

COST

Domain Committee Food and Agriculture

COST Action FA0904

Start Date 29/03/2010

Eco-sustainable Food Packaging Based on Polymer Nanomaterials

MONITORING PROGRESS REPORT

Reporting Period: from 29 March 2010 to 1 May 2011

This Report is presented to the relevant Domain Committee.

It contains three parts:

- I. Management Report** prepared by the COST Office/Grant Holder
- II. Scientific Report** prepared by the Chair of the Management Committee of the Action

III. Previous versions of the Scientific Report; i.e., part II of past reporting periods
The report is a “cumulative” report, i.e. it is updated annually and covers the entire period of the Action. Confidentiality: the documents will be made available to the public via the COST Action web page except for chapter II.D. Self evaluation.

Based on the monitoring results, the COST Office will decide on the following year’s budget allocation.

Executive summary (max.250 words):

Progress in the Action includes several successful activities:

- Kick-off meeting (Brussel 29-30 /3/2010), where the procedures and the tools to guarantee the Action development were set .
- Plenary conference (Iasi , Romania 29/30-6-2010), that included the 1° WGs meeting and a Round Table dedicated to industry;
- Technological Seminar London (1/2 -9-2010) on Ethical Issues.
- International Workshop (Pozzuoli Italy 3/4-3-2011) with a session dedicated to WG1, MC meeting and a Round Table for ESRs.
- Dissemination Activities: web page setting –open enabling interested parties to access the most up-to-date information
- Networking among participants and with other projects to avoid overlaps, optimize resources and exchange best practice: it resulted in submission of joint publications/ projects
- Activities for involvement of ESRs and increasing their visibility: 7 STSMs grants, organization of a round table, constitution of a intergroup Entity.

The scientific innovation resulting from the networking is proved by the WGs and STSMs activities:

WG1 started the mapping of the institutes/universities interested with their expertise, WG2/WG3 aiming to go beyond the materials development, processing and characterization, offer specific collaborations to evaluate food shelf-life, biodegradability; WG4 distinguished two domains of communication 1) intra-technology 2) Extra-technology between scientists/industry/consumers/regulators/ policy-makers.

Innovative knowledge resulting from networking is in progress and will be presented in the next report. The preliminary results are very encouraging with **some results already obtained:** Plans for 2011-12 include a Training School in FYROM , Two Workshops (WG1 Finland , WG 2 Spain), a MC meeting and 2 Round tables for ESRs and industry, together with 6/7 STSMs.

I. Management Report prepared by the COST Office/Grant Holder

I.A. COST Action Fact Sheet

Action FA0904 Fact Sheet

Title
Eco-sustainable food packaging based on polymer nanomaterials

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Details	
Draft Mou:	Mou: 261/09
Start of Action: 29/03/2010	Entry into force: 13/01/2010
End of Action: 28/03/2014	CSO approval date: 02/12/2009

Objectives
The main objective of this Action is to constitute an international scientific and technology network on issues related to eco-sustainable Polymer Nanocomposites Food Packaging for the preservation, conservation and distribution of high quality and safe food. The Action will constitute an international scientific and technology network on issues related to Eco-sustainable Polymer Nanomaterials for Food Packaging (PNFP), for the preservation, conservation and distribution of high quality and safe food. The Action aims at exploiting the potentiality of polymer nanotechnology in the area of food packaging treating in a complete way the demanding needs of the users, such as health, environment, taste, cost and the specific requirements of the food industry. The envisioned direction is to look at the complete life cycle of the PNFP by the combined efforts of leading research and industrial groups. The Action will identify the barriers (in research and technology, safety, standardisation, trained workforce and technology transfer) that prevent a complete successful development of PNFP and will indicate the strategies to proceed further.

