Active and biodegradable multilayer structure for dehydrated or dried food packaging applications
Acronym: BIOACTIVELAYER

WP 6. Dissemination and exploitation

Deliverable 6.10 "Final Plan of the use of dissemination of knowledge"

Project funded by the European Commission within the Seventh Framework Programme		
Dissemination level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	x

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1. Introduction

Work Package 6 deals with IPR protection and dissemination, having specific activities related to exploit the project's results throughout the Europe and the World global food packaging industry. This workpackage includes specifically actions to develop project outcomes and to arrange dissemination activities focus on promoting BIOACTIVELAYER project results to the audience.

The BIOACTIVELAYER Consortium provides in this document the terms of use and dissemination of the foreground arising from the project and which the project partners own, in accordance with the consortium agreement. The document gives the final route established by all the partners for the use and dissemination of the whole project knowledge (foreground) once the project will be finished. Also this document gives a cumulative overview of the dissemination activities, which were performed in order to increase awareness, participation and interaction among different stakeholders in relation to biodegradable packaging.

1.1. Purpose of the document

This report aims to describe in detail the actions taken under the Work Package 6. The document provides information of main dissemination activities carried out (Section 2) and of the potential exploitable foreground generated within the project (Section 3) and the

The dissemination activity does not only have the responsibility to act as an intermediate between the project and the potential users/consumers, but also disseminate news and ongoing activities within the project consortium.

Because of that, dissemination work is a continuous effort, while most of the dissemination tasks during the project start phase will focus on the visibility of the project and its concept, this emphasis will shift towards disseminating the project achievements as the project progresses. And finally major achievements and goals, which are described in previous deliverables and in the Final Report (month 25)

Along with these activities, BIOACTIVELAYER Consortium provides in this document the terms of use and dissemination of the foreground arising from the Project and which the Project partners own, in accordance with the partner's interest. The main results of the foreground described on Deliverable 6.5 "*Interim plan for use and dissemination of the knowledge*" to be obtained at BIOACTIVELAYER Project were:

- Coated paper with improved moisture barrier.

- Improved oxygen barrier layer with active compounds.
- Composite with improved moisture barrier developed for the specific application.
- Multilayer structure with improved oxygen and moisture barrier.
- Final packaging solution.

These results have been changed as are described in the current document.

The present version is based in the previous version of D6.4 (month 9). The plan described in D6.4 was executed during the extension of the project, from September 2013 to September 2015. The plan described in this deliverable will be executed after the end of the project.

2. Objectives of the dissemination activities

Based on the overall objective of the project, the aim of the Dissemination Plan was to combine knowledge generated in research tasks and information exchange through the relevant channels, tools and contents in order to obtain an active and significant contribution and cooperation from stakeholders. These aspects are fundamental for the project's success raising market needs and applicability:

- Raising awareness and promoting actions to provide information about potential benefits for Europe's economic growth to public and private stakeholders at European, national and local level.
- Assessing main outputs and strategic outcomes in order to provide partners an evaluation about the competitiveness of the developed materials.
- Reinforcing the exchange of information between the research community and stakeholders and among stakeholders themselves to strengthen and converge research results from different DG's of the EC and exploit cooperation with existing networks;
- Designing and implementing effective dissemination tools and channels to widely promote project outputs all over Europe.
- Creating the basis for the exploitation of project achievements after project completion.

Dissemination is seen as one-way promotion and is effective in raising awareness and sharing information. A range of dissemination activities took place particularly in the early phases of the project to raise awareness of the existence of the project, its objectives, partners and intended impacts. These activities will be included in the project final report.

Dissemination activities have been performed through various media. These have been selected for facilitating the collaboration among involved parties, i.e. bidirectional flow of knowledge and technology, or promoting the project and its results in a unidirectional informative manner, providing targeted or generic information and allowing the provision of feedback and suggestions / requirements raised by scientific and user´s communities.

On the other hand, "knowledge transfer" requires several more crucial steps, such as identifying exploitation mechanisms and activities focused on identified end-users to ensure impact and uptake of the results, being much more dependent on partner application. The dissemination strategy was a two-tiered approach, trying to reach:

- European and International level: the project included actions, events and instruments able to promote the transfer of information to other stakeholders / institutions / organizations / researchers of the envisaged project development.
- At local and national level, the dissemination was based on the submission of press releases, brochures and other actions based on each partner capabilities.

Dissemination has been active throughout the project duration, aiming to gather explicit input and feedback from stakeholders and to share the project findings. Dissemination strategy was developed to foster project results and impacts at local/national/international level even after project completion.

