, solubility properties and degradation study were investigated.



Key words: Polycondensation, Bio-based, Degradation

References

[1] Gandini, A. Silvestre, A. J. D. Neto, C. P. Sousa, A. F. Gomes, M. *J. Polym. Sci. Polym. Chem.* **2009**, 47, 295.

[2] A. Bougarech, M. Abid, F. Gouanvé, E. Espuche, S. Abid, R. El Gharbi, E. Fleury, *Polymer.* **2013**, *54, 5482.*

[3] R. Triki, A. Bougarech, M. Tessier, S. Abid, A. Fradet, M.Abid, J. Polym. Environ **2017**

EFFECT OF COMPATIBILIZATION ON THE RHEOLOGICAL AND MECHANICAL PROPERTIES OF LOW DENSITY POLYETHYLENE/POLY (ε-CAPROLACTONE) BLENDS

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Most of the bio-based polymers, such as polyesters and starch, have limited properties and required either to be chemically modified or to be mixed with other polymers to improve their weak properties, like mechanical ones or further to reduce their sensitivity to moisture. Aliphatic polyesters have been of increasing interest because of their biodegradability and biocompatibility. This family includes a large number of renewable polymers such as poly (lactic acid) (PLA), Poly (hydroxyAlcanoates) (PHB, PHBV, etc), and poly (ε-caprolactone (PCL) [1, 2]. The present work is devoted to the study of the properties of uncompatibilized and compatibilized blends of low density polyethylene (LDPE) and poloy(ε-caprolactone) (PCL). The LDPE/PCL blends were prepared with different ratios of PCL ranging from 0 to 100 wt% while the compatibiliser, poly (ethylene-co-glycidyl methacrylate) (EGMA), was added to the blend 75/25 (LDPE/PCL) at concentrations ranging from 0 to 10 phr. The formulations were subjected to several investigations: structural (FTIR), rheological (Torque and MFI) and mecanichal (impact, microhardness). Infrared spectroscopy (FTIR) of the binary blends (LDPE/PCL) indicated the absence of any reaction between the homopolymers in these mixtures whereas the spectra of the ternary blends (LDPE/EGMA/PCL) revealed clearly the existence of interactions between the different constituents. The rheological study showed an increase in the value of the torque and the melt flow index of the LDPE/EGMA/PCL blends with the incorporation of the compatibilizer. In addition, the incorporation of the compatibilizer led to an improve in the impact resilience.

Key words: Poly (ε-caprolactone), low-density polyethylene, EGMA, immiscible blend, interface, biodegradation, compatibilisation.

References :

[1] D. S. Rosa, I. Chiovatto Neto, M. R. Calil, A. G. Pedroso, C. P. Fonseca, S. Neves (2004). Journal of Applied Polymer Science, Vol. 91(6) 3909-3914.
[2] M.A. Woodruff, D. W. Hutmacher (2010). Progress in Polymer Science, Vol.35 (10), 1217-1256.

STRUCTURAL, RHEOLOGICAL AND MECHANICAL PROPERTIES OF LOW-DENSITY POLYETHYLENE/POLY (3-HYDROXYBUTYRATE-CO-3-HYDROXYVALERATE) (PHBV) COMPATIBILIZED WITH POLY (ETHYLENE-CO-GLYCIDYL METHACRYLATE)

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Biodegradable polymers are prime candidates for use in a variety of disposable materials because of their eco-friendliness; however, these polymers have some drawbacks that limit their use as individual polymers **[1].** Poly (hydroxyalkanoate)s are biodegradable polymers that are naturally produced by bacteria. They can be processed to make a variety of useful products, in particular for application in single use packaging and agriculture [2]. In the present work, poly (hydroxybutyrate-co-hydroxyvalerate) (PHBV) is melt blended with low-density polyethylene (LDPE) as an attempt to improve its weak mechanical properties. To enhance interfacial adhesion in LDPE/PHBV blends, the copolymer poly (ethylene-co-glycidyl methacrylate) (EGMA) was used as compatibilizer. LDPE/PHBV blends were prepared with different ratios of PHBV ranging from 0 to 100 wt% while EGMA was added to the blend 75/25 (LDPE/PHBV) at concentrations ranging from 0 to 10 phr. To characterize the uncompatibilized and compatibilized blends, the different formulations were subjected to the following tests: FTIR spectroscopy, viscosity measurements (Torque and MFI) and mechanical tests (impact, microhardness). FTIR spectra of the uncompatibilized blends (LDPE/PHBV) revealed the absence of any reaction between the constituents whereas the spectra of the compatibilized blends (LDPE/EGMA/PHBV) showed the disappearance of EGMA bands indicating the establishment of interactions between the different constituents. The rheological investigation showed an increase in the viscosity of LDPE/EGMA/PHBV blends with the incorporation of the compatibilizer. Similarly, the mechanical properties of the ternary blends are improved due to the presence of the compatibilizer.

Key words: Biodegradable polymers, Poly (3-hydroxybutyrate-co-3-hydroxyvalerate), compatibilization, polyethylene.

References

[1] P. Ma, A.B. Spoelstra, P. Schmit, P.J. Lemstra (2013). European Polymer Journal, Vol.49 (6), 1523-1531.
[2] S. Modia, K. Koellingb, Y. Vodovotza (2013). European Polymer Journal, Vol.49 (11), 3681-3690.

Molecular Modeling Study of Tolfenamic and Flufenamic acids by β-Cyclodextrin

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The structural aspects for the complexation of tolfenamic (TA) and flufenamic (FF) acids / β -cyclodextrin were explored by using PM3mm, density function theory B3LYP/6-31G*, M05-2X/6-31G*,B3PW91/6-31G*, MPW1PW91/6-31G*, HF/6-31G* methods and several combinations of ONIOM2 hybrid calculations. Calculations were performed upon the inclusion complexation of β -cyclodextrin (β -CD) with TA and FF. The obtained results with PM3mm method clearly indicate that the formed complexes are energetically favored, the complex of TA/ β -CD in B orientation is significantly more favorable than the others energetically.The structures show the presence of several intermolecular hydrogen bond interactions that were studied on the basis of natural bonding orbital (NBO) analysis, employed to quantify the donor-acceptor interactions between TA and β -CD.

Finally, the chemical shifts (ppm) of free complexed tolfenamic (TA) and flufenamic (FF) were calculated at B3LYP/6-31G(d) by (GIAO method) and compared with experimental data taken from the literature.

Keywords: β- Cyclodextrin , PM3mm , ONIOM2 , GIAO.

The effect of Titanium Dioxide (TiO_2) on a PVC formulation

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This work deals study of the effect of the TiO_2 level on the mechanical and thermal properties of polyvinyl chloride (PVC). For that, two formulations were prepared in which the $CaCO_3$ loading rate was set at 19.2% for the F1 formulation and 22.5% for the F2 formulation and the TiO_2 content was varied from 0.5 to 4.5% for both formulations. The results obtained by Fourier Transform Infrared Spectroscopy (IRTF) showed the presence of the characteristic bands of PVC as well as the characteristic peaks of TiO_2 and $CaCO_3$. The tensile test showed the improvement in material stiffness as a function of the pigment content TiO_2 for the two formulations F1 and F2. This improvement is better in the case of F1 (19.5% $CaCO_3$) compared to F2 (22.5% $CaCO_3$). Measurement of resilience by impact test Izod confirmed that the impact resistance of PVC is better for formulation F1. Thus, the formulation F1 can be recommended at 1.5% TiO_2 for use at the industry level. Differential Scanning Calorimetry (DSC) showed an increase in Tg as a function of the TiO_2 level for both formulations. This increase is more pronounced in the case of the F2 formulation since the $CaCO_3$ charge rate is higher.

Keywords: polyvinyl chloride, Titanium Dioxyde, mechanical properties, thermal properties.

Effect of surface modification of olive stone flour reinforced polystyrene composites

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The influence of surface modification of olive stone flour (OSF) reinforced polystyrene composites on the morphological, thermal, tensile and water absorption properties were investigated. The flour was treated by kind of organosilane (3-Methacryloxypropyltrimethoxy Silane). Treated olive stone flour at various percentages was incorporated into polystyrene (PS) to produce composites. The changes in structure and properties resulting from this treatment were followed by various characterization techniques. It found that the increasing the OSF content decreased the tensile strength and elongation at break of composites. However, the water absorption increased with the addition of OSF. The tensile strength and elongation at break of modified composites was higher than unmodified composites. Surface modification with silane agent decreased the water absorption of the modified PS/OSF composites. The results showed that the filler-matrix interaction improved with the modification of OSF with (3-Methacryloxypropyltrimethoxy) Silane.

NEW SEMI CONDUCTING POLY-9,10- ANTHRACENES: SYNTHESIS, PHYSICO-CHEMICAL CHARACTERIZATIONS AND APPLICATION ON ORGANIC FIELD-EFFECT TRANSISTOR.

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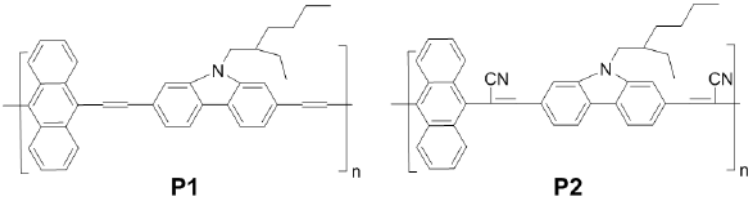
Two new semi-conducting conjugated polymers containing 2,7-disubstituted carbazole and anthracene moieties in the main chain, were synthesized via Wittig (**P1**) and Knoevenagel (**P2**) polycondensations.



Structures of the polymers P_1 and P_2

The effect of cyano (CN) side groups on physicochemical and electrical properties of the synthesized materials was studied. The two polymers exhibit good thermal stability up to 250 °C. The Differential Scanning Calorimetry analysis showed a glass transition at 51 ° C for **P1** and an amorphous behavior for the two macromolecules. Computational analyses by Density Functional Theory (DFT) and time-dependent (TD-DFT) were then used to obtain the conformation and the energy distributions of the molecular orbitals of the two compounds. The influence of cyano (CN) groups on the UV-Visible absorption and photoluminescence (PL) characteristics in solutions and in thin films was studied. The very weak fluorescence observed for **P2,** compared to **P1,** was related to the photo-induced electron transfer (PET) process from the cyano group to the anthracene fluorophore unit. The LUMO and HOMO energy levels and the band gap of **P1** and **P2** were investigated by cyclic voltammetry. Finally, devices with [ITO/Polymer/Al] configuration have shown relatively low turn-on voltages and three different mechanism conductions for each device. Charge-carrier mobilities were extracted from SCLC regime of the single-layer diodes.

Key words: Organic Semi-Conductors, Carbazole, anthracene, UV-Vis absorption, photoluminescence, Charges carrier mobilities, Schottky diode.

INFLUENCE OF PACKAGING ON FOOD QUALITY

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Polyethylene terephthalate is widely used as packaging in the food industry, especially for water conditioning.

Packaged waters fall into two categories: natural and spring mineral waters. Both types of water are of underground origin. However, mineral waters are distinguished from spring waters by their content of certain mineral constituents, the stability of their composition and their original purity, which gives them beneficial effects on health. Since the early 1980s, PET has gradually replaced other materials (glass) used for water conditioning in supermarkets. The use of this polymer has been favored given its physical properties such as transparency, gas tightness and its ability to recycle.

The assessment of the inertia of plastics in contact with foodstuffs, such as PET, is governed by a comprehensive and specific regulation that ensures the safety of the material. It appeared necessary to obtain more comparable and reliable information by linking the composition of the chemical mixtures present in the water at the end of the migration of the PET packaging and of potential toxicological effects, in order to conclude to an evaluation of the risks to human health. is therefore the subject of the present work, in order to specify the factors of influence of migration, the composition of migrats and the toxic potential of these. The aim is also to anticipate the health safety issues that regularly emerge when publishing articles with disturbing data.

Keywords: polymer, PET, mineral water, pollution, packing.

