

# CLP'14



1-4 May, 2014  
Papillon Ayscha Hotel, Belek - Antalya / TURKEY

## 3<sup>rd</sup> INTERNATIONAL SYMPOSIUM ON CONTROLLED/LIVING POLYMERIZATION FROM SYNTHESIS TO APPLICATION

<http://clp14.itu.edu.tr>



### ORGANIZING COMMITTEE

Metin H. Acar, Co-chairman  
Krzysztof Matyjaszewski, Co-chairman  
Buket Alkan, Secretariat  
Abdullah Aydoğan, Webmaster

Eren Elik  
Merve Bayraktar  
Ahmet Yasir Demir  
Zeynep Songur

**Prof. Metin H. Acar**  
*CLP'14 Co-chairman*  
Istanbul Technical University  
Chemistry Department  
Maslak 34469 Istanbul, TURKEY  
Tel : +90-212-285 3230  
Fax : +90-212-285 6386  
E-mail : macar@itu.edu.tr  
URL : <http://www.kimya.itu.edu.tr/macar>

**Prof. Krzysztof Matyjaszewski**  
*CLP'14 Co-chairman*  
Carnegie Mellon University  
Chemistry Department  
4400 Fifth Avenue  
Pittsburgh, PA 15213, USA  
Tel : +1-412-268-3209  
Fax : +1-412-268-6897  
E-mail : km3b@andrew.cmu.edu  
URL : <http://www.chem.cmu.edu/groups/maty>



TÜBİTAK



*Kerman*



A STAR ALLIANCE MEMBER



**4 May 2014, Sunday**

**Chairman: Prof. Mathias Destarac**

**09:00-09:30 Zi-Chen Li, Peking University, Beijing, China**

*Precision polymersynthesis via multicomponent polymerization*

**09:30-09:50 Ian Teasdale, Johannes Kepler University Linz, Leonding, Austria**

*Chain-end functionalized polyphosphazenes: Sturcturally controlled biodegradable polymers*

**09:50-10:10 Hui Niu, Chinese Academy of Sciences, Beijing, China**

*Application of living radical polymerization to polypropylene functionalization*

**10:10-10:30 Jaroslav Mosnacek, Slovak Academy of Sciences, Bratislava, Slovakia**

*Synthesis and properties of thermoplastic elastomers based on acrylate block copolymers and their composites*

**10:30-10:50 Coffee Breaks**

**Chairman: Prof. Devon A. Shipp**

**10:50-11:10 Yang Li, Dalian University of Technology, Dalian, China**

*Dentritic effects on fluorecence properties of functionalized dendrigraft polybutadiene*

**11:10-11:30 Ivan D. Grishin, Lobachevsky State University, Nizhny Novgorod, Russia**

*Catalytic systems based on ruthenium carborane complexes for synthesis of functional polymers*

**11:30-11:50 Porkodi Kadhivel, Instituto Politécnico de Bragança, Bragança, Portugal**

*Microreactor generated RAFT imprinted smart hydrogels*

**1:50-12:10 Yann Sarazin, CNRS/Université de Rennes 1, Rennes, France**

*Controlled living and immortal ring-opening polymerization of cyclic esters catalyzed by discrete main-group complexes: Mechanistic investigations and comprehensive kinetic anaylsis*

**12:10-12:30 Juraj Kronek, Slovak Academy of Sciences, Bratislava, Slovakia**

*Living cationic copolymerization of 2-ethyl-2-oxazoline and 2(4-alkoxyphenyl)-oxazolines*

**12:30-14:00 Closing Remarks**

**12:40-14:00 Lunch**

**14:00-..... Departure**

## MICROREACTOR GENERATED RAFT IMPRINTED SMART HYDROGELS

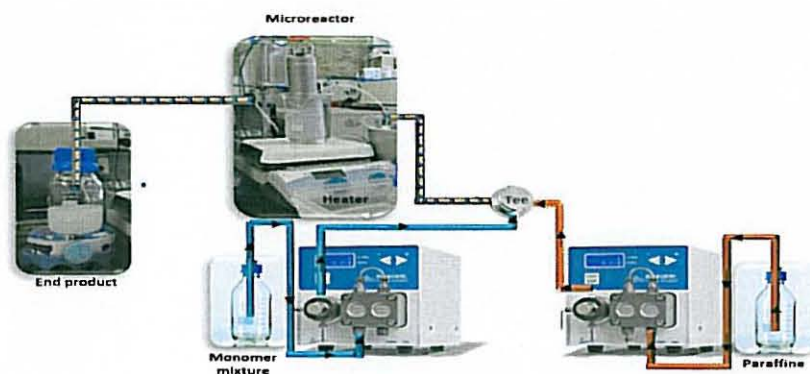
*Porkodi Kadhivel<sup>1</sup>, Rolando C.S. Dias<sup>1</sup>, Mário Rui P.F.N. Costa<sup>2</sup>*