2.1. Post project dissemination activities

At national and European level, by taking profit of different partner´s assistance to relevant fairs and conferences related to the field of the project and the areas of interest of the partners, dissemination of BIOACTIVELAYER project will be continued. Specifically, this activity will be based on the project results, offering the chance to exploit under the agreed terms between partners. The foreground will also be disseminated through material such as press releases, as well as, companies' webpages. Post-project, specific attention will be given in marketing the foreground to local audiences. As potential dissemination activities after project, the partner have already identified the following opportunities:

- European Trade Fair for Packaging, Technology, Processing and Logistics. 29th September – 1st October 2015. Exhibition Centre Nuremberg, Germany.
- EMPACK 2015. The future of the packaging technology. Different locations, 18-19th November, Madrid, Spain; 24-25th February, NEC Birmingham, United Kingdom.

- Pharmapack Europe. 10th & 11th February 2016 in Paris Expo Porte De Versailles, France
- Food & Drink Expo. 18 – 20th April 2016 at Birmingham's NEC, United Kingdom.
- 20th IAPRI World Packaging Conference taking place between 12-15th June 2016 in Campinas, Sao Paulo.
- EMBALLAGE: ALL4PACK Paris that is held from 14th to 17th November 2016.
- INTERPACK, Processes and packaging Leading trade fair. 4-10th may, 2017. Düsseldorf, Germany.
- HISPACK 2018 (without confirmed dates), Barcelona, Spain.
- Project website: A public area to provide diffusion and dissemination the project goals will be kept during two years after project finish. This is public for viewing, and offers information on each of the partners involved, give information on events taking place and the public deliverables are available for download. In this way, project information can be available worldwide, and potential contacts with partners can be carried out.
- Project video will be available at project website, offering an illustrative presentation of research and development along the project, and the partners involved.

3. Use of the foreground

In principle, foreground will be managed accordingly with the provisions of the European Commission, and the access to the foreground created throughout the project lifetime will be ruled by the Consortium Agreement signed by the project partners. The main elements of the consortium agreement include the following:

- the internal organization of the consortium;
- the distribution of the Community financial contribution;
- additional rules on dissemination and use including intellectual property rights arrangements, as appropriate;
- settlement of internal disputes.

3.1. Exploitable foreground

3.1.1. General concepts

Where foreground is capable of industrial or commercial application (even if it requires further research and development, and/or private investment), it should be protected in an adequate and effective manner in conformity with the relevant legal provisions, having due regard to the legitimate interests of all participants, particularly the commercial interests of the other participants. Participants should, individually and preferably collectively, reflect on the best strategy to protect in view of the use of the foreground both in further research and in the development of commercial products, processes or services.

As a general rule, the foreground has been considered as a property of the Contractor generating it, and in this sense the originator is entitled to use and to license such right without any financial compensation to or the consent of the other Contributors.

In case of licensing to third parties, the Contributors shall be informed in advance and appropriate financial compensation shall be given to them. Starting from these basic rules, other particular situations could be summarized as following:

- If the features of a joint invention are such that it is not possible to separate them, the Contributors could agree that they may jointly apply to obtain and/or maintain the relevant rights and shall strive to set up amongst themselves appropriate agreements in order to do so;
- An originator of the foreground could decide not to seek protection of certain of its Foreground. In this case, another contractor interested in such protection might apply for, advising the other Contractors. In case several Contractors are interested in so, an agreement is necessary between them.

In other cases, it might prove advisable to keep the invention confidential and to postpone the filing of a patent (or other IPR) application (and consequently any dissemination), for instance, to allow further development of the invention while avoiding the negative consequences associated with premature filing (earlier priority and filing dates, early publication, possible rejection due to lack of support / industrial applicability, etc.).

The foreground will be exploited differently by each SME, with common approached present amongst them. The SME will analyze the targeted cost and pricing of the products on the different markets, with a deeper analysis on cost sensitive markets.

Where appropriate, the participants (or some of them) may consider specific strategies for managing and exploiting their foreground and intellectual property, for instance by setting up:

- one or more "patent pools" (groups of patents or other IPRs relating to a given technology) which could be freely used or cross-licensed among themselves and/or jointly licensed to third parties; or,
- a new legal entity which would own the intellectual property concerned and exploit it jointly, in order to manage it in a more flexible and effective way (subject to the granting of access rights and fulfilment of other commitments under the EC grant agreement); or
- clustering expertise to minimize knowledge management / technology transfer or product development costs.