Polypyrrole-wrapped carbon nanotube composite films deposited on diazonium-modified flexible ITO sheets for the electroanalysis of heavy metal ions

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Highly sensitive multicomponent materials designed for the recognition of hazardous compounds request subtle control over interfacial chemistry. It is a key parameter in the construction of sensing architectures. In this work, multiwalled carbon nanotubes (in short CNTs) were deposited on diazonium-modified flexible ITO electrodes prior to electropolymerization of pyrrole. This three step process (diazonium electroreduction, deposition of CNTs and electropolymerization) provided adhesively bonded polypyrrole-wrapped CNT composite coatings on aminophenyl-modified flexible ITO sheets. The aminophenyl (AP) groups were attached to ITO by electroreduction of the in situ generated aminobenzenediazonium compound in aqueous, acidic medium. For the first time, polypyrrole (PPy) was electrodeposited in the presence of both benzenesulfonic acid (dopant) and ethylene glycol-bis(2-amin oethylether)-tetraacetic acid (EGTA) which acts as a chelator. The flexible electrodes were characterized by XPS, Raman and scanning electron microscopy (SEM) which provided strong supporting evidence for the wrapping of CNTs by the electrodeposited PPy. Indeed, the diameter of the nanotubes increased from 2-9 nm to ~24-35 nm for 1 cycle of voltammetry and further increased to ~29-45 nm for 5 cycles.

The PPy/MWCNT$_S$/NH$_2$-ITO films generated by this strategy exhibit significantly improved stability and higher conductivity values compared to a similar PPy coating without any embedded CNTs as judged from electrochemical impedance spectroscopy measurements.The potentiometric response is linear in the 10^{-8}-3×10^{-7} mol.L^{-1} Pb(II) concentration range and the detection limit is 3×10^{-9} mol.L-1 at S/N=3.

DFT investigation of ring opening of aziridines under lewis acid catalysis

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Anionic polymerization is among the best proposed methods for the preparation of great variety of polymers. Several accessible materials are available for that purpose such as vinyl monomers which are known as reliable compounds followed by different ring opening strategies of three membered ring systems in particular nitrogen heterocycles like aziridines. Ring strain renders aziridines susceptible to the ring opening reactions that dominate their chemistry and makes them useful synthetic intermediates but also as important monomeric units in polymerization reactions. Anionic ring polymerization of aziridines is realized by activating the aziridine ring through N-protonation, N-acylation or N-complexation with lewis acids.
Hence in this work, emphasis has been placed on the ring opening of aziridium ion obtained through N-complexation with lewis acid catalyst. Thus, we investigate theoretically by density functional theory (DFT) both mechanistic and kinetic approaches of the ring opening by using the hybrid functional B3LYP at 6-311G (d, p) level of theory all by including the polarizable continuum model (PCM) to take account for the solvent effect.
All obtained transition states were confirmed with IRC calculations.

Keywords: Density functional theory (DFT), aziridine ring opening, Kinetic study, polymerization

References

[1] Laura T, Frederik R. W. Living Anionic Polymerization of Functional Aziridines, Macromol. Symp. 2015, 349, 51-56.
[2] D. Tanner. Chiral aziridines—their synthesis and use in stereoselective transformations. Angewandte Chemie International Edition. 33 (1994) 599-619.
[3] J. M. Concello´ n and E. Riego. J. Org. Chem.. 2003. 68. 6407-6410

Involvement of hybrid materials based on natural clay and poly(vinyl chloride) into extraction of metal cations

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The solid-liquid extraction is one of the most used methods for protection of the environment against organic and inorganic pollutants. The hybrid materials have been synthesized by a simple method from natural clay and modified poly(vinyl chloride) (PVC). The obtained products were characterized by various techniques, infrared spectroscopy (FT-IR), thermogravimetric analysis (TGA) and differential thermal analysis (DTA). The final materials were successfully used for entrapping heavy metal ions (Fe, Cu, Cd, Zn, Pb, Mn and Co). The quantities of adsorbed metal cations were determined by atomic absorption analysis. It has been revealed that the metals extraction was governed essentially by the af- finity between the functional groups of the hybrid material and the investigated metal ion. The cations are extracted in the following decreasing order of effectiveness: $Fe^{3+} > Cu^{2+} > Co^{2+} \approx Mn^{2+}$ Pb^{2+} $Cd^{2+} \approx Zn^{2+}$.

Keywords: modified poly(vinyl chloride), clay, hybrid material, metal cations, extraction.

COMPATIBILIZATION OF RECYCLED POLY (ETHYLENE TEREPHTHALATE)/POLYPROPYLENE BLENDS

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Polyethylene terephthalate (PET) is widely used in the manufacturing of food packaging industry, especially mineral water bottles due to its high tensile and impact strength, chemical resistance, clarity, transparency, and good thermal stability [1,2]. The production of PET bottles in large number has created a very large environmental problem, as most of these bottles do not decompose. The effective solution to deal with this problem is through recycling of used PET bottles. There are chemical and mechanical methods for recycling of PET. The last one includes re-melting and mixing of PET with other polymers and reinforcing fillers, is the widely used because it's the easiest and the cheapest to perform [3,4].

In this study, Binary blends of polypropylene (PP)/recycled poly(ethylene terephthalate) (r-PET), and ternary blends of PP/r-PET (80/20 w/w) compatibilized with various amounts (2.5, 5 and 10 wt%) of maleic anhydride grafted polypropylene (PP-*g*-MA) were prepared on a twin-screw extruder. The effect of the compatibilizer content on the morphological and mechanical properties of PP/recycled PET blends was investigated. Tensile strength, and tensile strain at break, improved with the addition of the compatibilizer. The compatibilized blends had a smaller size of dispersed phase compared with the uncompatibilized blends. This may result from the enhanced interaction between the matrix and dispersed phase.

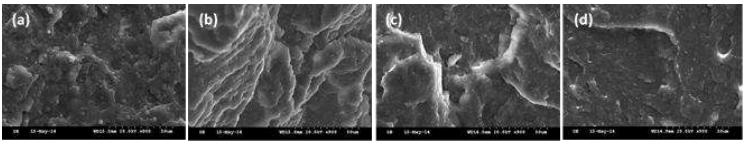

Figure 1 : SEM micrographs (a) PP/r-PET 80/20 (b) PP/r-PET/PP-*g*-MA 80/20/2.5 (c) PP/r-PET/PP-*g*-MA 80/20/5 (d) PP/r-PET/PP-*g*-MA 80/20/10

Key words: Blends, Polypropylene, Recycled poly(ethylene terephthalate), Mechanical properties.

References

[1] Ishak. A, Chiachun. T, Muichin. H, Characterization of polyester composites from recycled polyethylene terephthalate reinforced with empty fruit bunch fibers. Materials and Design (2011); 32: 4493-4501.
[2] Ayse. A, Nevin Gamze K, Sertan Y, Effect of short fiber reinforcement on the properties of recycled poly(ethylene terephthalate)/poly(ethylene naphthalate) blends, Materials and Design (2013) ;46:867-872.
[3] Y.X. Pang,* D.M. Jia, H.J. Hu, Hourston D.J, Song. M, Effects of a compatibilizing agent on the morphology, interface and mechanical behaviour of polypropylene/poly(ethylene terephthalate) blends, Polymer (2000); 41: 357-365.
[4] Nunez AJ, Sturm PC, Kenny JM, Aranguren MI, Marcovich NE, Reboredo MM, Mechanical characterization of polypropylene-wood flour composites. J Appl Polym Sci (2003); 88:1420-1428.

Electropolymerized Fe_3O_4NPs-Overoxidized polypyrrole-Erichrome Black T nanocomposite on platinum electrode for dopamine detection

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Dopamine (DA) is an important neurotransmitter and its abnormal concentration are associated with different diseases [1]. In this work, we report the electrochemical deposition of iron oxide nanoparticles (Fe_3O_4NPs) on ultrathin overoxidized polypyrrole (PPy_{ox}) film coating on platinum electrode in presence of Erichrome Black T (NET) and dapsone (DDS), used to detect dopamine. The deposited Fe_3O_4NPs significantly increased the surface area of working electrode. The properties of the nanocomposite have been characterized by scanning electron microscope (SEM) and electrochemical investigations. The kinetic data obtained at different temperatures were studied using CV. The nano-Fe_3O_4NPs/PPy_{ox}/NET/Pt had strongly catalytic activity toward the oxidation of dopamine. The catalytic peak currents obtained from differential pulse voltammetry (DPV) increased linearly with increasing DA concentrations in the range of 10^{-4} to 10^{-6} M with a sensibility of 0.232 A/mol. L^{-1}. The designed non-enzymatic sensor exhibited excellent sensitivity, stability and favorable electron transfer kinetics toward dopamine.

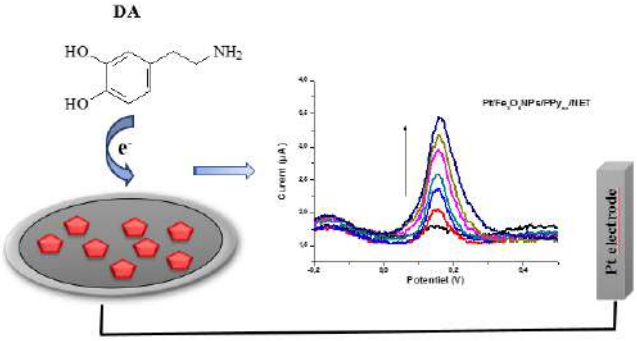

Fig: Electrocatalytic oxidation of dopamine

Reference

[1] Zhuang, Z., Li, J., Xu, R., and Xiao, D. Electrochemical detection of dopamine in the presence of ascorbic acid using overoxidized polypyrrole/graphene modified electrodes. Electrochem. Sci. 6,6 (2011), 20149-2161.

COMPARATIVE STUDY OF THE ELECTROCHEMICAL DEGRADATION OF THE PHENOL ON αPbO_2 CHEMICAL-PANI AND αPBO_2 CHEMICAL-PANI-ADDITIVE ANODES

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This present work had as a principal objective the synthesis of two type composite materials containing αPbO_2 which are the αPbO_2 - Pani and αPbO_2 - Pani-Additive which has a good electrical conductivity and their use as materials of electrode for degradation of the organic compounds in suspension in water in fact the phenol. The analysis of diffraction of X-rays - of lead dioxide obtained by oxidation of a lead acetate solution showed the presence of a mixture of the two phases α and βPbO_2 whereas spectrum DRX carried out on the polymer (polyaniline) showed this last presents a high degree of crystallinity which confers a good conductivity to him. These results enabled us to test the electrocatalytic activity of our electrodes, with respect to the reaction of oxidation of the molecule of phenol. The results obtained showed that the oxidation of phenol occurred indeed and that the composite material is very effective for the decomposition of phenol.

Key words : Material composite, polyaniline, additive, electrocatalytic activity.

Development and characterization of gastro-retentive hydrogel formed in situ based on alginate.

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In situ gelling systems have given rise to great importance as bio drug delivery equipment and regeneration medicine, especially hydrogels undergoing a sol-gel transition at the site in which they are delivered.
The aim of this work was to form a gastro-retentive system based on sodium alginate which, in the presence of calcium carbonate and without calcium bicarbonate, is able to undergo gelation in situ during contact with gastric juice. Fifteen tests with different concentrations of sodium alginate and calcium carbonates were carried out. Gel formation in situ was confirmed in a simulated gastric fluid at pH 1.2 with very fast kinetics, and the stiffness of the latter was studied by measurements of the viscoelastic parameters which showed that the gel formed was consistent with the higher retention than the loss module. The results showed that a formulation with an amount of 5% of alginate and bicarbonate had the necessary properties for gastric retention.

Key words: Sodium alginate, in situ gelling, gastro-retention, viscoelasticity.

Effect of temperature and surfactant addition on the rheological behavior of polyvinylpyrrolidone aqueous solution

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The aim of this work is to study the rheological behavior of a concentrate neutral polymer, polyvinylpyrrolidone, aqueous solution and the effect of surfactant addition concentration ranged from 0 to 14 g/L. The effect of temperature is also examined in the 25°C to 60°C temperature range. The obtained η-γ rheogramms show different behaviors of the prospected solutions described quantitatively by the Ostwald model, $\eta = K\gamma^{n-1}$. A pseudo-platic to newtonien behavior transition was detected for polymer aqueous solution when temperature was varied. When the surfactant is added on the concentrate polymer aqueous solution at 25°C, a spectacular increase of the consistence index is observed by increasing the surfactant concentration.