<sup>2</sup>LSRE-Faculdade de Engenharia da, Universidade do Porto, Rua Roberto Frias s/n, 4200-465, Porto,

<sup>1</sup>LSRE-Instituto Politécnico de Bragança, Quinta de Santa Apolónia, 5300, Bragança, Portugal  
Portugal

### Introduction

Stimuli-Responsive Smart Hydrogels (SRSH) are extensively used in biotechnology and biomedicine amongst many other fields<sup>1</sup>. SRSH can be obtained conventionally through a batch reactor process resulting in irregular shaped particles, whereas emulsion, inverse-suspension, precipitation polymerizations, etc., lead mostly to spherical shaped particles. Recently micro-reactors have been introduced as an alternative approach to produce spherical/conical particles continuously through implementation of a microfluidic droplet based technique.<sup>2</sup> Reversible Addition-Fragmentation Chain Transfer (RAFT) controlled polymerization on the other hand has received a considerable attention in hydrogels provided the potential to produce macromolecules with a narrow molecular weight distribution.<sup>3</sup> Having faced some classical deficiencies of conventional Free Radical Polymerization (FRP), owing to the importance of hydrogel particle morphology and the promising behavior of Controlled Radical Polymerization (CRP) using RAFT agent, here we try to combine the continuous flow microreactor and RAFT to overcome the obstacles. Besides, one additional goal is to create molecular memory (imprinting) inside hydrogel network. Pharmaceutical drugs with different classifications are employed as templates to obtain molecular imprinted hydrogels (MIH) in a continuous flow microreactor (Figure 1).

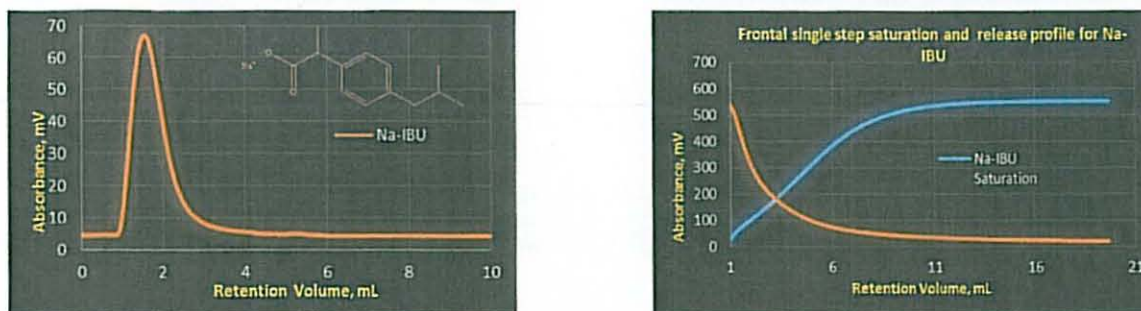


**Figure 1.** Schematic illustration of droplet-based microreactor device build-up in our laboratory.



**Figure 2.** Microscopic images of some SRSH hydrogel particles produced in this work.

The following Figures demonstrate the chromatographic behavior of microreactor produced hydrogels.



**Figure 3.** Observed chromatographic profile of Na-IBU in NIHAA-R hydrogel.

Smart hydrogel microparticles combined with RAFT polymerization were produced using continuous flow microreactor for MIP application in pharmaceutical industries. To our knowledge, this is the first research plan focusing on the RAFT influence in smart imprinted hydrogels production using continuous flow microreactor. Promising results obtained in the above mentioned discussion showed the usefulness of this research line in biomedical and biotechnological application fields.

### Acknowledgements

The authors thank FCT and FEDER under Programme COMPETE (Project PEst-C/EQB/LA0020/2013), QREN, ON2 and FEDER (Project NORTE-07-0162-FEDER-000050) and QREN, ON2 and FEDER (Project NORTE-07-0124-FEDER-0000014 - Polymer Reaction Engineering). P.K. thanks NORTE-07-0124-FEDER-0000014 for the Post Doctoral grant.

### References

- (1) I. Galaev, B. Mattiasson, *Smart Polymers. Applications in Biotechnology and Biomedicine*, Ed. II, CRC press, 2007
- (2) C. Diehl, P. Laurino, N. Azzouz, P.H. Seeberger, *Macromolecules* **2010**, *43*, 10311-10314
- (3) M.A.D. Gonçalves, V.D. Pinto, R.A.S. Costa, R.C.S. Dias, J.C. Hernández-Ortiz, M.R.P.F.N. Costa, *Macromol. Symp.* **2013**, *333*, 273-285