Parties							
Country	Date	Country	Date	Country	Date	Country	Date
Austria	13/01/2010	Belgium	03/02/2010	Bulgaria	04/03/2010	Czech Republic	12/07/2010
Denmark	11/06/2010	Finland	13/01/2010	Former Yugoslav Republic of Macedonia	22/02/2010	France	10/02/2010
Germany	25/01/2010	Greece	02/03/2010	Ireland	08/02/2010	Israel	16/03/2010
Italy	13/01/2010	Latvia	15/02/2010	Lithuania	04/03/2010	Netherlands	25/02/2010
Norway	16/03/2010	Poland	03/02/2010	Romania	13/01/2010	Slovenia	02/08/2010
Spain	13/01/2010	Sweden	10/05/2010	Switzerland	25/01/2010	United Kingdom	13/01/2010

Total: 24

Intentions to accept the MoU							
Country	Date	Country	Date	Country	Date	Country	Date
Serbia	N/A						

Total: 1

Participating Institutions from non-COST countries	
United States	University of Texas at Arlington
Canada	Agriculture and Agri-Food Canada, Food Research and Development Centre (FRDC)

Working Groups

WG1 Development of new safe PNFP

Leader: Dr Mika VAHA-NISSI (FI) - VTT Technical Research Centre of Finland Biologinkuja 7 FI-02044 VTT Espoo Finland

Vice-leader: Professor Alex SIVAN (IL) - The Institute for Applied Biosciences, Ben-Gurion University of the Negev, P.O.B. 653, Beer-Sheva, 84105

Vice-leader: Dr Janis ZICANS (LV) - Riga Technical University, Faculty of Material Science and Applied Chemistry, Institute of Polymer Materials Azenes street 14/24 LV 1048 Riga

Approximate number of members: 45

WG2 Development of new processing technologies including modelling and simulation

Leader: Professor Jose Maria LAGARON CABELLO (ES) - CSIC IATA, Novel Materials and Nanotechnology Group, Av. Agustin Escardino 7 46980 Paterna

Vice-leader: Dr Ramune RUTKAITE (LT) - Kaunas University of Technology Radvilenu plentas 19 LT 50254 Kaunas

Vice-leader: Dr Jeannette DEXPERT-GHYS (FR) - Cemes-Cnrs BP 94347, 31055 Toulouse

Approximate number of members: 45

WG3 Development of new strategies to identify any critical interaction of PNFP with food

Leader: Dr Qasim CHAUDHRY (UK) - The Food and Environment Research Agency Sand Hutton, Sand Hutton, York

Vice-leader: Dr Ignacy JAKUBOWICZ (SE) - SP Technical Research Institute of Sweden Polymer Technology P.O. Box 857, Brinellgatan 4 501 15 Boras

Vice-leader: Dr Ramesh Babu P (IE) - Trinity College School of Physics, College Green, Dublin 002

Dublin Ireland Approximate number of members: 30

WG4 Ethics, Standardization, Science-society dialog

Leader: Professor Geoffrey HUNT (UK) - Professor of Philosophy and Society at St Mary's University College, London

Vice-leader: Professor Marek KOZLOWSKI (PO) - Wroclaw University of Technology Wybrzeze Wyspianskiego 27 50-370 Wroclaw Poland

Vice-leader: Dr Ruth Schmid (NO) - SINTEF Materials Technology, Polymers and Composites, P.B. 124 Blindern

Approximate number of members: 30

Website

www.ictp.cnr.it/index.php?option=com_content&view=article&id=108&Itemid=104

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I.C. Overview activities and expenditure