DEXTRAN-CALCIUM ALGINATE BEADS AS A CONTROLLED DRUG DELIVERY SYSTEM

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A novel and smart oral drug delivery system, based on biopolymers, was developed for controlled release of sodium diclofenac (SD), as drug model [1, 2]. SD loaded Dextran-Calcium alginate (D-CA) particles beads were prepared by ionotropic gelation method using calcium chloride ($CaCl_2$) as cross-linker agent and were optimized using response surface methodology (RSM) [3-5] based on (3^2) factorial design. The effects of biopolymer-blend ratio and $CaCl_2$ concentration, as independent variables, on drug encapsulation efficiency (DEE, %) and cumulative drug release after 8h (R_{8h}, %) were studied. Therefore, the optimized D-CA particles beads showed DEE of 66.94 ± 2.45 %, R_{8h} of 61.14 ± 2.32 % and mean diameter of 1.08 ± 0.01 mm. The results suggested that such the compatible D-CA particles beads might be exciting and promising for controlled oral delivery of SD.

Keywords: beads particles, biopolymers, controlled release, diclofenac, drug delivery.

References:

1. González-Rodríguez, M.a.L., et al., *In vitro release of sodium diclofenac from a central core matrix tablet aimed for colonic drug delivery.* European journal of pharmaceutical sciences, 2003. **20**(1): p.125-131.
2. Rattes, A.L.R. and W.P. Oliveira, *Spray drying conditions and encapsulating composition effects on formation and properties of sodium diclofenac microparticles.* Powder Technology, 2007. **171**(1): p. 7-14.
3. Bezerra, M.A., et al., *Response surface methodology (RSM) as a tool for optimization in analytical chemistry.* Talanta, 2008. **76**(5): p. 965-977.
4. Giovanni, M., *Response surface methodology and product optimization.* Food technology, 1983.
5. Ghafari, S., et al., *Application of response surface methodology (RSM) to optimize coagulation-flocculation treatment of leachate using poly-aluminum chloride (PAC) and alum.* Journal of hazardous materials, 2009. **163**(2): p. 650-656.

Determination of poly aromatic hydrocarbon (PAHs) compounds in some fish tissues at Al -Gabal Al -Akhder (eastern north of Libya) coasts (As a product of petroleum industries)

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The contents of poly aromatic hydrocarbon (PAHs) compounds were studied by determination their contents in some fish tissues collected from different regions distributed along of eastern north of Libya coasts by using GC -Mass technique. The poly aromatic hydrocarbons are classification as major compounds which mainly attributed to the effect of petroleum industries on the environment, in this study the poly aromatic hydrocarbons including (Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene + Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(ghi)Perylene and indeno(1,2,3-cd)Pyrene). The concentrations of PAHs in the fishes organisms were fluctuated between (3.92 - 6.76 µg/g), (3.0648 - 4.94 µg/g) and (6.67 - 35.01 µg/g) in gills, muscles and liver, respectively, the high concentrations were recorded in the liver tissues in the three studied fishes samples (***siganus rivulatus, mugli sp and mullus barbatus***) were (35.0179, 6.674 and 16.66 µg/g) respectively. The maximum value of ∑ PAHs 17.791 µg/g was recorded for chrysene compound in the all samples. The high contents of ∑PAHs were recorded in ***siganus rivulatus*** comparing with the other studied species, while the low contents of ∑PAHs were recorded in muscles of ***Mullus barbatus*** species. The joint FAO/WHO Expert Committee on food additives has developed a notification that concentration of Bap should be not exceed the limit of 10 µg/g in the fishes tissues for human consumer.This value is lower than that obtained in present study i.e., between 0.02 - 2.671 µg/g for all organisms. The study concluded that the most resources of the recorded compounds are according to petrogenic source.

Accelerated aging of biobased/kenaf fibres composite: Visual appearance, color and structural changes

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In this presentation, a comparison between the degradation behaviour of starch-grafted-polypropylene reinforced with 30 % wt of kenaf fibres (S-g-PP/KF) and the virgin matrix (S-g-PP) were carried out, when materials were subjected to UVA and UVB radiations, for various periods. Changes induced by radiations on the structure, visual and morphological appearance, were evaluated.

Results of visual appearance have shown colour changes with the progression of exposure, from brown to chalky white colour in case of UVB exposed composite. Matrix samples have shown also chalky white colour after exposure to UVB, while a complete discoloration followed by yellowing was observed for UVA exposed matrix. Colour measurements demonstrated an increase in lightening and total colour changes after UV exposure, in parallel to a decrease in yellowness and redness parameters. Changes were more accentuated in UVB exposed composite.

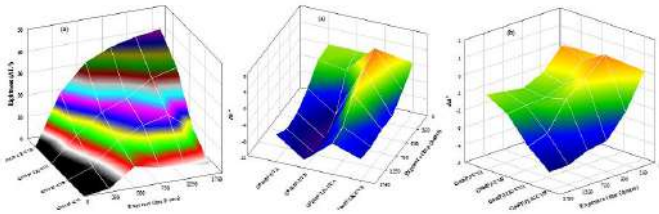

Fig. 2 Lightness, Yellowness and Redness parameters change of UV exposed samples.

FTIR-ATR analysis confirmed the deterioration of the chemical structure of exposed samples. Complexes mechanisms occurs which evidenced the co-existence of crosslinking and chains scission reactions. Fibres has found to not affect the mechanism of oxidation while it is, visibly, affected by the irradiation intensity.

References

[1] Ahmad Thirmizir, M.Z., et al., Natural Weathering of Kenaf Bast Fibre-Filled Poly(Butylene Succinate) Composites: Effect of Fibre Loading and Compatibiliser Addition. Journal of Polymers and the Environment, 2010. 19(1): p. 263-273.
[2] Méndez-Hernández, M.L., et al., The effect of thermoplastic starch on the properties of HDPE/TPS blends during UV-accelerated aging. Polymer Bulletin, 2011. 67(5):p.903-914.
[3] Cogulet, A., P. Blanchet, and V. Landry, Wood degradation under UV irradiation: A lignin characterization. J Photochem Photobiol B, 2016. 158:p.184-91.
[4] Ndiaye, D., et al., Durability of wood polymer composites: Part 1. Influence of wood on the photochemical properties. Composites Science and Technology,2008. 68(13): p.2779-2784.
[5] Azwa, Z.N., et al., A review on the degradability of polymeric composites based on natural fibres. Materials & Design, 2013. 47:p.424-442.

Olive Pomace as filler source to development of composite materials based on agro-food waste

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Biodegradable materials from renewable agricultural resources have attracted much attention for sustainable development. Wheat gluten with its unique viscoelastic properties and its water insolubility is of particular interest. Gluten-based materials can be usually obtained by mixing. In this process, both mechanical shearing and heating are involved, gluten proteins is modified and undergoes an aggregation. Application of protein-based bioplastics is severely restricted due to their lower stiffness, and their strong propensity to absorb moisture. The use of agrowaste materials as a source of fillers or reinforcements; provides a renewable source and could generate a non-food source of economic development. Among these materials, olive pomace is an industrial byproduct of the olive oil production process. Olive pomace contains a big amount of cellulose, hemicelluloses, lignin. Chemical were applied to promote a strong interface adhesion between polymers and fillers. During the last decades, a lot of interest was given to the biocomposites development, due to the low cost and degradability of waste food industries. In this study, biocomposites were developed from Wheat Gluten plasticized by 35% of glycerol, containing 0-20% of Clean Olive Pomace (COP), Esterified Clean Olive Pomace (ECOP), or Mercerized Clean Olive Pomace (MCOP) powders, which were prepared by conventional blending.. Mechanical properties was detailed.

Keywords: Wheat gluten, olive pomace powder, biocomposites, mechanical properties

Modification of interfacial adhesion with a functionalized polymer in PHA/Olive husk flour composites

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In recent years, considerable attention of researchers is focused on the use of biodegradable polymers and natural fibers as reinforcement in the design of composite materials for associating a durable, lightweight, non-abrasive, structured and low cost. Our work focuses on the development of composite materials based on polyhydroxyalkanoates loaded with olive husk flour (OHF). However, despite all these benefits natural fibers raise a major inconvenience when combined with thermoplastics. Indeed the timber has a strong hydrophilic character, creating an interface incompatibility between the lignocellulosic materials and thermoplastic hydrophobic character. This interfacial incompatibility affects the synergy between the composite constituents knowing that the interface is the privileged place of the stress transfer between the reinforcement and the matrix. To overcome this problem of interfacial incompatibility. A method is proposed in this study, it is to use an AM (maleic anhydride) modifying agent that has been grafted onto the polymer using an extruder. Maleic anhydride door improving the compatibility between the matrix and the fiber, and then obtain a better dispersion of the olive husk flour (OHF) in the last.These composites have been characterized by various techniques: mechanical tests, the rheological, morphological, physical and thermal.

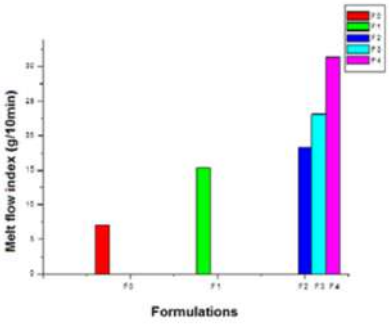

Figure 1: Evolution of the melt flow index of F0 (virgin PHA), F1 (PHA/OHF), F2 (PHA/OHF/1% AM), F3 (PHA/OHF/2% AM) and F4 (PHA/OHF/3% AM).

Key words: Composites; Compatibilization; Vegetable fiber; Grafting; PHA.

References

1. Hamour N, Boukerrou A Djidjelli et al (2017) Effect of gamma irradiation aging on mechanical and thermal properties of alfa fiber-reinforced polypropylene composites: Role of alfa fiber surface Treatments. J Thermoplast Compos Mater 1-18.
2. Rutkowska M, Krasowska K, Heimowska A et al (2008) Environmental degradation of blends of atactic poly[(R, S)-3-hydroxybutyrate) with natural PHBV in Baltic sea water and compost with activated sludge. J Polym Environ 16: 183-191.

Preparation and characterization of a biopolymer from starch extracted from potato waste

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In recent decades, plastic research has focused on the use of biodegradable polymers as an alternative to petroleum based plastic products. Current trend in the plastic bag industry is the substitution of chemical compounds by others of natural origin, such as starch. The aim of this work is to develop a bioplastic based on starch extracted from potato waste.

In this work, a structural characterization was carried out on the starch extracted from the potato peeling and compared with commercial starch. Mechanical, rheological and thermal characterizations were made (tensile test, viscosity and DSC).

The extracted starch was characterized via infrared absorption spectroscopy (FTIR), good purity was noticed.

A DSC characterization was made to determine the thermal transitions, namely the melting temperature, and this to be able to inject this polymer into a mold for tensile test. The end of the endothermic peak is around 150°C, it is the temperature that can be used for the injection.

Traction test showed that the made biopolymer is more flexible and malleable than the polypropylene generally used for bags, it support more elongation at the maximal force; this is suitable for injection into plastic films. But polypropylenes still have better mechanical properties: more weight support, more rigid, therefore less easy to drill. That can be enhanced by addition of crosslinking agents such as peroxides or silanes.

A comparative study of thermo-mechanical and dielectric properties of two epoxy-based polymers

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In this study, we investigate thermo-mechanical and dielectric properties of two epoxy-based polymers. The main difference between them is related to the resin type: diglycidyl ether of bisphenol A (DGEBA) for the first one and Triglycidyl p-Aminophenol (TGAP) for the second one. In both cases, the curing agent was diethylenetriamine (DETA). Dynamic mechanical thermal analyses indicate that TGAP/DETA has higher Young modulus and higher glass transition temperature than DGEBA/DETA. This can be attributed to the fact that TGAP presents three epoxy functions while DGEBA possesses only two, making the first network more reticulated than the second one. Dielectric relaxation spectroscopy was considered to carry out the dielectric properties of epoxy samples at different temperatures, in the frequency range 0.1 Hz - 10 MHz For both polymers, dipolar α and interfacial Maxwell-Wagner-Sillars relaxations have been observed; whereas, the dipolar β-relaxation appeared only in TGAP/DETA. The relaxation parameters, deduced from experimental data, using the Havriliak-Negami model, will be presented and compared according to the considered epoxy resin.

