



Executive Unit for Financing Education Higher, Research Development and Innovation

Advanced researches related to the behavior of multi-component polymer systems under simulated environmental factors action

IDEAS Program, Exploratory Research Project Project number: PN-II-ID-PCE-2011-3-0187





"Petru Poni" Institute of Macromolecular Chemistry Iasi Romania

Project duration: 2011 – 2014



#### PROJECT TEAM

#### Project manager:

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#### Team members:

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- □ Drd. Manuela Tatiana Nistor



#### **OBJECTIVES**

The present research project is focused on the transformations of polymers with different structures under weathering conditions and especially solar light.

The following objectives were taken into consideration:

- Immobilisation of dyes of different structures and concentrations onto natural and/or synthetic polymers
- Obtainment of multi-component systems containing polysaccharides
- Obtainment of semi-interpenetrating networks based on collagen or polyaspartic acid.
- Study of the influence of controlled environmental factors upon polymer systems colored with dyes (solar light, heat, humidity)
- Study of the stability of the multi-component systems to weathering conditions



### Research directions

The mentioned objectives are oriented in the following directions:

- Obtainment of knowledge on the implications of some reactive dyes immobilized onto polymers and the determination of the biological effects in correlation with their physico-chemical properties.
- Characterisation and evaluation of the stability of the multi-component systems containing polysaccharides at weathering conditions.
- Study of the photochemical behaviour of the natural polymers exposed to UV irradiation.



#### PROJECT BUDGET

Stage 2011: **120.000 lei** 

Stage 2012: 500.000 lei

Stage 2013: **450.000 lei** 

Stage 2014: **350.000 lei** 

Total budget: 1.420.000 lei



### Project stages

### **Stage 2011**

#### Objectives:

- 1. Comparative analysis of the current state of polymer behavior under the influence of environmental factors
- 2. Documentation in the modern instrumental techniques and methods

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### Results 2011

On the results obtained in the stage 2011, these scientific papers were prepared and presented at scientific meetings:

- 1. R.Bodirlau, C.-A.Teaca, D.Rosu, L.Rosu; Photo-degradation behaviour of wood after coating with epoxidized soybean oil; Zilele Universitatii "Al. I. Cuza", Iasi, 28-29 oct. 2011
- O.M.Paduraru, N.Tudorachi, A.Chiriac; Thermal analysis of new hydrogels based on natural and synthetic polymers; Zilele Universitatii "Al. I. Cuza", Iasi, 28-29 oct. 2011
- 3. L.Rosu, D.Rosu, C.-D. Varganici; The thermal behaviour of some semiinterpenetrated polymer networks based on epoxy resin and aromatic polyurethane; Zilele Universitatii "Al. I. Cuza", Iasi, 28-29 oct. 2011
- 4. D.Rosu, L.Rosu, F.Mustata; Effect of UV radiation on some semi-intepenetrated polymer networks based on epoxy-resin and polyurethane; Zilele Universitatii "Al. I. Cuza", Iasi, 28-29 oct. 2011



### **Stage 2012**

### Objectives:

- 1. Obtainment of multicomponent polymer systems
- 2. Characterization of synthesized polymer systems and establishing structure-property relationships