Type	Start	End	City	Type	Title	Amount	Total EUR
DISSEMINATION	2010-07-13	2010-06-25	(n.a.)	(n.a.)	Poster on the aims/objectives of the COST Action	30	
DISSEMINATION	2010-07-13	2010-06-25	(n.a.)	(n.a.)	Poster on the application/uses of polymer materials applied to the food packaging	30	
DISSEMINATION	2010-07-13	2010-06-24	(n.a.)	(n.a.)	Proceedings of the meeting in Iasi on 28-29 June 2010	213.96	
DISSEMINATION	2010-10-22	2010-11-03	(n.a.)	(n.a.)	Website	700	
DISSEMINATION	2011-01-07	2011-03-29	(n.a.)	(n.a.)	Proceedings of COST International Workshop Pozzuoli 3-4 March 2011	1600	2573.96
MEETING	2010-06-28	2010-06-29	Iasi	Working Group Meeting, Workshops/Conferences	Conference + WG	24292.24	
MEETING	2010-09-01	2010-09-02	London	Other COST relevant meeting	Other COST relevant meeting	9754.22	
MEETING	2011-03-03	2011-03-04	Pozzuoli - Naples	Management Committee Meeting, Working Group Meeting, Workshops/Conferences, Other COST relevant meeting	Management Committee Meeting + COST relevant meeting-Workshop+WG Meeting	28565.34	62611.8
OERSA	2010-06-25	2010-06-25	(n.a.)	(n.a.)	Banking charge	39.75	39.75
STSM	2010-11-01	2010-11-30	Pozzuoli NA	STSM from Romania to Italy	STUDY OF some NANOSTRUCTURED MATERIALS	2150	
STSM	2010-11-15	2010-12-17	Iasi	STSM from Latvia to Romania	Electrical and magnetic properties of polymer nanocomposites and their structure	2500	
STSM	2011-01-05	2011-01-31	Genève	STSM from Italy to Switzerland	A novel nano sensor to measure relative humidity levels	2500	
STSM	2011-01-17	2011-02-14	Reading	STSM from Italy to United Kingdom	Morphological study of new nanocomposite materials for food packaging applications	2460	
STSM	2011-02-14	2011-03-03	Valencia	STSM from Bulgaria to Spain	Structural and mechanical characterization of polymer nanocomposites and recycled polymers.	1900	11510

II. Scientific Report

II.A. Innovative networking

The Action has fully achieved its objectives and technical goals for this first period as shown by the numbers of the Action schematically reported in the table 1 below

No Networking participants	No Networking Countries	No STSMs	No links with project/activities	No joint projects submitted	No joint publications
220	27	7	20	7	20

• **Innovative knowledge resulting from COST networking through the Action**

A highlight for innovative networking is the promotion of the cooperation with other existing platforms on polymer nanotechnology and standardization bodies

- Very interesting the synergy with the FP7 project Napolynet “Setting up research-intensive clusters across the EU on characterization of polymer nanostructure” with Dr. Silvestre (Action chair) as Coordinator and several Cost MC members as partners. Two very important joint events were organized: (*programme/participants list in the annex1,2*)
 - *Technological Seminar “ Polymer nanomaterials for food Packaging, 1-2 September London 2010*
 - *International Workshop “ Safe nanostructure Polyner nanomaterials 3-4 March, Pozzuoli 2011*
- A strong link was created with Cost Action MP0107“Composites with Novel Functional and Structural Properties by Nanoscale Materials (Nano Composite Materials-Ncm)” Chair Prof Erick Kny. member of the Cost Action FA0904: the Action contributed (participation, dissemination, supporting) to two events organized by Cost Action MP0701
 - *International conference on Food Packaging in Graz Austria. (75 participants): “Food Packaging Innovations- Conference ”. 5-6 October 2010 Graz, Austria*
 - *Training School “Synthesis of Hybrid Organic-Inorganic Nanoparticles for Innovative Nanostructured Composites” Naples, 28 February - 2 March 2011*

The joint organization avoiding overlaps and optimizing the budget resources made possible to invite several top level speakers, to increase the number of participants and in particular the number of grants for young researchers.

Innovative knowledge resulting from COST networking is in progress and will be presented in the next report. The preliminary results are very encouraging Some innovative results were already obtained: To mention - *in the case of isotactic polypropylene containing either inorganic nano-platelets to increase the tortuosity of the gas paths or spherical particles which provide anti-microbial properties* - the identification through designed and implemented special experimental apparatus (quantitative scattering techniques complemented with scanning, transmission electron and scanning probe microscopy) of the shape (plate-like or spheroidal). and minimum number of nanoparticles required to influence the polymer matrix and the range of processing conditions.