SBA-15 $Cu^{(II)}$ for the synthesis of disubstituted 1,2,3-triazoles

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In order to take into account the environmental impact of chemical reactions, green chemistry processes are increasingly developed. "Click chemistry" that consists of connecting building blocks with a total atom economy is an effective strategy that responds to the green chemistry principles, particularly if the catalyst can be reused.
The copper-catalyzed azide-alkyne cycloaddition (CuAAC) is the landmark reaction in click chemistry and originates from the pioneering works of Sharpless *et al*[1] and Meldal *et al*.[2] Copper (I) catalysis accelerates dramatically the Huisgen 1,3-dipolar reaction and leads to a high regioselectivity in favor of the 1,4-isomer of the triazole product. The copper (I) sources are generally copper (I) salts in presence of a base and/or a ligand, *in situ* reduction of copper (II) salts usually by ascorbate, and a mixture of copper (0) and copper (II) species.[3]
As far as we are concerned, we have been already interested in controlling the regioselectivity of the reaction in microreactors such as micelles.[4] Herein we have explored the usefulness of mesoporous material and the potential role of the pores in the catalysis of the process. Indeed copper loaded on silica type materials as MCM-41 and SBA-15 have been shown to be very useful in selective catalytic experiments.[4] Our preliminary results concerning the use of SBA-15 copper (II) show that copper (II) is an efficient and reusable heterogeneous catalyst for the CuAAC reaction ; no additives such as a base or a reducing agent are required. In reactions with quantitative yields a mere filtration of the mesoporous material which retains copper (II) allows the recovery of the catalyst and the product, leading to a very low E-factor for the process.

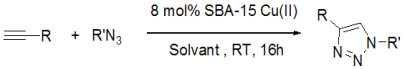

Figure: Cu-SBA-15 Huisgen cycloaddition catalysis

This catalyst is not only active in organic solvents but also in aqueous solution. The conversion can be as high as 99 % and even in aqueous media a regioselectivity of 100% is obtained. To our knowledge, this is the first time that an SBA-15 Cu(II) material has been shown to be active as a reusable catalyst for azide-alkyne cycloaddition reactions. Further investigations have been performed in the aim to determine the mechanism of the reaction, involving or not Cu(I). But no evidence have been obtained and a Cu(II) catalysis with control of the regioselectivity is proposed.

References

1- V. V. Rostovtsev, L. G. Green, V. V. Fokin and K. B Sharpless, *Angew. Chem., Int. Ed.* 2002, **41**, 2596-2599.
2- C. W. Tornøe, C. Christensen and M. Meldal, *J. Org. Chem.* 2002, **67**, 3057-3064
3- M. Meldal and C.W. Tornø, *Chem. Rev.* 2008, **108**, 2952-3015.
4- R. Aït Youcef, M. Dos Santos, S. Roussel, J.-P. Baltaze, N. Lubin-Germain and J. Uziel *J. Org. Chem.* 2009, **74**, 4318-4323

Structural Characterization of Polypropylene/ Wood Floor Composite

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In recent years, due to growing environmental concerns and the depletion and price of oil, there has been a growing renewal of interest in fibres derived from natural sustainable sources, as a result of their potential use in high performance composite materials. Many types of natural fibre have been identified as having appropriate mechanical properties for structural applications [1]. However, natural fibers are hydrophilic in nature and exhibit poor interfacial adhesion between fiber and matrix. Modification of the fiber surface by chemical methods, such as alkalisation, benzoylation and acetylation, has been used by researchers to improve this shortcoming [2].

The aim of this work is to study the effect of the alkali treatment (5%w NaOH) on the structural properties of polypropylene/Wood Floor **(**PP/WF) composite. According to the results, it was found that the treatment increases the Wood Floor's crystallinity index and that composites PP/WF had a rate of crystallinity higher than PP pure.

Key words: Composite, Wood Floor, surface treatment, alkalisation, structural properties

References

[1] V. Placet et al., « Nonlinear tensile behavior of elementary hemp fibers. Part I: Investigation of the possible origins using repeated progressive loading with in situ microscopic observations », Composites: Part A, Vol. 56, 2014, pp. 319-327

[2] S.A. Paul et al., « Effort of fiber loading and chemical treatments on thermophysical proprieties of banana fiber/polypropylene commingled composite material », Composite Part A: Applied Science Manufacturing, vol. 39, 2008, pp. 1582-1588.

Enhancement of thermomechanical and physical properties of biocomposites from polylactic acid and olive solid waste filler with core-shell acrylate rubber particles

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Biocomposites from polylactic acid (PLA) and olive solid waste (OSW) were melt-blended with core-shell acrylate rubber particles (ACR) in order to enhance the thermal stability upon melt processing and the mechanical performances of these biocomposites, thereby expanding their area of application. Dynamic mechanical analysis indicated that the ACR particles imparted more flexibility to the PLA/OSW biocomposites and thermal analysis showed that the incorporation of ACR significantly restrained the ability of the PLA chains to crystallize. The values of complex viscosity and storage modulus were significantly increased with the introduction of ACR. These results could be assigned to the entanglements between the PLA chains and those of the ACR shell, giving rise to a physical network that limited the segmental mobility of PLA and induced a high melt elasticity. Mechanical tests revealed that the elongation at break and the impact strength of the biocomposites were considerably improved. Moreover, morphological observations showed a clear adhesion enhancement between the PLA matrix and the OSW fillers in the presence of the ACR additive.

Synthesis of Carboxymethylchitosan-graft-poly(methylmethacrylate): An efficient Hg^{2+} ions binder

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The consumption of contaminated water with mercury can provokes serious health problems in the central nervous and cardiovascular systems, kidneys and bones. This element tends to accumulate in tissues and organs of living organisms, causing several diseases and at extreme conditions, death [1]. Various methods for the removal of heavy metals from water exist such as chemical precipitation, coagulation-flocculation, ion exchange, electrodialysis, membrane filtration, reverse osmosis and adsorption [2, 3]. On the other hand, natural polysaccharides like chitin and chitosan have been used for the adsorption of heavy metals. Nonetheless, functionalization or immobilization techniques are often required to improve selectivity of the biopolymer for a particular metal ion [4]. We report herein a graft copolymerization of polymethylmethacrylate onto Carboxymethyl-chitosan in aqueous medium using microwave irradiation. The graft copolymer was characterized by Fourier transform infrared and ^{13}C NMR spectra analysis, differential scanning calorimetric and thermogravimetric analysis. The prepared copolymers have been used in removal of Hg^{2+} ions from water followed by adsorption studies at pH = 6.0. The effect of the contact time, kinetics and thermodynamic studies on the adsorption of Hg^{2+} ions has been also reported.

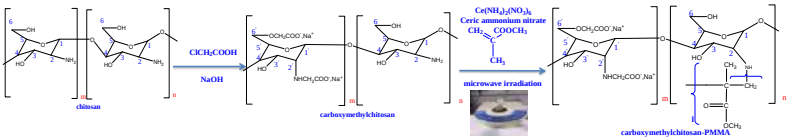

Fig. Schematic synthesis of CMCS and CMCS-g-PMMA under the microwave irradiation.

Keywords: chitin, chitosan, adsorption, mercury, wastewater treatment.

References

[1] P.B. Tchounwou, W.K. Ayensu, N. Ninashvili, D. Sutton, Environ. Toxicol. 18 (2003) 149-175.
[2] I. Ali, M. Asim, T.A. Khan, J. Environ. Manage. 113 (2012) 170-18.
[3] Q.Y. Chen, Z. Luo, C. Hills, G. Xue, M. Tyrer, Water Res. 43 (2009) 2605-2614.
[4] K.S. Xia, R.Z. Ferguson, M. Losier, N. Tchoukanova, R. Brüning, Y. Djaoued, J. Hazard.Mater. 183 (2010) 554-564.

Theoretical studies of hyper-Rayleigh scattering (HRS) first hyperpolarizability of push-pull polyacetylene compounds

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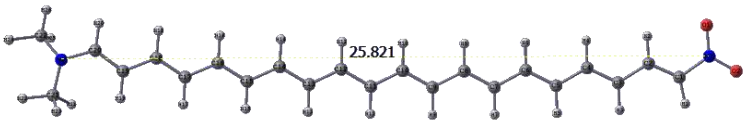
The polarizabilities and hyper-Rayleigh scattering first hyperpolarizabilities β_{HRS} of representative push-pull π-conjugated polyacetylene compounds has been calculated to assess the effects of basis sets, of frequency dispersion, and of the solvent within the polarizable continuum model (IEF-PCM), as well as to address structure-property relationships. These calculations confirm the specific behaviour of the hyper-Rayleigh scattering (HRS) first hyperpolarizability and of its depolarization ratio (DR) as a function of the incident light frequency are strongly system-dependent, the large impact of including solvent effects on the first hyperpolarizabilities, the interplay between several second-order nonlinear optical molecular responses: the norm of the first hyperpolarizability (β_{vec}), the projection on the dipole moment ($\beta_{//}$), which can be obtained from EFISHG measurements, and the HRS response (β_{HRS}).



REFERENCES

[1] B. Champagne and B. Kirtman, in Handbook of Advanced Electronic and Photonic Materials and Devices, ed. H. S.Nalwa, Academic Press, New York, 2001, Chap. 2, vol. 9, p. 63
[2] W. Chen, G. T. Yu, F.L. Gu, and Y. Aoki, J. Phys. Chem. C 113 (2009) 8447.
[3] A. Bossi, E. Licandro, S. Maiorana, C. Rigamonti, S. Righetto, G.R. Stephenson, M. Spassova, E. Botek, and B. Champagne, J. Phys. Chem. C 112 (2008) 7900
[4] A. Baranovska and A.J. Sadlej, J. Comput. Chem. 31 (2010) 552.
[5] J.R. Hammond and K. Kowalski, J. Chem. Phys., 130 (2009) 194108.
[6] A. Corozzi, B. Mennucci, R. Cammi, and J. Tomasi, J. Phys. Chem. A 113 (2009) 14774

Electrochemical amperometric sensor based on heteropolyanion of Dawson type for determination of *m*-cresol in aqueous solutions

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Due to their significantly harmful impact on the environment and human health, the qualitative and quantitative determination of cresols receives great attention. In this study, a novel amperometric sensor based on polymeric membrane incorporating a three different heteropolyanions of Dawson type (HPAs) functionalized platinum electrode (Pt) was shown for determination of *m*-cresol in aqueous solutions. The cyclic voltammetry results demonstrated that the wide linear range of 1.79×10^{-12} g L^{-1} to 1.94 g L^{-1} for the determination of *m*-cresol was obtained. The detection limit of the sensor was calculated to be equal to 2.05×10^{-12} g L^{-1}. The surface morphology of the electrodes was characterized by scanning electron microscopy (SEM).

Keywords: Amperometric sensor, heteropolyanions of Dawson type, *m*-cresol, cyclic voltammetry, platinum electrode

Insight into the self-assembly behavior of nanostructured amino acid-deriving polymers

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Polyamidoaminoacids (PAACs) are a new class of stimuli-responsive bioinspired chiral polymers. Recently, amphoteric PAACs isomers named ARGO7 were obtained by the polyaddition of L-, D- and D,L-arginine to an aqueous solution of N,N′-methylenebisacrylamide.[1] Molecular modeling studies in water showed that L- and D-ARGO7 folded into rigid and compact conformations driven by the polymer main chain flexibility. In order to demonstrate that the observed behavior was a general one, a library of amphoteric PAACs were synthesized from different L-, D- and D,L α-aminoacids by stepwise polyaddition to N,N'-methylenebisacrylamide. The reaction occurred in water at pH > 10 and 50 °C for 6 days with 92% yield, M_n from 4000 - 6000 and PD 1.40. Hydrodynamic radius (R_h) was determined by Dynamic Light Scattering (DLS), revealing only one family of nanoparticles with 1.5 nm average radius. CD spectra, recorded in the 3-12 pH interval, were consistent with the presence of pH-dependent ordered secondary structures, whose changes with pH were rapid and fully reversible. The dependence on temperature, ionic strength and presence of denaturating agents was assessed for the hydrophobic α-aminoacids deriving PAACs. CD spectral pattern were insensitive to all these parameters, suggesting highly stable and rigid structures. Future studies on cell internalization will assess the potential of PAACs for establishing chirality-dependent selective interactions with cell components.