Such strategies may also prove helpful in ensuring continuity after the end of the project. It is clear that they need to comply with competition law.

3.1.2. BIOACTIVELAYER.

The consortium had initial plans on how to exploit the results throughout the project. As the consortium does involve a full supply chain, each partner was supposed to have a portion of the obtained results, being able to apply the developed materials in the target application of this project, or wide its applicability to other fields, e.g. non-food packaging. The following results were identified within BIOACTIVELAYER project:

- Coated paper with improved moisture barrier
- Improved oxygen barrier layer with active compounds
- Composite with improved moisture barrier developed for the specific application
- Multilayer structure with improved oxygen and moisture barrier
- Final packaging solution

The BIOACTIVELAYER project will draw on pre-existing knowledge and know-how contributed by partners. In general, all the intellectual property rights and documentation related to the partners' pre-existing knowledge and know-how will remain the partner who owns them. The management of knowledge and intellectual property rights within BIOACTIVELAYER are governed by the Consortium Agreement (CA).

In order to manage IPR adequately, this CA defines the foreground material and background material, making a clear separation between results brought in by the consortium members and results generated within the project.

Partners who own patentable knowledge may (and are encouraged to) at their own expenses apply for patent or similar form of protection and shall supply details of such application to the other partners. To assure the protection of the knowledge generated, it is foreseen to patent some of the process or technical innovations, at least, in the countries where they will be developed. The partners will have a proactive policy in pursuing all possible patents and licensing opportunities arising from this project. The IPR arising from this project will be the property of the SMEs.

All patent applications relating to foreground filed shall be reported in the plan for the use and dissemination of foreground, including sufficient details/references. The RTD performers will not receive any IP rights. The research organizations will have their costs fully remunerated in exchange for their share of the IPR.

3.2. Description of exploitable foreground.

In this section the intellectual property developed within the scope of the project will be detailed, each topic is listed with a description of its sector and of the way it is intended to be exploited. A list of foreseen exploitable foreground described in the DoW can be found in Table 1.

Table 1. Description of exploitable foreground.

Result	Expected IPR protection	Timetable	Owners and other partners involved
Coated paper with improved moisture barrier	Patentable. Blending technology based on the use of biodegradable polymers will be considered as contributing to the IP and then kept as confidential know-how by the SMEs. Composition of the blends will be treated as confidential Scientific/Development Information	9	Hatzopoulos will own the knowledge developed for improved moisture barrier paper, which will be based on shellac/waxes blends, and hold property of developed paper.
Improved oxygen barrier layer	Patentable. Film processing and active compound technology will be considered as contributing to the IP	9	NTC will own the knowledge related to the composition of the composites and active packaging materials, and will be

with active compounds	and then kept as confidential know-how by the SMEs.		encouraged to patent the results from the project. SKYMARK will have a 15% reduction of market rates for 2 years post project plus a 7% during three more years.
Composite with improved moisture barrier developed for the specific application	Patentable. Blending technology based on the use of biodegradable polymers will be considered as contributing to the IP and then kept as confidential know-how by the SMEs. Composition of the blends will be treated as confidential Scientific/Development Information.	13	NTC will own the knowledge related to the composition of the composites and active packaging materials, and will be encouraged to patent the results from the project. SKYMARK will have a 15% reduction of market rates for 2 years post project plus a 7% during three more years.
Multilayer structure with improved oxygen and moisture barrier	Patentable. Final multilayer composition will be treated as confidential, based on previous results. Scientific/Development Information will be treated as confidential.	16	SKYMARK and Hatzopoulus will have divided property of the coated paper used for the package (60/40% respectively), and have a license for free for using blends produced. Hatzopoulos have a 15% reduction of market rates for 2 years post project plus 7% for a three years period for the films used in the structure.
Final packaging solution	Patentable. Pouch technology will be considered as contributing to the IP and then kept as confidential know-how by the SMEs. Pouch design will be considered to have design rights.	24	SKYMARK and Hatzopoulus will have divided property of the coated paper used for the package (60/40% respectively), and have a license for free for using blends produced. Hatzopoulos have a 15% reduction of market rates for 2 years post project plus 7% for a three years' period for the films used in the structure. Belourthe will receive preferential manufacturing rights for packing their products during until the 3rd year after the end of the project. Belourthe will have as well a 15% reduction of

			market rates for 2 years post project, and 7% for additional three years.

From all developments carried out in BIOACTIVELAYER Project two different results could be potentially patentable.