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### Scientific papers: 9

- 1. C.-D.Varganici, A.Durdureanu-Angheluta, D.Rosu, M.Pinteala, B.C.Simionescu; Thermal degradation of magnetite nanoparticles with hyrdrophilic shell; *J. Anal. Appl. Pyrol.* **96,** 63–68 (2012)
- D.Rosu, L.Rosu, F.Mustata, C.-D.Varganici; Effect of UV radiation on some semiinterpenetrating polymer networks based on polyurethane and epoxy resin; *Polym. Degrad. Stab.* 97 1261–1269 (2012)
- 3. O.M.Paduraru, D.Ciolacu, R.N.Darie, C.Vasile; Synthesis and characterization of polyvinyl alcohol/cellulose cryogels and their testing as carriers for a bioactive component; *Materials Science and Engineering C.* **32**, 2508–2515 (2012)
- C.-D.Varganici. O.Ursache, C.Gaina, V.Gaina, B.C.Simionescu; Studies on new hybrid materials prepared by both Diels-Alder and Michael addition reactions; J Therm Anal Calorim. http://dx.doi.10.1007/s10973-012-2532-y
- S.F.Patachia, M.-T.Nistor, C.Vasile; Thermal behavior of some wood species treated with ionic liquid; *Industrial Crops and Products*, Available online 29 Oct <a href="http://dx.doi.org/10.1016/j.indcrop.2012.10.003">http://dx.doi.org/10.1016/j.indcrop.2012.10.003</a>
- 6. D.Rosu, L.Rosu, C.-D.Varganici; The thermal stability of some semi-interpenetrated polymer networks based on epoxy resin and aromatic polyurethane; *J. Anal. Appl. Pyrol*, 2012, submission needing revision 1
- C.-A.Teaca, D.Rosu, R.Bodirlau, L.Rosu; Structural changes in wood under artificial UV light irradiation determined by FTIR spectroscopy and color measurements – A BRIEF REVIEW; BioResources, 2012, submission needing revision 1
- O.Ursache, C.Gaina, V.Gaina, C.-D.Varganici; New hybrid materials obtained by Diels-Alder and Michael addition reactions. A comparative study; Polym. Bull., 2012, submitted
- 9. M.-T.Nistor, C.Vasile; TG/FT-IR/MS study on the influence of nanoparticles content on the thermal decomposition of the starch/poly(vinyl alcohol) montmorillonite nanocomposites; *Iranian Polymer Journal*, 2012, submitted



### COFrRoCA – 2012, Septième Colloque Franco-Roumain de Chimie Appliquée, 27 – 29 Juin 2012, Bacau, Roumanie:

- 1. D.Rosu, L.Rosu, C.-D.Varganici; Le comportement photochimique et thermique des systèmes polymérique multicomposant; Proceedings Colloque ISSN: 2068-6382, pg.123-124 *(COMMUNICATION)*
- 2. C.-D. Varganici, O. Ursache, C. Gaina, V. Gaina, B. C. Simionescu; Nouveau matériaux hybride autorenouvelable thermique. Etudes thermiques; Proceedings Colloque ISSN: 2068-6382, pg.129-130 (*COMMUNICATION*)
- 3. L.Rosu, C.C.Gavat, D.Rosu; Decoloration degradation des textiles colores en presence des rayonnement ultraviolets; Proceedings Colloque ISSN: 2068-6382, pg.149-150 (**POSTER**)
- 4. C.-A.Teaca, R.Bodirlau, L. osu, D.Rosu; FTIR analyse thermiques des bois resineux apres modification et traitment avec l'huile de soja epoxydee; Proceedings Colloque ISSN: 2068-6382, pg. 153-154 (**POSTER**)
- 5. M.T.Nistor, L.E.Nita, A.P.Chiriac, C.vasile, R.Darie; Conception des structures polymeres sensibles avec proprietes controlees. L'influence de l'agent de reticulation; Proceedings Colloque ISSN: 2068-6382, pg. 145-146 (*POSTER and Award for best poster*)



7th MoDeSt Conference, 2 - 6 Sept., 2012, Prague, Czech Republic, Abstract book, published by the Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Prague 6 – Břevnov, Czech Republic

- 6. D.Rosu, C.-D.Varganici, L.Rosu; Thermal decomposition study of some polymeric multicomponent systems based on aromatic polyurethane and epoxy resin network; ISBN 978-80-85009-74-3, pg. 222-223 (COMMUNICATION)
- 7. L.Rosu, F. Mustata, D.Rosu, C.-D.Varganici; Semi-interpenetrating polymer networks polyurethane-epoxy resin. Study of photochemical stability; ISBN 978-80-85009-74-3, pg. 278-279 (*POSTER*)
- 8. C.-D. Varganici, A. Durdureanu-Angheluta, D. Rosu, M. Pinteala, B. C. Simionescu, Thermal stability of core-shell hydrophilic nanoparticles for biomedicine; ISBN 978-80-85009-74-3, pg. 290-291 (*POSTER*)
- 9. R.Bodirlau, C.-A.Teaca; Obtainment and characterization of organic acid modified starch/plasticized corn starch composite films; ISBN 978-80-85009-74-3, pg.369-370 (*POSTER*)
- 10. C.-A.Teaca, R.Bodirlau, D.Rosu; Characterization of irradiated wood after chemical modification with organic anhydride and coating with epoxidized vegetable oil; ISBN 978-80-85009-74-3, pg. 374-375 (*POSTER*)