Reference

A. Manfredi, N. Mauro, A. Terenzi, J. Alongi, F. Lazzari, F. Ganazzoli, G. Raffaini, P. Ferruti, *ACS. Macro Lett.,* **2017**, *6*, 987.

Electrochemical Behavior of a new organic-inorganic nanocomposite based on polyterthiophene/Ag for the detection of cadmium in water

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The high application potential of conducting polymers (CP) in chemical and electrochemical sensors is one of the main reasons for the intensive investigation and development of these materials [1, 3].
The combination of noble and transition metals with conducting polymers films have been extensively studied because of their interested electrochemical and electronic properties of the metals as well as the high conductivity and stability of the polymer [4].
In the present work, a composite material of polyterthiophene Poly(3T) and silver nanoparticles was electrochemically synthesized. This new material was obtained from a solution of (CH_3CN/LiClO4 0.1M) containing the monomer (terthiophene) with cyclic voltammetry then, the resulted polymer film was conditioned in silver nitrate solution for the optimized time. The obtained material was characterized using electrochemical methods (Cyclic Voltammetry, Electrochemical Impedance Spectroscopy and Square Wave Voltammetry). The results show that the addition of silver particles in polyterthiophene films matrix increased the film conductivity and its electroactivity. For this reason they have been envisaged for the detection of one of heavy metals which was the cadmium in water for environment interest.
The study was carried out by studying some parameters that can influence the sensibility of the sensor for traces detection.
The results show that the composite material polyterthiophene/Ag can detect the cadmium and the effect of Ag particles improves the limit of detection lower than 10^{-9} M determined by square wave voltammetry.

Key words: Polyterthiophene, composite material, cadmium, cyclic voltammetry, square wave voltammetry..

References

[1] U. Lange, N.V. Roznyatovskaya and V. M. Mirsky, Anal. Chim. Acta. 614 (2008) 1.
[2] M.D. Shirsat, C.O. Too and G.G. Wallace, Electroanalysis. 20 (2008) 150
[3] N. Maouche, B. Nessark, I. Bakas, Arab. J. Chem (2015), http://dx.doi.org/10.1016/j.arabjc.2015.04.029
[4] F.Terzi, C.Zanardi, V.Martina, L. Pigani, R.Seeber, J.Electroanal.chem. 619-620 (2008) 75-82.

Synthesis and characterization of copper/poly (5- aldehyde-2,2',5',2"-terthiophjene) composite material and its application for electrocatalysis

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Electrochemical modification of electrodes surfaces with electrodeposition of conducting polymers plays an important role in electroanalysis and electrocatalysis [1-3]. Among of these conducting polymers; oligothiophenes which are the most studied and synthetized, in raison of their chemical stability, and electrochemical properties.

In this work copper/poly (5-aldehyde-2,2',5',2"-terthiophene (3TCHO)) composite material (Cu/3TCHO) have been prepared electrochemically. The poly(3TCHO) films were electropolymerized by cyclic voltammetry from deaerated solution of CH_3CN which contained (10^{-2}M) of monomer (3TCHO) and 0.1 M TBAP as supporting electrolyte, by cycling the potential between 0V and 1.5V (versus SCE) at 50 mVs−1. Then the formed film was conditioned in metallic solution of copper.

The resulting materials were characterized by cyclic voltammetry, X-ray Photoelectron Spectroscopy (XPS), and Scanning Electron Microscopy (SEM).

The electrochemical analysis and XPS measurements show that copper exists in the final products. A SEM image shows the copper particles dispersion which are spherical in nature and seem to be microsized. Finally, the composite material was tested for the electrocatalysis of ascorbic acid and it's exhibited a best signal compared with the simple film of poly(3TCHO). This work provides a simple route for the synthesis of Cu/polyoligothiophenes microcomposites materials.

Keywords: Composite materials; Electropolymerization; 5-aldehyde-2,2',5',2"-terthiophene; Ascorbic acid.

References

[1] G. Inzelt, M. Pineri, J.W. Schultze, M.A. Vorotyntsev, Electrochim. Acta. 45 (2000) 2403.

[2] M.E.G. Lyons (Ed.), Electroactive Polymer Electrochemistry. Part 2, Plenum Press, NewYork,1996.

[3] Naima MAOUCHE, Saloua CHELLI, Belkacem NESSARK, Salah AEIYACH. Physics Procedia 2 (2009) 1241.

New carbazole-stilbene copolymer: Synthesis, structural and photo-physical properties of films and nanowires elaboration

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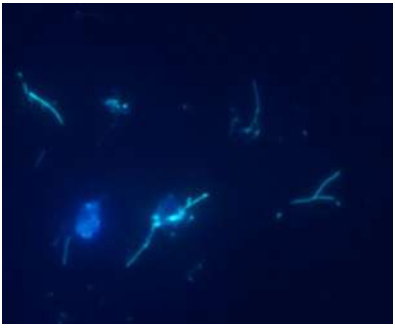
With regard to the problem of insolubility of PVK-PPV copolymer [1-4], a novel diblock copolymer based on carbazole CZ and the oligomer of PPV (trans-stilbene) in the hope to obtain a soluble copolymer with original photophysical properties. Therefore, we have synthesized a new conjugated copolymer, CZ-stilbene, which exhibits solubility in chlorobenzene. For that, films and nanowires of CZ-stilbene copolymer were also synthesized. The grafting of stilbene with carbazole moieties was elucidated by infrared absorption, Raman spectroscopy. A structural and morphological study of the films and NWRs of result copolymer by scanning and transmission electron microscopy reveal a multiscale one-dimensional self-organization of NWRs and a globular form at the molecular and at the sub-micrometric level of film. The resulting copolymer it exhibits original optical properties compared to the carbazole and stilbene ones.

Carbazole-stilbene nanowires



References

[1] M. Mbarek, F. Abbassi, K.Alimi. Journal of Physica B: Condensed Matter (2016) doi:10.1016/ j.physb.2016.05.033

[2) M. Mbarek, F. Abbassi, K.Alimi, Journal of Molecular Structure 1120 (2016) 125-131

[3] M. Mbarek, M.Chemek, J.Wery, J.L.Duvail, K.Alimi Journal of Physics and Chemistry of Solids 75 (2014) 752–758.

[4] M. Mbarek, F. Massuyeau, J. L. Duvail, J. Wéry E. Faulques, and K. Alimi. Journal of Apllied Polymer Sciences 130 (2013) 2839-2847.

Comparative study of cellulose Nano Crystals extraction methods from wood flour

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Synthetic polymeric materials are in permanent development, but the challenge for scientists today is to find substitute or bio-renewable additives to remedy the pollution by these materials and limit the depletion of oil sources, all keeping their high performance. The incorporation of plant material into these materials to make them biodegradable is an alternative, in addition these are from a renewable source by culture or main constituent of the biomass [1].
Cellulose is the most abundant biological material and its derivatives are known to give a series of structural motifs such as nanocrystals (CNC) once subjected to a strong acid hydrolysis. CNC with mechanical properties comparable to those of steel can simultaneously act as a reinforcement and a biodegradable fillers [2].
In this work, we extracted Cellulose nanocrystals, commonly known as CNC, from wood flour from joinery (waste recycling) by exploiting four different techniques drawn from bibliographic research. The extracts obtained have undergone several tests of physical and structural characterizations to evaluate the influence of the extraction method on the quality and quantity yield of the CNCs.

References

[1] M.S. Nazir, B. A. Wahjoedi, A.W. Yussof and M. A. Abdullah, "Eco-friendly extraction and characterization of cellulose from oil palm empty fruit bunches" Bio. Resou., 2013, 8, pp 2161-2172

[2] M. Cheng, Z. Qin, Y. Chen, S. Hu, Z. Ren, and M.fang Zhu, "Efficient Extraction of Cellulose Nanocrystals through Hydrochloric Acid Hydrolysis Catalyzed by Inorganic Chlorides under Hydrothermal Conditions" ACS Sustainable Chem. Eng., 2017, 5 (6), pp 4656-4664

Semiconducting polyrotaxane based on β-CD and anthracene moieties

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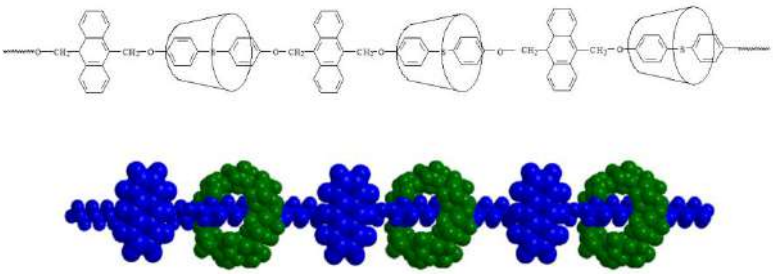
A polyrotaxane in which β-cyclodextrin (β-CD) is threaded onto a polyether chain, was prepared by polycondensation of a β-CD-Thiodiphenol inclusion complex with 9,10-dichloromethylanthracene under microwaves irradiation. The polyrotaxane (**PR**) structure was confirmed by NMR, FT-IR and MALDI-TOF spectroscopies. Morphological properties of the organic membrane were evaluated using contact angle measurements and atomic force microscopy. The optical properties of the synthesized material were investigated by UV-visible absorption and photoluminescence (PL) spectroscopies. An optical gap of 2.77 eV was estimated from the absorption-onset of the polyrotaxane thin film. The HOMO and LUMO energy levels were evaluated by cyclic voltammetry analysis indicating a p-type semi-conducting material. Conduction mechanisms of **PR** were extracted from the current density-tension characteristic of a Schottky diode with [ITO/**PR**/Al] configuration. Charge carrier mobility was calculated from the current space-charge-limited (SCLC) regime of the single layer diode device.

Keywords: Polyrotaxane; β-Cyclodextin; Semi-conducting polymer; Anthracene; Organic thin layer.



Structure of the polyrotaxane (PR)

Thermal and mechanical properties of abundant biomass/ polyvinylchloride composites

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The present paper studies the effects of fiber surface treatments on the properties of the composites. Untreated and treated fibers with varying amounts (ranging from 5-20 wt %) were mixed with PVC matrix using two-roll mill followed by compression molding. Morphology and fiber-matrix interfacial adhesion, thermal and mechanical properties were examined. The results show that, the surface treatments can improve interfacial adhesion between these two phases. Treated fibers improve mechanical properties of the composites. Young's modulus, tensile strength and elongation have been increased compared to untreated fibres. Whereas, the thermal stability, as measured by thermogravimetry (TGA) methods, indicated that the addition of natural fibres into polymer matrix induced an increase of the onset degradation temperature of the composite compared to the PVC virgin matrix, except of the composite at fiber loading of 20 wt %, for the thermograms DTG of composites, we find that the speeds decomposition of different composites developed during the first stage of decomposition are lower than that of virgin PVC (F0). It can be said that the incorporation of cellulosic filler significantly retards the decomposition of PVC and plays a role of an inhibitor of thermal degradation.

Swimming micro-motors for targeted medical applications

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Mimicking natural biological process was considered as the most fascinating challenge in Nanomedicine due to obvious benefits especially in the field of biosensing and drug delivery. Since current cancer treatments like radiation therapy and chemotherapy often end up destroying more healthy cells than cancerous ones, developing artificial microscale medical containers [1] seems to be a very promising solution. Those small microengines could deliver a dose of medication directly to the infected area in the body which is achieved by catalytic motion [2]. In this context, chemically propelled tubular micromotors driven by catalytic fuel source was investigated for in-vivo application. The SEM images have shown 13 µm length tubular structures proving their microscale design. The high-speed of microjets highlights the promising applicability of these tiny machines in the human body for a very fast action.

