GUEST EDITORIAL

Research on Renewable Materials and Innovative Processes for Sustainable Packaging

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Packaging - An Important Tool for a Sustainable Society

Packaging is an important part of our everyday life and the use of packaging materials has shown a continuous increase over time. Changes in society lead to changes in the way goods are produced and therefore in packaging demands. The packaging is a means of providing the correct environmental conditions for goods during transportation, distribution and storing to the consumer. It has to perform a number of key functions: • preserve and protect the product, preventing thus the losses • communicate brand image and convey information for the identification and correct use of the product • offer convenience across the supply chain, as well as convenience of effective disposal at the end of product life.

"Better Quality of Life through Better Packaging for More People" is the primary goal of the World Packaging Organisation (WPO). "Actually, packaging has tremendous resource-saving potential. Clearly, over-packaging consumes too many resources. Under-packaging allows for damage and spoilage of contents, also wasting resources. The goal is "right size" and "right strength" packaging. It is the result of a holistic view that balances the proper use of resources against the environmental, social, and financial needs of packaging users and Society"(*Position Paper: Packaging – An Important Tool for A Sustainable Society,* www.worldpackaging.org).

The packaging industry accounts for the following shares of material: paper and board – 36%, metal – 17%, plastic – 34%, glass – 10%, other – 3% (Brandon Gaille, *Packaging Industry Statistics and Trends, November 1, 2013, htpp://brandongaille.com*). Paper and board are the oldest and most versatile packaging materials available on the market today, being an environmentally friendly material, obtained of renewable resources, easily recycled, composted or incinerated after use. In fact, paper and board is the most recycled packaging in Europe – 81.3% in 2011, followed by steel with 74% and glass with 70% (*CEPI Sustainability Report 2013*, www.cepi.org). Therefore, increasing environmental pressure is the main driver for the further growth of paper-based packaging markets.

The use of natural, renewable bio-based resources together with well developed recycling systems qualifies paper-based packaging industry as a major player in the bio-economy. However, paper is lacking certain properties that are especially important for food contact packaging materials. In particular, food packaging should provide some barrier properties (e.g. water and water vapour, oxidation, light and microbial infection). In the case of paper-based packaging, specific barrier properties may be obtained with dedicated chemical treatments or through lamination with other materials, such as metal or plastic.

Research on Sustainable Packaging in the frame of COST Action FP 1003

The COST Action FP1003 is titled "Impact of Renewable Materials in Packaging for Sustainability – Development of Renewable Fibre and Bio-based Materials for New Packaging Solutions (BiomatPack)". The Action ran from December 2010 to December 2014 and it has had 19 COST countries (BE, CH, DE, DK, ES, FI, FR, GR, HR, HU, IT, NL, NZ, PL, RO, SE, SI, SK, TR, UK), one international partner (New Zealand) and one organization (CEPI) as members. Totally 188 people participated at Action events, from which 73 ESRs (Early Stage Researchers). There was also a good gender balance of participants, 92 female and 96 male participants.

Objectives and organisation

The activities in COST Action FP1003 were focused on packaging solutions based entirely on renewable resources in order to remove the serious disadvantages associated with future paper and board packaging solutions that continue to rely on non renewable materials. The main objective of the Action was to enhance the knowledge concerning materials derived from the forest sector and thus identify potential new renewable packaging solutions using these materials alone or in combination. The work plan adopted a

sustainability approach by addressing aspects related to technical, environmental, economic and societal outcomes.

The Action was organized in five Working Groups (WG), from which the first four WGs were covering research in the most important aspects of the packaging value chain and the fifth WG was dedicated to dissemination and communication.

WG1 - Material Development was focused on the potential of renewable materials to replace the current, oil-derived materials with renewable alternatives and more specifically to improve knowledge regarding the use of forest/renewable materials in the packaging value chain.

WG2 - *Packaging Value Chain efficiency including market aspects* aimed to investigate, determine and understand the extent to which renewable materials may result in lower weight, fit-for-purpose packaging solutions with additional functionalities.