- RESULT 1: An oxygen scavenger derived from natural and biodegradable substances, to absorb oxygen from head space of packages containing dehydrated or dried food.
- RESULT 2: A biodegradable multilayer structure with improved oxygen and moisture barrier properties.

To analyse the patentability of the results of the BIOACTIVELAYER Project, information considered on the early stages of the project, such as the state of the art review and an additional search carried out on last months of the project done by ITENE was submitted to an external reviewer. It was decided to carry out official report of the most potential development to be patentable a patentability report in order to determine whether the two results developed in BIOACTIVELAYER Project are patentable. More specifically, the results were described as follows:

- RESULT 1: An oxygen scavenger consisting in a polyunsaturated fatty acid (PUFA), more specifically linoleic acid. It is included in a formulation of biodegradable polyurethane adhesive, and then it is applied in laminating process. The active system absorbs oxygen from head space of developed packaging at lab and pilot scale.
- RESULT 2: A biodegradable multilayer structure with improved oxygen and moisture barrier properties. The developed multilayer structure is formed by a paper, an active moisture barrier film of metallized regenerated cellulose (Naturflex NKME), a high oxygen barrier film and a sealing layer.

3.2.1. RESULT 1: *An oxygen scavenger derived from natural and biodegradable substances, to absorb oxygen from head space of packages containing dehydrated or dried food.*

Some patents have been identified describing different oxygen scavenger formulations for packaging applications, several of them specifically for dry foodstuff. Linoleic acid is also

described in many of patents, and the most critical issue is related to combinations of PUFAs and polyurethane adhesives.

To argue inventive step, it would be necessary to prove an unexpected effect resulting of the introduction of linoleic acid in polyurethane adhesive.

The most interesting patent are summarized in next table and briefly commented below:

1. ***Mitsubishi Gas Chemical (1990)***
2. ***Beckenhauer Thomas William (2013)***
3. ***Rameshchandra M. Gohil (2009)***
4. ***Holland Colours (2011)***
5. ***Valspar Sourcing (2010, 2012, 2013, 2014)***

Main patents related to Result 1 are the following three:

1. ***Mitsubishi Gas Chemical (1990)***

Oxygen absorbent, and more particularly an oxygen absorbent applicable to preservation of **dry foodstuffs and medical drugs** and to the rust prevention of metallic articles. The invention provides an oxygen absorbent comprising: **PUFA or a fatty oil containing a PUFA** + Transition metal + Basic substance

Preferable PUFAs are oleic, **linoleic** and linolenic acids. Use of transition metal as catalyst (Mn, Co, Fe, Ni, Zn). Basic substance reacts with PUFA to solidify it (application as powder).

4. ***Holland Colours (2011)***

Oxygen scavenging additive system for improving polyesters barrier properties in packaging for food and drink applications.

The additive system comprises: Oxidisable polymer + Transition metal catalyst + Fatty acid ester of trimethylolpropane.

5. ***Valspar Sourcing (2010, 2012, 2013, 2014)***

A composition that includes an oxygen-scavenging polymer and a catalyst. The oxygen-scavenging polymer includes:

Base polymer having a backbone + Unsaturated side chain attached to the backbone

PUFAs → **Linoleic acid**

Specific examples:

- **POLYOL + PUFA:** an adduct is formed and acts as an O_2 scavenger. Also it can reacts to a polyester (PET, PLA) and a new absorber compositions is generated.
- **POLYOL + PUFA:** an adduct is formed and it reacts to an **ISOCYANATE** that produces a **polyurethane with O_2 absorber properties**.
- **Polymer with reactive –NCO + PUFA:** a polymer (PU) with terminal PUFA is generated and it acts as an O_2 scavenger.

Different patents describing oxygen scavenger formulations for packaging applications have been found, several of them specifically for dry foodstuff. Linoleic acid is also described in many of patents, and the most critical issue is related to combinations of PUFAs and polyurethane adhesives.

Therefore, to argue inventive step, it would be necessary to prove an unexpected effect resulting of the introduction of linoleic acid in polyurethane adhesive.