• **Significant scientific breakthroughs as part of the COST Action. (Specific examples)**

Innovations resulting from work in this Action have arisen in both STSMs and WG activities:

STSMs Progresses and significant scientific breakthroughs

7 STSMs that took place with topics related to the WGs on basic and applicative science in PNFP, from the investigation of the morphological/structural properties (identification of the degree of dispersion of nanoparticles in the matrix) and their influence on rheological, electrical, mechanical properties, to the study of recyclability of some PNFP for increase ecosustainability, to the **new approach for setting up novel nanosensors to measure temperature and humidity based on fiber optic sensor**. Some publication are in preparation reporting these interesting results. The STSM grantees were invited to present the result of their stage at the International Workshop in Pozzuoli March 2011. The list of the STSMs and the scientific report is in the Annex 5.

Progress in WGs

After the first meeting of the WGs held at Conference and WGs meeting “Ecosustainable food packaging based on polymer nanomaterials”, Iasi, Romania, 28-29 June 2010. (report on annex 3) where each group leader presented the content of the activities of group and an agreement on the major themes and work of the groups with a division of labour and tasks was established, the groups started their activity and reached the following progresses:

WG1/WG2

- A mapping of the research and industrial Institutions/Universities interested in WG1/WG2 with their main competence and expertise is in preparation);
- The initial steps for organization of a WG 1 workshop in Espoo, Finland in mid-September 2011 were taken. This was approved by the MC during the meeting in Pozzuoli, (Italy) March 2011;
- One day topical workshop for WP2 was organized in March 2011 in Naples. Many issues relevant to the topics were discussed and relevant new people coming from several countries such as Italy, Sweden, Portugal, Turkey and Algeria joined the meeting to present their views;
- The initial step for the organization of a WG1/WG2 workshop in Valencia in March 2012. It was suggested that presentations by the industry, EFSA people and other legislation bodies should be included in that meeting;
- Plan for the future includes presentation of demonstrator projects carried out within the WG1/WG2, to highlight the importance of proving the concepts.- In order to do so, several WG1/WG2 members suggested to go beyond the materials development, processing and characterization and offered themselves for specific collaborations downstream to evaluate food shelf-life, biodegradability and other application related aspects. A summary of their technological offers and contacts is in the annex 4.

WG3/WG4

- WG3 group distinguished between two domains of communication within its remit: 1) intra-technology communications between different fields of science, technology such as polymer science, chemical engineering, nanoscience, biology, food technology. 2) Extra-technology communication between the scientists/technologists and other relevant parties such as industry, consumers, NGOs, regulators, policy-makers and insurance companies.
- Organisation of the Technological Seminar at St Mary's University College, Twickenham, London 1st- 2nd September 2010. The theme of the seminar was ‘Polymer Nanomaterials for Food Packaging: Characterisation Needs, Safety and Environmental Issues’ and was attended by participants from 17 countries.
- A seminar to be held late in 2012 devoted to understand the possible interactions of food and Food Contact Materials (FCM). Focused on Migration and food impact and Food quality is planned WG4
- The WG leader Prof. G.Hunt together with Dr. Erden proposed to produce a booklet for consumers that explains the development of safe nanomaterials-based

• **Tangible medium term socio-economic impacts achieved or expected.**

- A highlight in term of socio-economic impact was the Conference and WGs meeting “**Ecosustainable food packaging based on polymer nanomaterials”, Iasi, Romania, 28-29 June 2010**” with a Round Table dedicated to the Industry and the international Workshop where numerous industrial representatives participate and pointed out their view on the importance of exploiting nanotechnology for food packaging applications
- The two workshops held in the reporting period covered all aspects of different approaches for manufacturing successfully polymer nanomaterials for food packaging application including toxicity and environmental aspects, proper handling and environmental concerns of nanoparticles. Those workshops underlined the needs of networking (possible only through an instrument like COST Action) among several different disciplines -chemistry, physics, life sciences, engineering, various application oriented fields - in order to be successful
- The interest and the participation in all the events organized and/or co-organized by the action was very high. A total of about 220 scientists attended.