References :

1. O. Akhavan *et al.*, Nano Lett, 2016, 16, 5619-5630.
2. M. Medina-Sanchez *et al.*, Nature, 2017, 545, 406-408.

Synthesis of New Materials for Use As Organic Active Layers Characterization of Z (2, 3-diAryl) Acrylonitrile by Cyclic Voltammetry and Impedance Spectroscopy

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Organic ´-conjugated oligomers and polymers constitute an important class of functional materials in organic electronics. They are used as active layers in organic light-emitting diodes (OLEDs), organic field-effect transistors (OFETs) or in organic solar-cells (OSC). In this latter application, efficient materials usable as p-conducting layer in bulk-heterojunction (BHJ) solar cells in association with fullerene derivatives as n-conducting materials are needed [1, 2] In fact, a material with a bandgap of 1.1 eV is able to absorb 77 % of the solar irradiation, however, semiconducting polymers or oligomers have bandgaps higher than 2 eV and can then harvest only 30 % of the solar photons.

In the last few years, the scientists seek to synthesize organic molecules having gaps similar to those of metals. Recent studies showed that the family of the poly (thienylenevinylene) (PTV) presents a gap electronic Eg lower than that of polythiophen (Pt), 1.8 and 2.1eV respectively. Other work showed that the introduction of an acceptor group into the combined chain has an advantage in the control of this forbidden band. Indeed, the substitution of the electron-withdrawing cyano group in the double connection of the poly (thienylenevinylene) leads to a polymer with a great electronic affinity.

We have synthesized monomers to study a class of soluble low band gap conjugated polymers based on heterocyclic units and cyano vinylenes. We report a sample study of one of this class of material, the poly (Z) (2-phenyl-3-furyl) acrylonitrile.

The poly (Z) (2-phenyl-3-furyl) acrylonitrile film was synthesized electrochemically by anodic way in an electrolytic bath of Bu_4NPF_6 (0,2M)/CH_2Cl_2 with anhydrous conditions and under inert atmosphere. The polymer formed on Pt or ITO electrode, either by cyclic voltammetry or by potentiostatic method, was characterized by spectroscopic methods NMR, IR, UV, fluorescence and differential scanning calorimetry. Its electrochemical impedance study showed the semicircle which is a characteristic of charge-transfer resistance of the electrode/polymer interface at high frequency and at low frequency, the mass transfer process of the redox species.

Key words: Poly Z (2-penyl-3-furyl) acrylonitrile, cyclic voltammetry, impedance spectroscopy, fluorescence.

References:

1. T. Xu and L. Yu, Materials Today, 17 (2014) 11
2. N. Kaur, M. Singh, D. Pathak, T. Wagner and J. M. Nunzi, Synth. Met., 190 (2014) 20

Comparative study between the electronic properties of two Arylene-Cyanovinylene isomers and of their respective electrogenerated polymers.

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Organic π-conjugated oligomers and polymers constitute an important class of functional materials in organic electronics (OE). They are used as active layers in organic light-emitting diodes (OLEDs), organic field-effect transistors (OFETs) or in organic solar-cells (OSC). In this latter application, efficient materials usable as p-conducting layer in bulk-heterojunction (BHJ) solar cells in association with fullerene derivatives as n-conducting materials are needed.[1, 2] In fact, a material with a bandgap of 1.1 eV is able to absorb 77 % of the solar irradiation, however, semiconducting polymers or oligomers have bandgaps higher than 2 eV and can then harvest only 30 % of the solar photons. In this field, a lot of work has been done during the last forty years to synthesize conducting polymers with very low bandgap and especially those with thiophene units.[3, 4] In this area, Roncali determined five contributions that may modify the bandgap of polyaromatic linear π-conjugated systems: [4](i) the energy related to the bond length alternation ($E^{\delta r}$), the deviation form planarity (E^{θ}), the aromatic resonance energy of the cycle (E^{Res}), the inductive or mesomeric electronic effects of eventual substituent (E^{Sub}) and the intermolecular or interchain coupling in the solid state (E^{int}). For example, it has been shown that polythienylenevinylene (PTV) has a lower bandgap (around 1.8 eV)[5] than polythiophene (PT) (2.2 eV).[6] The introduction in the polymer chain of the vinylic double bonds reduces the aromatic character of the π-conjugated backbone and limits the rotational disorder which plays a major role in the magnitude of the bandgap in PT. Later on, it was shown that the introduction of electron withdrawing cyano groups at the ethylene linkage leads a considerable decrease of the bandgap which reaches very low values.[7]

In the present work, we studied the electrochemical behavior and the anodic electropolymerization of two arylene-cyanovinylene isomers **I** and **II** (see chart 1) consisting of a central phenyl unit substituted in *para* or *meta* positions by two cyanovinylene-3, 4-ethylene dioxythiophene, compound derived from thiophene which further reduces the band gap and the oxidation potential. A specific outlook is done on the influence of the phenyl substitution (*para* vs *meta*) on the electronic properties of the polymers and their precursors.

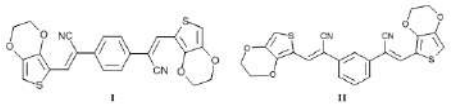

Chart 1. Structure of the two isomers studied in this work

Keywords: Electropolymerization; Electroactive polymer; p- doping process, n-doping process; arylene-dicyanovinylene.

References:

1. T. Xu and L. Yu, *Materials Today*, 17 (2014) 11.
2. N. Kaur, M. Singh, D. Pathak, T. Wagner and J. M. Nunzi, *Synth. Met.*, 190 (2014) 20.
3. J. Roncali, *Macromol. Rapid Commun.*, 28 (2007) 1761.
4. J. Roncali, *Chem. Rev.*, 97 (1997) 173.
5. M. Catellani, S. Luzzati, A. Musco and F. Speroni, *Synth. Met.*, 62 (1994) 223.
6. T.-C. Chung, J. H. Kaufman, A. J. Heeger and W. F., *Phys. Rev. B*, 30 (1984) 702.
7. H. A. Ho, H. Brisset, P. Frère and J. Roncali, *J. Chem. Soc., Chem. Commun.*, (1995) 2309.

Amorphous inorganic materials: Structural, Physic-Chemical and Thermochemical Study of Phosphate Glasses in the $BaO\text{-}Na_2O\text{-}P_2O_5$ System

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Glasses constitute an important class of materials whose mechanical properties are comparable to those of crystalline solids, while having a molecular arrangement analogous to that of liquids, where the long-range order is totally absent. The chemical composition of these "amorphous solids" is extremely varied, and includes in particular elements (P, S, Se), mineral corps (usually oxides, or their mixture) and organic. All these molecules have in common a certain asymmetry that makes them capable of forming chains, or two or three-dimensional networks. It is therefore legitimate to compare their structure with that of more or less branched or cross linked polymers, although the nature of intermolecular bonds is generally different from that of the covalent bond C-C.

In glasses, phosphate glasses are largely investigated owning to their interesting physical properties such as high coefficient of thermal expansion, low softening and melting temperatures and high transparency in UV region compared to silica based glasses. These properties make them candidates for solid state batteries, radiation shielding materials and dosimeters. Phosphate glasses and glass ceramics are already used for as sealant for nuclear waste, in tissue engineering, bone graft scaffold and amplifiers in solid state lasers. Nevertheless, the low chemical durability of these glasses limits their use in many applications.

The present work is devoted to study the structure properties relationship of barium polyphosphate glasses with the formula $(100\text{-}x)NaPO_3\text{-}xBaO$ where $5 \leq x \leq 25$ molar%. The glasses were synthesized with the melt quenching technique. The FTIR and Solid State NMR of ^{31}P show the depolymerization of the metaphosphate network. The density and thermal analysis of the glasses show the shrinking and the progressive reticulation of the phosphate network. The chemical durability analysis shows the strengthening of the polyphosphate chains towards water attack. The thermochemical study carried out by the microcalorimeter C-80 (Setaram) shows the decrease of the dissolution enthalpy as the content of BaO increases in the glasses.

Corrosion prevention of AA2024-T3 aluminium alloy with a polyaniline/poly(γ-glycidoxypropyltrimethoxysilane) bi-layer coating: Comparative study with polyaniline mono-layer feature

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The physicochemical properties, particularly the anticorrosion performance of coatings deposited onto AA2024-T3 surface, namely a mono-layer coating of polyaniline (Pani) and a bi-layer one consisted of an inner Pani layer and an external poly(γ-glycidoxypropyltrimethoxysilane (Poly(γ-GPTMS)) layer (Pani/Poly(γ-GPTMS)) were investigated. For both coating types, Pani was electrodeposited onto AA2024-T3. Poly(γ-GPTMS) layer was applied by dip-coating onto Pani to form the bi-layer coating.

Scanning Electron Microscopy (SEM), Fourier Transform Infrared Attenuated Total Reflectance (FTIR-ATR) and Ultraviolet-Visible spectrophotometry (UV-Vis) proved the successful synthesis of coatings.

For Pani/Poly(γ-GPTMS), formation of hydrogen bonds between layers was proved. Poly(γ-GPTMS) layer has filled defects of Pani network, where metallo-siloxane bonds, were established. Pani/Poly(γ-GPTMS) coating revealed better adhesion, water repellency and anticorrosion performance than Pani. Electrochemical Impedance Spectroscopy (EIS) demonstrated that the Poly(γ-GPTMS) layer served as an effective physical barrier top-coat against the penetration of corrosive species ***through*** the Pani layer. Poly(γ-GPTMS) improved hence, the anticorrosion performance of coating system for a longer exposure period in chloride medium.

Key Words: Pani, Poly(γ-GPTMS), bi-layer coating, AA2024-T3, corrosion.

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Study of the physical properties and anticorrosion performance polyaniline coating electrodeposited onto AA2024-T3 aluminium alloy

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Chronoamperometry was used to deposit polyaniline (Pani) films on AA2024-T3 aluminum alloy from a sulphuric acid electrolyte. Electropolymerization parameters of 1 V_{SCE} and 17 min produced a Pani coating with the highest protection ability in 0.5 M NaCl solution.

Structure and morphology of the coating were characterized by scanning electron microscopy (SEM) and infrared spectroscopy under reflectance mode (FTIR-ATR) analysis.

Electrochemical impedance spectroscopy (EIS) was applied to access the physical proprieties and the anticorrosion performance of Pani in 0.5 M NaCl solution. Impedance spectra, collected at open circuit potential (OCP), exhibited, at high frequencies, a CPE contribution related to inhomogeneous water uptake in the coating which was analyzed by normal power-law distributions of the local resistivity and permittivity of coating. Finally, the Pani anticorrosion performance was discussed.

Keywords: AA2024-T3, Polyaniline, Impedance, Corrosion, Resistivity, Permittivity.

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Synthesis of Gelatin-co-Poly(methyl methacrylate) via Type II Photopolymerization

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Gelatin has become an important component in polymeric materials used especially in biomedical application and in the last decade and gelatin-poly (methyl methacrylate) based hybrid materials has been extensively studied in order to develop the mechanical properties of gelatin. In this work, we proposed an alternative method for preparing gelatin-PMMA graft copolymer by grafting poly (methyl methacrylate) on gelatin nanofibers using gelatin as a macro initiator in presence of type II photoinintiator, benzophenone. First, gelatin nanofiber mat was prepared by electrospinning. Then the polymerization of methyl methacrylate on electrospun gelatin nanofibers were carried out based on the hydrogen abstraction of type II photo initiator from free amine groups ($-NH_2$) of gelatin. After the polymerization, chemical structure of poly (methyl methacrylate) grafted gelatin nanofiber were analyzed by Raman spectroscopy and then surface morphology was examined via scanning electron microscopy.

Membranes based on poly(vinyl alcohol)/water insoluble β-cyclodextrin polymer blends in the transport of organic molecules

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Polymeric inclusion membranes (PIMs) based on of two biodegradable polymers, poly(vinyl alcohol) (PVA) and water insoluble cyclodextrin polymer (Poly β-CD) were successfully prepared using casting technique. The obtained membranes were firstly characterized by X-ray diffraction and Fourier transform infrared. The surface and cross-section morphology of the membrane was inspected by scanning electron microscopy (SEM). The membranes obtained were tested in the transport of a toxic organic molecule (phenol). The experiments were performed in a pertraction system, using a two compartments transport cell separated by the membrane, under various experimental conditions, such as carrier content in the membranes, stirring rate and initial phenol concentration. The effects of these parameters on the transport process were studied using the experimental design methodology. This study, in a minimum of tests revealed:

- The effect of the phenol concentration of the source phase is the most important.
- A strong interaction between the stirring speed and the content of the CD in the membrane.
- The stirring speed strongly depends on the content of cyclodextrins in the membrane

Keywords: Polymer inclusion membranes (PIMs); insoluble β-cyclodextrin polymer; phenol; design of experiment; statistical analysis.