Document number	Publication date	Priority date	Assignee	Title	Abstract	Invention
US4908151	13/03/1990	12/02/1988	MITSUBISHI GAS CHEMICAL CO., INC.	Oxygen absorbent	The present invention relates to an oxygen absorbent, and more particularly to an oxygen absorbent applicable to preservation of **dry foodstuffs and medical drugs** and to the rust prevention of metallic articles. Thus, the invention provides an oxygen absorbent comprising: (A1) an **unsaturated fatty acid** and/**or a fatty oil containing unsaturated fatty acid**, (B1) a transition metal and/or a transition metal compound, and (C1) a basic substance,and an oxygen absorbent comprising: (A2) one member or a mixture of two or more members selected from unsaturated fatty acid compounds including unsaturated fatty acids, esters of unsaturated fatty acid and metallic salts of unsaturated fatty acid, (B2) a basic substance, and (C2) an adsorbent.	PUFA or oil containing PUFAs + Transition Metal + Basic comp. Preferable PUFAs: Oleic, linoleic and linolenic Transition metal as catalyst: Mn, Co, Fe, Ni, Zn Basic compound reacts with unsaturated fatty acid to solidify it and then to improve handling. Application as powder or granulate (pouches) Dried food and medicines packaging applications
US20130236616	12/09/2013	17/11/2010	BECKENHAUER THOMAS WILLIAM (particular)	METHOD OF SCAVENGING OXYGEN AND ABSORBING OXYGEN	Methods of absorbing oxygen are disclosed with the use of compositions useful as oxygen absorbers. The compositions are generally salts of unsaturated fatty acids that have one or more carbon to carbon double and or triple bonds. The compositions may be prepared by **reacting an unsaturated fatty acid with a hydroxide resulting in a salt of the unsaturated fatty acid**. Water soluble compositions are dissolved in aqueous solutions for the purpose of absorbing oxygen from the aqueous solutions and or their containers. Water insoluble compositions are protected from moisture due to their water repellent character and this characteristic is used advantageously in order to absorb oxygen from containers that may contain moisture where it is desired that the compositions remain relatively unaffected by moisture, intact and remain where they are placed.	Reaction of linoleic acid with sodium or calcium hydroxide in aqueous solvent to produce corresponding linoleic acid salts which act as oxygen scavengers Possibility of dissolving in aqueous foods (milk, coffee, soups, ...) Some compositions are insoluble in water, they are then dissolved in apolar solvenes and act as water repellents
US20090028841	29/01/2009	25/07/2007	RAMESHCHANDRA M. GOHIL (particular)	OXYGEN SCAVENGING COMPOSITION, COATING COMPOSITION AND PACKAGE CONTAINING FREE FATTY ACID	An oxygen scavenging composition being an oxidizable ascorbic acid derivative, a multi-copper oxidase enzyme, and a **free fatty acid** wherein the enzyme is disposed upon the surface of the oxidizable ascorbic acid derivative, and wherein the free fatty acid is intermixed with the oxidizable ascorbic acid derivative. The invention extends to a coating composition thereof and a package or container containing the oxygen scavenging composition.	Ascorbic acid derivatives with an oxidase enzyme are used as oxygen absorbers. A PUFA is added (preferred oleic acid, corn oil is also tested) to enhance oxygen absorber capacity. Covalent bonds are not formed between ascorbic acid and PUFAs
EP2386598A1	16/11/2011	12/05/2010	HOLLAND COLOURS N.V.	Oxygen scavenging compositions	The invention is directed to an oxygen scavenging additive system for polymers, said additive system comprising an oxidisable polymer, a transition metal catalyst and a **fatty acid ester of trimethylolpropane**, wherein the **fatty acid is a C6 to C18** fatty acid having a linear or branched chain, to polyester compositions containing said additive and to containers, or preforms for containers, prepared from said polyester composition.	Application of additives to increase barrier properties of polyesters in food and drink containers It is used an oxidizable polymer (polybutadiene) + transition metal + trimethylolpropane ester of fatty acid (C16-C18)(Linoleic acid is not specifically mentioned)
WO/2011/142668A1	17/11/2011			OXYGEN SCAVENGING COMPOSITIONS		
US20100247821	30/09/2010	27/08/2007	VALSPAR SOURCING, INC.	Oxygen Scavenging Composition	An oxygen-scavenging composition is provided that includes an oxygen-scavenging polymer and a catalyst. The oxygen-scavenging polymer, which in preferred embodiments is suitable for use in packaging articles, includes a base polymer having a backbone, and an **unsaturated side chain** attached to the backbone. In one embodiment, the unsaturated side chain comprises includes at least one aliphatic carbon-carbon double bond or two or more carbon-carbon double bonds.	The composition of oxygen absorber is a polymer structure with a C=C chain engaged in it. PUFAs are specifically mentioned, and linoleic acid in particular. Specific examples: - POLYOL + PUFA: an adduct is formed and used as O2 scavenger, or it reacts with a polyester (PET, PLA) or with a diacid and then a new oxygen absorber composition is generated. - POLYOL + PUFA: the formed adduct reacts with an isocyanate and then the generated polyurethane has oxygen absorbing properties. - Polymer with -NCO reactive + PUFA: a polymer (polyurethane) with a terminal PUFA that acts as oxygen absorber is generated.
US20100237283	23/09/2010			Oxygen Scavenging Composition		
WO/2009/029611A1	05/03/2009			OXYGEN SCAVENGING COMPOSITION		
WO/2009/029615A1	05/03/2009			OXYGEN SCAVENGING COMPOSITION		
US8308976	13/11/2012	27/10/2011		Oxygen-scavenging materials and articles formed therefrom	An oxygen-scavenging composition is provided that includes an oxygen-scavenging component and a catalyst. The oxygen-scavenging component, which in preferred embodiments is suitable for use in packaging articles, includes two or more oxygen-scavenging groups having different scavenging properties. In one embodiment, one of the **oxygen-scavenging groups is an unsaturated bicyclic group**.	The oxygen absorber contains an unsaturated bicyclic compound + catalyst Application in compositions with MXD6, also in cases of backbone polymer with PUFA PUFA composition + conjugated diene (containing bicyclo)
US8562861	22/10/2013	19/01/2012		Oxygen scavenging composition and article formed therefrom	The present invention provides an oxygen-scavenging composition and articles formed therefrom. The oxygen-scavenging composition preferably includes an **oxygen-scavenging polymer having an unsaturated bicyclic group**, a based polymer, and an optional oxidation catalyst. The base polymer preferably includes a substituted or unsubstituted addition backbone, which may include heteratoms.	
US8758644	24/06/2014	04/03/2010		Oxygen-scavenging materials and articles formed therefrom	An oxygen-scavenging component and methods for producing the oxygen-scavenging component are provided. The oxygen-scavenging component, which in preferred embodiments is suitable for use in packaging articles, includes an **oxygen-scavenging group preferably having at least one double bond**. The oxygen-scavenging component may be combined with a polymer and/or an oxidation catalyst to form an oxygen-scavenging composition.	
US8871352	28/10/2014	10/10/2013		Dendritic oxygen scavenging polymer	An oxygen-scavenging composition is provided that includes an oxygen-scavenging polymer and a catalyst. The oxygen-scavenging polymer, which in preferred embodiments is suitable for use in packaging articles, is a **dendritic polymer having one or more oxygen-scavenging groups**.	Introduction of oxygen scavengers previously developed in dendritic structures. PUFAs are used again due to low cost and easy availability