The following interWG progresses/success of the Action that results from the of COST framework must be underlined:

- *The request to the chair from the press* Koninklijke Brill NV, Leiden The Netherlands *to act together with dr. Cimmino as editor for a book titled Ecosustainable polymer nanomaterials for food Packaging* With ISBN 978-90-04-207373-0 with the contribution of 10 MC Cost members
- *The Action activities and results were selected for:*
 - Presentation at the Cost strategic Workshop on principles and Development on Bio-Inspired Materials 13-15/April 2010 Vienna
 - Publication on the Italian Magazine “Rassegna dell’imballaggio” 2010; Almanacco del CNR/Italy April 2011; CBET Bulletin Newsletter Newsletter StMary’s University College Twickenham London October 2010; CfAM News University of Reading October 2010 February 2011

• **Spin off of new EC RTD Framework Programme proposals/projects. (List);**
Spin off of new National Programme proposals/projects. (List)

The networking among participants created by the COST action has already stimulate participants to submit joint projects in the field of PNFP, see table 2 below. At least 7 projects were submitted with the first 5 already approved and financed. It is expected that this stimulus will increase its strength in the next periods and will generated a conspicuous number of grants application of innovative proposal/projects.

AGREEMENT CNR/BAS JOINT PROJECT 2010-2012	<i>An integrated approach to designing polymer nanocomposites with layered silicates and carbon nanotubes</i>
ACCORD CNR/CNRS PROJECTS CONJOINTS DE RECHERCHE 2010-2011	<i>Nanocompositi antibatterici a matrice poliolefinica per l’imballaggio Alimentare</i>
Project supported by Academy of Science of the Czech Republic 2009_2011	<i>”Nanocomposite films and nanoparticles prepared in low pressure plasma for surface modifications</i>
Consortium Universities research centres , the regional Chamber of Commerce and industrial association	ASTER
Project for Elettra beam time n. 2010/5480	<i>Crystallization behaviour of novel polymer nanocomposites for food packaging applications</i>
INFRA-2011-2.1.1.	Structuring High-quality Research Infrastructures on Polymer Nanomaterials for innovative, sustainable and functional Food Packaging Application
FP7-PEOPLE-ITN-2011	Structuring an High-quality Research Training Network on Polymer Nanomaterials for Innovative, Sustainable and Functional Food Packaging Applications
KBBE.2011.2.1-01:	Strategies for improving communication between social and consumer scientists, food technology developers and consumers

II.B. Inter-disciplinary networking

• **Additional knowledge obtained from working with other disciplines within the COST framework. (Specific examples)**

- Synergies with 20 European networks (list in annex 6) was established for exchange of the best practice and combination of events and courses. Already mentioned the Synergy of FA0904 with COST MP0701 and the FP7 project Napolynet with organization of joint events that made possible to attract scientists from different disciplines, e.g. biotechnology, food technology, composites, nanotechnology, toxicology and enabling participants to meet scientists they do not meet in their regular network, stimulating new contacts and eventually new multidisciplinary initiatives.
- The close synergy with Napolynet makes also possible to exploit the facilities of the Napolynet European Open Laboratory (EOL). (Several STSM Grantees from Costs were hosted by Napolynet partners at the EOL location) and to attract scientists from different disciplines, e.g. biotechnology, food technology, composites, nanotechnology, toxicology and enabling participants to meet scientists they do not meet in their regular network, stimulating new contacts and eventually new multidisciplinary initiatives.
- A further good example of additional knowledge generated by interdisciplinary networking was the COST International conference on food packaging and innovation involving three COST actions (MP0701, FA0904, MPN 527): October 4th 5th Graz, Austria mainly dedicated to SMEs