Synthesis of Cross-linked Poly (ester-amide) Based on Itaconic Acid: Application to The Preparation of Biobased Inks

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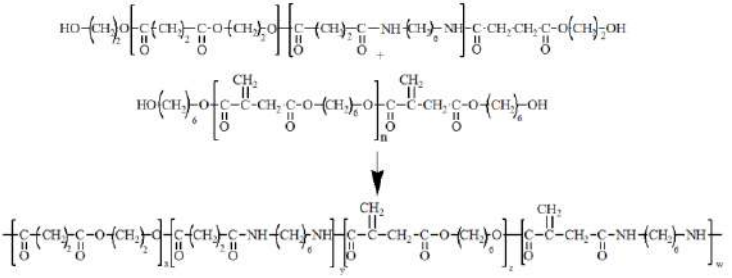
Itaconic acid and its esters have been extensively studied in the past as alternative monomers for poly(meth)acrylates with applications ranging from super absorbers to drug-delivery to name but a few. This bio-based acid is composed of two carboxylic acid functionalities and an α,β-unsaturated double bond, which also allows for the synthesis of bio-based unsaturated polyesters[1]. Polymers of this type have been studied as materials for thermal and UV-light induced radical cross-linking [2].

We report in the present work the preparation of novel co-polyester amides based on itaconic acid. A diethyl succinate was reacted in bulk with hexane-1,6-diamine and ethan-1,2-diol to obtain an oligoester amide. The polycondensation involves a hydroxyl-ester (oligoesteramide-itaconic polyester) interchange[3]. The resulting co-polyester amides exhibit low viscosities and high UV-curing reactivity. Their structure has been confirmed by ^{1}H NMR and IR spectroscopy. Their amorphous character was verified by differential scanning calorimetry (DSC).



Keywords: Bio-based Monomers, Poly(ester amide)s, Itaconic acid.

References

[1] J. Dai, S. Ma, Y. Wu, L. Han, L. Zhang,J. Zhu and X. Liu, Green Chem., 2015, 17,2383.
[2] T. Robert, S.Friebel, Green Chemistry, 2016, 13.
[3] R. Triki, M. Abid, M. Tessier, S. Abid, R. El Gharbi, A. Fradet, European Polymer Journal, 2013, 49, 1852.

REMOVAL OF BROMOCRESOL PURPLE DYE FROM AQUEOUS SOLUTIONS USING MAGNETITE MULTI-WALLED CARBON NANOTUBES COMPOSITE

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Carbon nanotubes (CNTs) have attracted the fancy of many scientists world-wide as a new type of adsorbents due to their outstanding ability for the removal of dye contaminants from aqueous solutions. In the present work we tried to synthesize the magnetic composite of Multi-Walled Carbon Nanotubes (MWCNT-Fe_3O_4) by the co- precipitation method, with the aim to determine the adsorption capacity of this composite for dye removal. The characterization by the X-Ray diffraction (XRD) of this material shows a presence of the magnetite on the surface of the carbon nanotubes. Thermodynamic study suggested that the adsorption of Bromocresol purple (BCP) dye on MWCNT-Fe_3O_4 was a spontaneous and exothermic process. The adsorption isotherm represented perfectly by the Langmuir model. Beside the value calculated by Freundlich model indicated that the adsorption is favorable. This work shows the interest of a magnetic composite (MWCNT-Fe_3O_4) as an efficient adsorbent for (BCP) removal.

Keywords: Carbon nanotubes, composite, dye, adsorption.

Reference:

N. Dalai, M. Habibizadeh, K. Rostamizadeh, and S. Nakusa, Synthesis of magnetite multi - walled carbon nanotubes composite and its application for removal of basic dyes from aqueous solutions, Just. Venure. Engaged (2014).

Grape pomace polyphenols encapsulated in chitosane microbeads

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Wine production represents one of the major agricultural activities worldwide. This production is accompanied with the generation of tremendous amounts of wastes and by-products exceptionally rich in bioactive compounds (especially phenolics). Polyphenols are secondary metabolites present in all vascular plants, and constitute a large family of ubiquitous and varied substances, from simple molecules to complex structures. In this work grape pomace phenolic compounds were extracted by ultrasonic method (US) from seeds and skin using three different solvent. the total phenolic compounds of seeds using ethanol is better than other solvents.

Chitosan microbeads were prepared by emulsion technique and loaded with phenolic compounds of grape pomace. The effects of concentrations of chitosan and glutaraldehyde as a crosslinking agent on the main properties of microbeads were assessed. Grape pomace polyphenols were effectively encapsulated and the microbeads recovered a spherical shape.

Key words: grape pomace, polyphenols, microbeads, chitosan.

Hybrid paper-TiO_2 anatase prepared under mild conditions with high photocatalytic activity under sunlight

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Two simple routes for the synthesis of a paper-TiO_2 composite were tuned up and the efficiency of the resulting paper-TiO_2 photocatalyst was investigated in the 2-propanol oxidation in gas phase. The first route involved the in-situ generation over the sheet of paper of a TiO_2 layer starting from a solution of $Ti(OBu)_4$ in tert-butanol/acetic acid, followed by hydrothermal treatment at 120 °C for 3 h. The sample was labelled as paper-TiO_2 (H). The second approach was based on the adsorption on the paper of a ready-made suspension of titania nanoparticles (TiO_2 sol), generated in autoclave at 140 °C and stable in acid medium at pH < 3. The sample was labelled as paper-TiO_2 (S). Evidence of the generation of crystalline TiO_2 was confirmed by Raman spectroscopy and the morphology of the TiO_2 layer was analyzed by FE-SEM microscopy. The optical properties of the two paper-TiO_2 samples and the surface and bulk chemical compositions were studied by UV-vis, XPS spectroscopies and TGA analysis as well. The surface properties of the two paper-TiO_2 composites in term of wettability were also investigated through water contact angle measurements. The photocatalytic oxidation of 2-propanol in gas phase, under simulated sunlight irradiation in presence of the two paper-TiO_2 samples was studied at room temperature and compared with a commercial sample, TiO_2 P25 (Evonik). Both functionalization approaches led to a photoactive paper capable of the complete decomposition of 2-propanol in CO_2 and H_2O within acceptable timescale. The photocatalytic performances of both paper-TiO_2 composites compare favorably with TiO_2 P25.

Purification of human plasma using new polystyrene supported acetylacetone Bis (3-aminopropyl) amine Schiff base resin toward some divalent metal ions.

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In this study, we have carried out the synthesis and characterization of Chelating polymer resins which are found to be more selective by nature as compared to other conventional techniques in the removal of metal ions to adsorbed a natural protein of human plasma especially Albumin, In the light of the above, several polystyrene-supported chelating polymer resins have been synthesized recently a pentadentate Schiff base complexes as (acetyl acetone - bis3-aminopropylamine Schiff base). The complexes were obtained in the same conditions of the ligand using cobalt, nickel, zinc and copper acetate salts while the metal complexes were characterized by elemental analyses, infrared, and IMAC chromatography. In conclusion, the prepared resin showed excellent results for purified human plasma

Keywords: Chelate polymers. Ligand. PSCM. Metal complexes. Schiff base. IMAC.

Vulcanization and characterisation of the synthetic nitrile rubber NBR_{18}/ fumed silica

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Our study will focus on the vulcanization of acrylonitrile butadiene rubber by vulcanizing agent peroxide Dicumyl and strengthening of the synthetic nitrile rubber NBR_{18} by fumed silica what is a very polar mineral filler for their effect on the properties of vulcanizates was studied. For that a series of formulations where the concentration of the vulcanizing agent was varied from 0.2%-1.0% were prepared vulcanized and characterized. In a second series or the concentration of the vulcanizing agent was fixed at 0.5% the concentration of fumed silica was varied from 1%-25%. formulations were prepared characterized before and after vulcanization. The characterization of our materials was made on considering the following methods:
Infrared spectroscopy, swelling, extraction, resistance to the absorption of oil and measurement of mechanical properties. The results show the effectiveness of fumed silica on the properties of vulcanizates of acrylonitrile butadiene rubber and our stability they also demonstrate the evolution of resistance to the absorption of oil and increased rigidity in the material

Keys words : NBR, SiO_2,vulcanization,Peroxyd, Elastomer reinforcement

Piezoelectric Biotextiles for Energy Harvesting Applications

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Mechanical Energy Harvesters (MEH) are miniature power generation devices based on the use of innovative piezoelectric materials. These emerging devices are able to convert the mechanical energy into suitable electrical energy which can be used for many applications, such as portable devices, stretchable electronics and implantable biosensors [1-2]. Piezoelectric materials play a crucial role in the field of MEH and piezoelectric biobased polymers, i.e. PA11 and PLA, could represent an interesting alternative that have benefits regarding carbon footprint.
The BIOHARV project aims to develop an original approach to produce piezoelectric textiles fiber based on biopolymers which can be integrated into totally polymeric MEH prototypes. The BIOHARV project combine the knowhow of several partners such as Douai Mines, ARMINES, Centexbel, the University of Mons, the University of Valenciennes and the University of Lille 1 in order to develop prototypes and to highlight and promote the energy performance and sustainability of these devices.

References

[1] Shaikh, Faisal Karim, and Sherali Zeadally. "Energy harvesting in wireless sensor networks: A comprehensive review." Renewable and Sustainable Energy Reviews 55 (2016): 1041-1054.
[2] Hinchet, Ronan, and Sang-Woo Kim. "Wearable and implantable mechanical energy harvesters for self-powered biomedical systems." ACS nano 9.8 (2015): 7742-7745.
[3] Leveque, M., Douchain, C., Rguiti, M., Prashantha, K., Courtois, C., Lacrampe, M. F., & Krawczak, P. "Vibrational energy-harvesting performance of bio-sourced flexible polyamide 11/layered silicate nanocomposite films." International Journal of Polymer Analysis and Characterization 22.1 (2017): 72-82.

Accelerated aging of high density polyethylene potable water pipes

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Polyethylene (PE) is a widespread material for pressurized, buried potable water pipes due to its numerous advantages, such as, ease of installation, absence of corrosion related problems, relatively low cost, and projected 50 to 100-year service life. Medium-density (MDPE) and high-density polyethylenes (HDPE) are commonly used. They are usually compounded with additives such as phosphite and hindered phenol antioxidants to protect them against thermo-oxidative degradation during processing and service time.

The aim of the present work is to evaluate the performance of a black HDPE pipe material (PE100 classification), known as fourth generation of PE piping material, in drinking water application. For this purpose, accelerated aging tests were conducted in the laboratory. During these tests, PE pipe samples were immersed in potable water at different temperatures 20, 40 and 80°C over a period of about 24 weeks (4344 hours). The level of antioxidants present in the PE pipe was periodically evaluated in terms of oxidative induction time (OIT). In addition, crystallinity, melt flow index (MFI) and tensile properties of PE piping were examined. OIT results showed losses of antioxidants during exposure time at all temperatures due to the extraction of antioxidants into water and their chemical consumption [1, 2]. Furthermore, the phenomena were found to be thermally activated. Using Arrhenius model, the activation energy (E_a) of antioxidants depletion was determined and thus noticed to be lower than that reported in a previous study on a blue PE100 water pipe [3]. Therefore, the lifetime of the black PE100 water pipe could be estimate to be longer. On the other hand, the antioxidants were not totally depleted after aging, the raison in which no significant change in physical or tensile properties was observed.

References

[1] Skjevrak I, Due A, Gjerstad KO, Herikstad H. Water Res. 2003, 37, 1912-1920.
[2] Dear JP, Mason NS. Polym. Polym. Compos. 2001, 9, 1-13.
[3] Hoang EM., Lowe D. Polym. Degrad. Stab. 2008, 93, 1496-1503.