3.2.2. RESULT 2: *A biodegradable multilayer structure with improved oxygen and moisture barrier properties.*

A preliminary search based on biobased or biodegradable multilayer structures with high barrier properties was carried out, and main patents related with this field were identified. As main competitors related to Bioactivelayer, the most important patents are summarized in next table and four of them were considered as the most similar to BIOACTIVELAYER development:

1. ***SKC Co. (2012)***
2. ***The Procter & Gamble Company (2014)***
3. ***NewPage Wisconsin System (2014)***
4. ***Ishida Co. (2010)***
5. ***Honeywell International (2013)***

1. ***SKC Co. (2012)***

The document D1 relates to an environmentally friendly multilayer film with improved gas-barrier property which is useful for wrapping material, and a preparation method thereof.

A **multilayer barrier film** comprising at least one first resin layer and at least two second resin layer, both outermost layers being the second resin layers.

- The first resin layer comprising **PVOH** (Tm= 170~220ºC)
- The second resin layer comprising **PLA** or PET (Tm= 205ºC or less)

Multilayer structure can enhance gas-barrier property by adjusting a thickness of the PVOH layer and exhibits **good biodegradability** since it employs environmentally friendly resins.

Structure examples: PLA/PVOH/PLA or **PLA/Adhesive/PVOH/Adhesive/PLA**

The difference between examples shown in this patent and 5 co-extruded layers including in the structure defined in Bioactivelayer proyect is the use of the HAVO polymer instead of PVOH.