- **Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide scientific impacts.** (Specific examples)

The Focus of the R&TD work of participants is concentrated on specific applications. A database on applications of relevant research work is planned to be started in the second period and will be updated each coming year. This will be of great future help to initiate the exploitation of the collected knowledge with participating industry, SMEs and start-ups. Interaction with companies in various projects and meetings has already been very intense. See the complete updated list of participating companies in annex 7

II C. New networking

- **Additional new members joining the Action during its life.**

The number of countries joining the action FA0904 has been increased more than by 50% (from 18 to 26), including 2 No Cost Countries and 1 pending participant Country) from 18 at the kick off to 26 during this year with the addition of Czech Republic, Denmark, Slovenia, Sweden and two No Cost countries Institutions, USA and Canada. At the moment Serbia and New Zealand (RA Country) are asking to participate, and Portugal and Turkey are showing their interest.

- **Total number of individual participants involved in the Action work**

The number of individual participants has been constantly growing over the year and stands now at 220 with ESR 105, Female 105. Non Cost countries 3 (Algeria, USA, Canada). The percentage of ESR is 45 % , Female is 47 % The numbers show a pretty good balance achieved by the Action in gender and among senior and ESR researchers.

- **Involvement of Early Stage Researchers in the Action, in particular with respect to STSMs, networking activities, and Training Schools.**

One of the main priorities of the Action is the **involvement of ESRs**. This is mainly reflected in the number of STSMs granted (**7**) higher than that planned (This was possible thanks to the reduction of the expenses of the MC meeting that found the full approval of the MC). A large number of additional applications is expected following the Round table dedicated to young researchers " Making the Science of future in PNFP" held in conjunction with the Cost International Workshop " Safe nanostructure Polymer nanomaterials 3-4 March, Pozzuoli 2011: There the ESR express great interest for the STSM instruments and asked for higher dedicated budget. Approx 105 ESR (and students) have been involved in the 2 workshops and conferences performed The number of ESRs involved in the Action Activities already high is expected to increase in the next period as a training school is planned in late October 2011 in Skopje.

- **Involvement of researchers from outside of COST Countries.**

7 scientists from 3 No Cost Countries participated with presentation in the various events (Algeria, Usa, Canada). The NON COST members of FA0904 are presently USA and Canada; Institution of New Zealand showed the interest in participating.

Participation of Non COST scientists is very valuable: to be mentioned the expert scientist from USA invited to the Food Packaging workshop in London reported about relevant work in this sector in USA. The expert from Canada informed the Action Community of the calls for PhD students to be performed in Canadian institutions on the action subject. The participation from Algeria concerns 4 young researchers /Female and will contribute to make Europe wider.

- **Advancement and promotion of scientific knowledge through publications and other outreach activities.**

The number of publications is at the moment 20. the See the list of publications updated until in Annex 8. Of course a great increase in the number is foreseen for the next future.

- **Activities and projects with COST network colleagues.**

See the list of projects in table 2 and annex 6.

- **The capacity of the Action members to raise research funds**

The submission of proposal generated in conjunction with the COST action has already secured some research funding already showing the high capacity of the Action members to raise research funds in the field of PNFP that it is expected will be confirmed in the next periods (see list in Tab.2).

III. Previous scientific report(s)

N/A

IV Annexes

No 8 Annexes

Annex 1 Report on the International Workshop Pozzuoli- 3-4 th March 2011

Annex 2 Report on the Technological Seminar London 1st -2nd Sept 2011

Annex 3 Report on Conference and WGs meeting Iasi, Romania, 28-29 June 2010

Annex 4 Technological offers and contacts

Annex 5 List and Scientific Report of the STSMs

Annex 6 Synergies of Cost Action FA0904 with European networks/projects

Annex 7 Companies involved in the Cost Action FA0904 Activities

Annex 8 Joint Publications