Effects of Thyme Essential Oil Chemicals on Germination of Barley

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The population in the world is increasing day by day, meanwhile, food demand is also increasing. There is no opportunity to further expand existing agricultural areas on Earth. For this reason, the use of bio-herbicides, which have no adverse effects on human health and the environment, is increasing in order to increase productivity. The essential oil components of medicinal and aromatic plants are known to have allelopathic effects on cultivated plants and weeds. This work; In order to determine whether allelopathic effects of geraniol, carvacrol, α-terpinene, thymol, and thyme essential oil on barley seed, was carried out in Çanakkale Onsekiz Mart University Faculty of Agriculture Department of Irrigation Department in 2017. Germination ratio of barley seed decreased as result of using geraniol, carvacrol, α-terpinene, and thymol essential oil compounds. However, thyme oil did not affect the germination ratio of barley seed. Moreover, the effective dose of these essential oils on germination was found as 0.4 µl. These effective compounds can be used as bio-herbicides with required doses. The gained knowledge will provide additional contributions to the next level of research by establishing a future search.

Keywords: Barley, germination, allelopathy, essential oil components, thyme

Fluorinated copolymers/Moroccan Beidellite clay nanocomposites prepared via *in situ* radical copolymerization: Structure and characterizations

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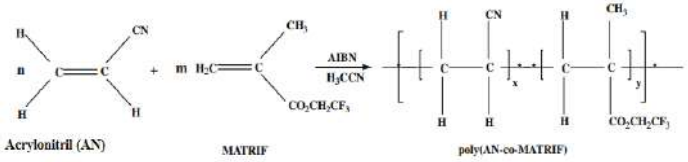
In the frame work of valorising of the Moroccan Beidelite clay (BDT) as nanochage, the developing new fluorinated materials have been synthesized. The raw Ferruginous beidellite clay (BDT) was collected from the Western High Atlas basin at the Agadir region (Morocco). *In-situ* preparation of poly(AN-*co*-MATRIF)/Moroccan Beidellite clay nanocomposites using an organomodified Moroccan Beidelite clay modified with hexadecyltrimethylammonium bromide (CTA) were successfully achieved via thermally initiated free radical copolymerization of acrylonitrile (AN) and 2,2,2-trifluoroethyl methacrylate (MATRIF) (Scheme 1).



Scheme 1: Synthesis route of poly(AN-*co*-MATRIF) copolymers.

The organomodified Moroccan clay CTA-BDT were characterized by IR, XRD and TGA analyses. The resulting nanocomposites depending on the clay concentration were characterized by IR and ^{1}H NMR Spectroscopies. The molar composition of AN and MATRIF monomers in the poly(AN-co-MATRIF) copolymer were calculated from ^{1}H NMR spectroscopy. Depending on the CTA-BDT loading (1, 3 or 5% by weight), nanocomposites of partially exfoliated and intercalated structures were obtained as evidenced by X-ray diffraction and TEM. The thermal properties of the nanocomposites were performed, an improvement of their thermal stabilities was evidenced by TG compared to the pure poly(AN-*co*-MATRIF). The nanoscale dispersion of CTA-BDT was also evidenced by a moderate increase of the T_g of these nanocomposites. The influence of nanoclay type and concentration on the thermal, water vapour sorption properties and surface characteristics of the resulting poly(AN-*co*-MATRIF) copolymer/CTA-BDT nanocomposites are also discussed.

The authors thank the CNRST (Morocco)-TÜBITAK (Turkey) program for its financial support and Erasmus $^+$ program between Cadi-Ayyad University and University of Zagreb,

STUDYING THE EFFECT OF NANOCLAY ON THE MECHANICAL PROPERTIES OF HDPE/PS NANOCOMPOSITES

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Blending of two or more polymers offers a good possibility to modify thermoplastic material so as to improve their properties. Polystyrene and high density Polyethylene (PS/HDPE) are two widely used commodity plastics. This work shows the effect of montmorillonite (MMT) on the mechanical properties of Polyethylene high density (HDPE)/Polystyrene (PS).
HDPE/PS/MMT nanocomposites have been prepared by melt mixing using maleic anhydride grafted styrene-butadiène-styrene (MAH-g-SBS) as compatibilizing agents. Melt mixing was achieved using single screw extruder. The MAH-g-SBS used as compatibilizer helped the dispersion of the MMT in HDPE/PS matrix. The nanocomposites were characterized by using mechanical properties. The results showed that the use of nanoclay has a significant effect on the mechanical properties.

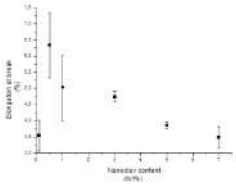

Fig.1. Elongation at break of nanocomposites as a function of nanoclay weight ratio

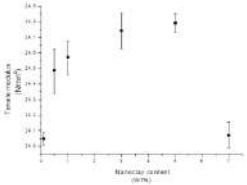

Fig.2. Tensile modulus versus nanoclay content

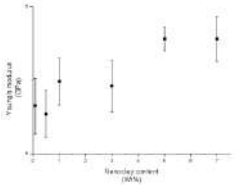

Fig.3. Young's modulus of nanocomposites as a function nanoclay weight percentage

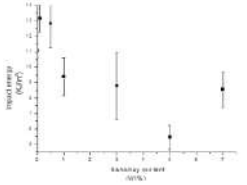

Fig. 4. Impact strength versus nanoclay content

Polyethylene high density /polystyrene compatibilized with SBS-G-AM 5% reinforced with various percentages of clay nanoparticules were prepared by mixture in a molten state. Our results revealed that there is an improvement of stress the rupture and a reduction in the impact resistance. The form and the size of the clay nanoparticules influence the dispersion and thus the final properties of the nanocomposites.

REFERENCES

[1] E. M. Araujo, K. D. Araujo, R. A. Paz, T. r. Gouveia, R. Barbosa, E. N. Ito, (2009) « Polyamide 66/Brazilian Clay Nanocomposites », Journal of Nanomaterials, PP5,.
[2] Tasnim Kallel, (2002). « Etude d'une voie de valorization des mélanges PE/PP et PE/PS aspect rhéologique », journal des déchets, science et technique N°25, PP16-19.
[3] B. Xu, J. Simonsen and W.E. Rocheford, (2000). «Mechanical properties and creep resistance in polystyrene /polyethylene blends», Journal of Applied Polymer Science, vol.76, PP 1100-1108.
[4] Kai Yang, Maya Endoh, Rebecca Trojanowski, Radha P. Ramasamy, Molly M. Gentleman, Thomas A. Butcher & Miriam H. Rafailovich, (2015).«The thermo-mechanical response of PP nanocomposites at high graphene loading », Nanocomposites, ISSN: 2055-0324, Maney Publishing.

Formulation and characterization of piroxicam emulgel based on xanthan gum.

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The aim of this work was to formulate an emulgel for a topical administration of a non-steroïdial anti-inflammatory drug: piroxicam and the study of its release profile relatively to the reference marketed gel. The emulgels have been prepared using nigella sativa oil as oily phase and stabilized by tween 80 and xanthan gum. Previously to the in vitro-liberation test, all obtained preparations were first subjected to different physic-chemical tests namely: macroscopic and microscopic controls, pH, conductivity and viscosity measurements. The obtained results, demonstrated that the developed emulgels present a creamy yellowish aspect, a homogenous microscopic distribution of globuls and exhibit a shear thinning rheological behavior. The spreading test demonstrates that the emulgels are more spreadable then the gel form, particularly the emulgel containing 20% Nigella sativa oil and 1% xanthan gum. The presence of xanthan increased the viscosity of the emulgel and allows a prolonged liberation of piroxicam relatively to the galenic form of reference. The formulated emulgels may be the considered as appropriate vehicles for the topical administration of piroxicam and other drugs.

Keywords : Emulgels, non-steroïdial anti-inflammatory drugs, gélifiant, piroxicam, rheology, xanthan gum.

Grafting Ionic bio-based Oligomers from Cellulose Fibers for in Biomedical Application

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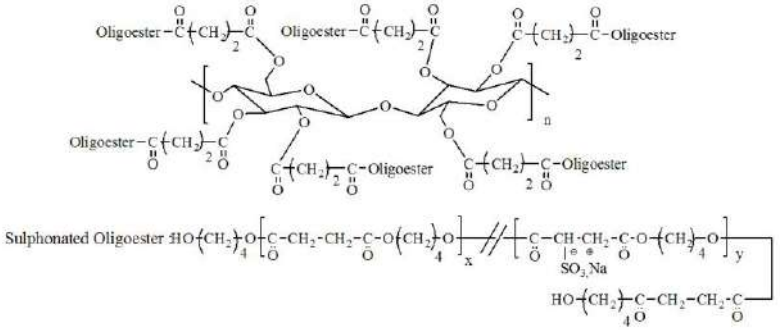
The exploitation of vegetal cellulose fibers for the production of new functional materials is a major issue; for both in academia and in industry.
Different ways of modifying cellulose have emerged for a long time [1]. However despite of the well known reactivity of cellulose OH groups the efficient functionalization of fibers is often a challenge. The chemical modification of cellulose, by incorporation of copolymers, confers on it, for example, antibacterial properties [2] and hydrophobicity. In this study, in order to synthesize a new material cellulosic for in biomedical applications, we report the modification of the vegetal cellulose fibers pretreated with aqueous NaOH by grafting of ionic oligomer (sulphonated aliphatic oligoester) at the intermediary of an acid chloride (succinyl chloride). FT-IR analyses and solubility testing confirmed that we obtained grafting from the cellulose. Studies on the graft from bacterial cellulose are now in progress.



Keys words: Vegetal cellulose, Ionic oligomer, Grafting

References

[1] Dieter Klemm, Brigitte Heublein, Hans-Peter Fink. Angew. Chem. Int. Ed. 44 (2005) 3358 - 3393.
[2] Debashish Roy, Jeremy S. Knapp, James T. Guthrie. Biomacromolecules 9(2008) 91-99.

Incorporation effect of semiconductor (TiO_2, ZnO) on the electrical and photoelectrochemical properties of organic conducting polymers

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The performance of photovoltaic devices with a light absorber consisting of a single-type conjugated polymer is poor, due to a low photo-generation yield of charge carriers, strong radiative recombination's and low mobility of charge carriers [1]. Recently, it has been shown that ultra-fast photoinduced charge transfer can also occur between a conjugated polymer and a metal oxide semiconductor such as SnO2, TiO2, ZnO, Nb2O5, etc. [2,3].

In this work, the electrical and photoelectrochemical properties of P3HT:PCBM and MEH-PPV:PCBM blends polymer films modified by incorporation of inorganic semiconductors (TiO2, ZnO) has been studied. Composite materials were prepared by incorporation of semiconductor nonoparticles into polymers matrix and deposited by spin-coating on indium thin oxide (ITO) substrates. The effect of inserting a ZnO or TiO2 nanoparticles interlayer in the polymer heterojunction device on the photoelectrochemical and optical characteristics of the device has been studied. The study showed that the presence of inorganic semiconductor nanoparticles in the polymeric film improves the optical and the photoelectrochemical properties of blend polymer composite.

Keywords: organic/inorganic semiconductor, morphology, photocurrent.

References

[1] W. Rieh, S. Karg, V. Dyakonov, M. Meier, M. Schwoerer, J. Lumin 60-61 (1994) 906.
[2] P. A. van Hal, M. M. Wienk, J. M. Kroon, W. J. H. Verhees, L.H. Sloof, W. J. H. van Gennip, P. Jonkheijm, R. A. J. Janssen, Adv. Mater. 15 (2) (2003) 118.
[3] H. Lu, F. Zheng, M. Zhang, M. Guo, Electrochimica Acta 132 (2014) 370-376.

Elaboration and characterization of poly(3-hexylthiophène)/n-ZnO heterojunction devices

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The aim of this work is the development and the characterization of ITO/ZnO/P3HT/Al bilayer films. We started by the electrodeposition and characterization of zinc oxide (ZnO) thin films and with the spin coating for P3HT deposits and finally the evaporation of the aluminum under vacuum to make the diode contacts. The materials obtained are characterized by electrochemical methods (cyclic voltammetry, chronoampérometry), morphological and spectroscopic methods (AFM, DRX, UV-visible).

The photoelectrochemical measurements show that the deposited semiconductor (ZnO) is the n-type. The I-V characterization of the ITO/ZnO/P3HT/Al bilayer structure shows the diode characteristics.

Key-words: P3HT, Zinc oxide, I-V characterization, Diodes

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