2. ***The Procter & Gamble Company (2014)***

Flexible barrier packages composed of materials that are substantially free of virgin, petroleum-based compounds. Different structures are explained:

- Sealant layer - 100% biobased (ex. Ecoflex)
- Tie layer - 99% biobased (ex. PU adhesive)
- Co-extruded substrate - 85% biobased

- Laminated outer substrate - 99% biobased (PLA or cellulose from Innovia)

3. NewPage Wisconsin System (2014)

Bio-degradable, high-barrier packaging materials and methods for production are provided. The present high-barrier packaging materials include a substrate having a print side and a back side. Preferably, at least one of the **metalized film** and the binding layer includes **polylactic acid**. Moreover, the back side preferably **also includes a polylactic acid heat seal layer.** Some structures are explained:

- **Paper** or cardboard (coated or not)
- Tie layer (ex. **PU adhesive**)
- Metallized cellophane (**NKME** from Innovia) or metallized PLA
- **PLA** as sealant layer

4. Ishida Co. (2010)

Biodegradable bag for packing **dried food** with oxygen and water vapor **barrier properties**. The bag comprises a laminated film with this structure:

- Biodegradable substrate (**PLA**) usually combined with **paper**
- **Oxygen and water vapor barrier layer** (ceramic deposition or metallized)
- Biodegradable adhesive
- Biodegradable sealant layer: **polyvinyl alcohol**