WG3 - End of life had as main goal to generate new scientific knowledge regarding existing, emerging and embryonic end-of-life options for renewable materials. The direction in WG3 is research into the performance of existing end-of-life technology in relation to renewable materials in packaging and research focusing on the potential development of new technology for end-of-life treatment.

WG4 - Sustainability evaluation was aimed at the environmental and economic assessment of the new processes/products that encompass the entire life cycle, as well as at critical evaluation of the impact on EU society at all levels.

WG5 - Knowledge Transfer and Exchange of Results was dedicated to the coordination and leading of all the activities associated with the sharing and transfer of knowledge. This Working Group was responsible for the organisation of common events (training schools, conferences, workshops, etc) and for dissemination of the results arising out of Action activities (website, newsletters, scientific publications database, etc.).

Summary of achievements

Bio-based packaging is a very hot topic and this COST Action had as a scope to look at biobased packaging from a holistic point of view, covering aspects from the total value chain. The Action has established a friendly environment for the dialogue and exchange of knowledge, opening up new knowledge areas for each other and increasing understanding of the packaging value chain.

The interacting was specifically implemented through several roadmap workshops within the Action, when the researchers sat together and discussed aspects of the packaging value chain and bio based packaging both from market and technical point of view. The ESRs were also invited for a special road map session.

One expressed objective of the Action was to interact and involve industry. In this respect, two roadmap sessions have been conducted with industry and then the feedback was obtained via a questionnaire. The industry was also involved in one of the Training Schools.

During the course of the Action, the researchers presented and discussed their daily research work and established the networks. The Action has offered the possibility to create cooperation projects and strengthen the European Research Area in bio based packaging and gave opportunities, especially to the ESRs to learn and develop research abilities through Training Schools and STSMs (Short Technical Scientific Mission). Therefore, the partners have also indicated a lot of interaction in EU and national programs where the Action in some way has had an influence.

Action output includes:

Two conferences: The 1st BioMatPack Conference "Sustainable and Renewable Packaging" was organised in the frame of Hispack, International Packaging Exhibition, which took place in Barcelona, 17 May 2012; The 2nd BioMatPack Conference "Innovative Packaging" was a joint event of the PTS and COST Action FP1003, 20-21 May 2014, organized in Munich, Germany.

Five joint technical papers, covering the state-of-art and challenges in different subjects, were published in international journals with impact factor.

Seven Roadmap workshops were organized, from which five in connection with MC meetings and two at European Paper Week, in November 2011, Brussels (one with invited ESRs and other with industry).

Two presentation workshops were organised in connection with the MC and WG meetings in Bratislava (March 2012) and in Bologna (October 2013).

Four Training Schools with over 20 participants (ESRs) in each were implemented: *New technologies for treatments in the end-of-use of packaging materials*, September 2011, Zagreb; *Printing of bio-based*

materials in packaging, September 2013, Budapest; *Use of nanopolysaccharides in packaging*, December 2013, Grenoble; *Innovation management*, October 2014, Valencia.

Totally 15 STSMs were implemented and the beneficiaries (ESRs) have been given the opportunity to present their research in two workshops as well as in the two conferences.

Innovation Testing Net Lab – pilot laboratory was promoted in Spain at several meetings with packaging industry.

New COST Action – The Action FP1003 has been followed up by a successful proposal for a new COST Action ActinPack (FP 1405), which was approved in November 2014 and will start in March 2015.

More information can be found on the Action website: *http://www.action-fp1003.eu*

This special issue of *Cellulose Chemistry and Technology (CCT)* is dedicated to an important research theme of forest products sector – *Renewable materials and innovative processes for sustainable packaging*. The idea for this volume originated in the scientific network developed in the frame of COST Action FP1003 – *Impact of Renewable Materials in Packaging for Sustainability – Development of renewable fibre and Bio-based Materials for new packaging Solutions (BiomatPack).* This CCT issue also includes four articles from the journal's portfolio, which fit perfectly the proposed theme.

Cellulose Chemistry and Technology is a reference journal in the field of pulp chemistry and technology, distributed worldwide, which guarantees that the important research results generated by COST Action FP1003 will reach all research and industrial communities interested in bio-based packaging materials. The partners of the COST FP 1003 thank the CCT Editorial Board for accepting to publish this special issue.