### 21st Symposium on Thermal Analysis and Calorimetry, 17 Feb. 2012, Bucuresti, Romania

- 11. C.-D. Varganici, O. Ursache, C. Gaina, V. Gaina, B. C. Simionescu; DSC studies on thermoreversible and non-thermoreversible hybrid materials (*COMMUNICATION*)
- 12. S.Patachia, M.T.Nistor, C.Vasile; Thermal behavior of wood treated with ionic liquid (COMMUNICATION)

### Fifth Cristofor I. Simionescu Symposium "Frontiers in Macromolecular and Supramolecular Science", 11 – 13 Iunie 2012, Bucuresti, Romania

13. C.-D.Varganici, A.Durdureanu-Angheluta, F.Doroftei, D.Rosu, M.Pinteala, B.C. Simionescu; Core-shell magnetic nanoparticles based on silane compounds and magnetite: Thermal behavior (*COMMUNICATION*)

### 2eme Colloque Franco-Roumain de Chimie Medicinale, CoFrRoCM 2012, lasi, Romania, Oct. 3-5, 2012

14. O.M.Paduraru, A.Bosinceanu, G.Tantaru, C. Vasile; Effect of cyclodextrin on the solubility of an anti-arrhythmic drug (*POSTER*)

### Days University "Alexandru Ioan Cuza" Conference Faculty of Chemistry, 25-27 Oct. 2012, Iasi, Romania

15. M.-T.Nistor, C.Vasile; Influence of nanoparticles on the thermal decomposition of hybrid nanocomposites based on starch/poly(vinyl alcohol) montmorillonite (COMMUNICATION)



#### The XXXII-nd Romanian Chemistry Conference, Calimanesti-Caciulata, Valcea, Romania, 03-05 October 2012

- 16. C.-D.Varganici, D.Rosu, L.Rosu; The effect of temperature on the thermal stability of some semi-interpenetrated polymer networks based on epoxy resin and aromatic polyurethane (*COMMUNICATION*)
- 17. D.Rosu, L.Rosu, C.-D.Varganici; Photooxidation behavior of some polyurethane based semi-interpenetrated polymer networks (*POSTER*)
- 18. C.-A.Teaca, R.Bodirlau, L.Rosu, D.Rosu, C.-D.Varganici; Wood treatment with organic anhydride and epoxidized vegetable oil thermal properties investigation (*POSTER*)
- 19. L.Rosu, D.Rosu, C.C.Gavat; Effect of radiation UV on textile dyeing (*POSTER*)
- 20. F.Mustaţa, I.Bicu, L.Rosu; Formaldehyde resins from hydroxyl esters of resin acids (*POSTER*)
- 21. F.Mustata, I. Bicu, D.Rosu; Thermoseting resins obtained via sequential photo and thermal crosslinking of epoxy resins. Curing kinetics, thermal properties and morphology (*POSTER*)



## Seminar thermal analysis: techniques for materials characterization using thermal analysis, lasi, Romania, 24 mai 2012

22. O.M.Paduraru, N.Tudorachi, A.Chiriac; Thermal degradation of carboxymethyl starch-g-poly(lactic acid) copolymer by TG-FTIR-MS analysis (*COMMUNICATION*)

23. C.-D. Varganici, L. Rosu, M. Pinteala, D. Rosu, B. C. Simionescu; Thermal analysis application to some polymeric material micro- and nanoparticles (*COMMUNICATION*)

## 15th International Conference Polymeric Materials, Halle, Germany, Sept. 12-14, 2012

24. O.M. Paduraru, D. Ciolacu, C. Vasile; Polyvinylalcohol/cellulose hydrogels as carriers for a bioactive component *(COMMUNICATION)* 

25. O.M.Paduraru, G.Tantaru, C.Vasile; Water soluble complex of hydroxypropyl-β-cyclodextrin and aminodarone (*POSTER*)

## 4th Bilateral Symposium on Functional Heterocyclic and Heterochain Polymers for Advanced Materials, Iasi, Romania, Sept. 2-7, 2012

26. O.M.Paduraru, C.Vasile, D.Ciolacu, R.N.Darie; Evaluation of polyvinylalcohol /cellulose hydrogels as carriers for drug delivery (*POSTER*)