Document number	Publication date	Priority date	Asignee	Title	Abstract	Invention
WO/2012/023779A2	23/02/2012	16/08/2010	SKC CO., LTD.	ENVIRONMENTALLY FRIENDLY MULTILAYER BARRIER FILM AND PREPARATION METHOD THEREOF	A multilayer barrier film comprising at least one first resin layer and at least two second resin layer, both outermost layers being the second resin layers, wherein the **first resin layer comprising PVOH** having Tm 170~220 degrees Celsius and the **second resin layer comprising PLA or PET** having Tm 205 degrees Celsius or less, can enhance gas-barrier property by adjusting a thickness of the PVOH layer and exhibits good biodegradability since it employs environmentally friendly resins.	Refers to 5 layers structure: A/B/C/B/A (where A: PLA + paraloids, B: Adhesive from Nippon, C: HAVOH) Multilayer barrier constisting on a polyvinyl alcohol layer (PVOH) and a second layer of PLA or PET. The structure has at least 3 layers, where 2 PLA layers protect the inner PVOH layer. Layers are generated by extrusion processing, and can be combined by lamination or co-extrusion process. Several co-extruded structures: a) PLA/PVOH/PLA, b) PLA/Adh/PVOH/Adh/PLA
US8871319	28/10/2014	10/04/2014	The Procter & Gamble Company	Flexible barrier packaging derived from renewable resources	Disclosed herein are **flexible barrier packages** composed of materials that are substantially **free of virgin**, petroleum-based compounds. The flexible barrier packages contain a **sealant** that has a **biobased** content of at least about 85%. The sealant is laminated to an **outer substrate** that has a **biobased** content of at least about 95% via a **tie layer** that can further include an extruded substrate. The **extruded substrate** has a **biobased** content of at least about 85%. Ink optionally can be deposited on either side of the outer substrate, and the exterior surface of the outer substrate can further include a lacquer. A **barrier material layer** can be deposited or laminated between the first tie layer and the outer substrate. The flexible barrier packages of the invention are useful for enclosing a consumer product, for example, **food,** drink, wipes, shampoo, conditioner, skin lotion, shave lotion, liquid soap, bar soap, toothpaste, and detergent.	Multilayer flexible packaging derived from renewable sources. Metallic cellulose from Innovia and PLA are considered in this patent. Also it is mentioned co-extruded paper with starch based temoplastics. Different structures are arisen, are summarized below: - Sealant layer: 100% biobased, starch-based films or Ecoflex (PLA does not specifically mentioned) - Tie layer = 99% biobased, several examples, including PU adhesives - Coextruded substrate: 85% biobased - Outer laminate substrate: 99% biobased, can be PLA or cellulose from Innovia - Optional: Inks / coatings Flexible container may include a barrier material (settle or laminated between outer and tie layer)
US8771835	08/07/2014	15/07/2010	NewPage Wisconsin System, Inc.	Substantially biodegradable and compostable high-barrier packaging material and methods for production	**Bio-degradable, high-barrier packaging** materials and methods for production are provided. The present high-barrier packaging materials include a substrate having a print side and a back side, a coating having nano pigments on the print side and a metalized film applied to the back side with a binding layer. Preferably, **at least one of the metalized film** and the binding layer includes **polylactic acid**. Moreover, the back side preferably also includes a polylactic acid heat seal layer.	High barrier biodegradable packaging. Several structures are arisen and summarized below: - Paper or cardboard (may be coated with nanopigments or PET emulsions) - Tie layer - Metallic cellophane (NKME from Innovia) or metallized PLA - PLA as sealant layer
US7707803	04/05/2010	04/06/2009	Ishida Co., Ltd.	Biodegradable bags for packing foods available in high speed production	A method for producing a **biodegradable bag and for packing a food**, such as a **snack food**, which is required to have an **oxygen barrier property and a water vapor barrier property**. The biodegradable bag can be produced at a high speed by a bag making and packaging machine, which can be degraded by naturally occurring microorganisms in soil or water finally to a non-hazardous degradation product, which can be biorecycled, and which is not accumulated in nature. The biodegradable bag for packing a food comprises a **laminated film** obtainable by laminating in the following order: a **sealant layer** comprising a **biodegradable polymer**; a **barrier layer** having an oxygen barrier property and a water vapor barrier property; and a **barrier layer-supporting substrate layer** comprising a **biodegradable polymer**, the laminated film being heat-sealed in order for the sealant layer to be inside.	Biodegradable pouche for dried food, with oxygen and water vapor barrier properties. The structure is summarized as follows: - Biodegradable substrate (PLA), usually it has a paper layer to retain water - Oxygen and water vapor barrier layer (ceramic or metal deposition) - Biodegradable adhesive for laminating - Sealant layer: biodegradable polymer (polyvinyl alcohol)
US8513144	20/08/2013	18/12/2008	Honeywell International Inc	Property films from renewable polymers	**High barrier multilayer films** incorporating a **biodegradable polymer layer**. More particularly, biodegradable insulation facing materials and insulation articles incorporating a biodegradable polymer layer. The structures have excellent barrier properties and superior mechanical strength.	It is presented next high barrier multilayer structure containing biodegradable polymers: - Biodegradable polymer layer - Adhesive - Moisture barrier layer (thermoplastic + nanoclay) - Adhesive - Tissue (fibrous substrate) - Insulating material (fiberglass or mineral fibers)
US7854994	21/12/2010	30/04/2009	Plantic Technologies Ltd.	Barrier film	A barrier composition which is injection mouldable and able to be made into a **transparent film or incorporated** (by **co-extrusion and/or lamination**) into **multi-layer film** products, the composition on dry basis: a) from 45 to 90% by weight of a **starch and/or a modified starch** selected from starches modified by reaction with a hydroxyl alkyl group, an acetate or a dicarboxylic acid anhydride or a grafting polymer; b) from 4 to 12% by weight of a water soluble polymer selected from **polyvinyl alcohol**, polyvinylacetate, and **copolymers of ethylene and vinylalcohol** which have a melting point compatible with the molten state of the starch components c) from 5 to 45% by weight of a **non-crystallising mixture** of sorbitol and at least one other **plasticizer** selected from glycerol, maltitol, xylitol, mannitol, glycerol trioleate, epoxidised linseed or soybean oil, tributyl citrate, acetyl tri-ethyl citrate, glyceryl triacetate, 2,2,4-trimethyl-1,3-pentanediol diisobutyrate; polyethylene oxide or polyethylene glycol; d) from 0.3 to 2.5% by weight of a C12-22 fatty acid or salt; e) from 0.25% to 3% of an emulsifier system having a hydrophilic lipophilic balance value between 2 and 10. The **barrier film may be co-injection moulded** with polyethylene terephthalate (PET) or **polylactic acid (PLA) for blow moulding** into beverage bottles, with polyethylene (PE) or polypropylene (PP) or biodegradable polymers for high gas-barrier containers or closures, or may be co-extruded with polyethylene, polypropylene or polylactic acid for thin film packaging applications or for blow-moulded containers.	Barrier film composition (by co-extrusion and/or laminating): - Starch or derivative - PVOH / EVOH - Mixtures of non-crystalline plasticizers - C12-C22 fatty acid (stearic acid) This barrier composition is co-extruded or co-injected with PLA

According to the study of retrieved documents, preliminary evaluation did not find any divulgation describing an identical multilayer structure. However, we have found several documents describing different multilayer structures with improved barrier properties that could affect the inventive step.

Some of the patents include biobased materials, but many other documents explain biodegradable multilayers containing materials such as PLA, NKME from Innovia or others that have been used in BIOACTIVELAYER project.

To argue inventive step, it would be necessary to include an oxygen scavenger formulation in one of the tie layer contained in the developed BIOACTIVELAYER multilayer structure.

As conclusion and next steps, based on project results and identified patents and information, a patentability report has been requested to a patent attorney (based on our previous patentability report). Once obtained, exploitation and protection strategy will be defined by partners, and if considered, will proceed with a patent application.