PROJECT FINAL REPORT

Grant Agreement number: 605658

Project acronym: NATURTRUCK

Project title: DEVELOPMENT OF A NEW BIO-COMPOSITE FROM RENEWABLE RESOURCES WITH IMPROVED THERMAL AND FIRE RESISTANCE FOR MANUFACTURING A TRUCK INTERNAL PART WITH HIGH QUALITY SURFACE FINISHING

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[1] The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

Table of contents

Executive summary

The main objective of NATURTRUCK was to develop **injected plastic parts for the commercial vehicles industry (mainly cabin truck parts)** made with thermoplastic **composite materials** from renewable resources (**at least 80% w/w**), namely physically modified polylactic acid (PLA) grades and natural fibres, with improved thermal and flame retardancy properties and high quality surface finishing to be used in **truck internal parts** as a real alternative to low-gloss standard ABS grades[2] at a competitive cost. The availability of PLA with improved properties and optimised production process allowed to fabricate **new thermoplastic biocomposite products suitable to satisfy the commercial vehicles manufacture sector stringent mechanical, thermal, fire resistance and eco-friendliness requirements, at a cost comparable to current ABS price**, increasing their **differentiation from competitors** and creating significant **market opportunities**.

The main innovation of NATURTRUCK in comparison with previous projects is the possibility t**o tailor the properties of commercial PLA grades by a synergic combination of different types of additives and reinforcements** (radiation susceptors, chain extenders, flame retardants and natural fibres) and **post-annealing techniques based on non-conventional high frequency energy sources**[3]**.** This **challenge** makes NATURTRUCK a real "**beyond of the estate of art**" project, due to the **smart combination of technologies and materials** employed, which will permit for instance to increase the rate and percentage of the crystalline phase in the PLA biocomposite and in consequence to increase its thermal resistance and mechanical properties.

[2] Styrene-acrylonitrile block copolymer with a butadiene-rubber

[3] MW micro-wave and IR Short wave infra-red. This technology already demonstrated for thermoset resing curingin a previous project CODE: Curing Polyester Resins on Demand FP6EC STREP priority 3 STRP 516957.

Summary description of project context and objectives

FP7 NATURTRUCK project that deals with renewable materials in the Truck Sector is undoubtedly increasing reflecting a real need, so it is indispensable the adaptation of the truck suppliers to this new situation, in order to be able to offer products according to the customer's philosophy, mainly based on thermoplastic biocomposites. Therefore, manufacturers of plastic components, mainly SMEs, face a technically complex challenge.

Following this approach, NATURTRUCK will solve the current technical limitations of thermoplastic biocomposites related to highly restrictive regulations and stringent specifications imposed by the truck industry, while maintaining a competitive cost in comparison with petrochemical based polymers used nowadays. The achievement of NATURTRUCK objectives will demonstrate the possibilities of polymer thermoplastic composites from renewable resources to be used in applications demanding high technical requirements at a competitive cost.

Therefore, the main objective of NATURTRUCK is to develop injected plastic parts for the commercial vehicles industry (cabin truck parts) made with polylactic acid (PLA) composite materials from renewable resources (at least 80wt%) and natural fibres, with improved thermal and flame retardancy properties and high quality surface finishing to be used in truck internal parts as a real alternative to low-gloss standard ABS grades at a competitive cost.

The main innovation of NATURTRUCK in comparison with previous projects is the possibility to tailor the properties of commercial PLA grades by a synergic combination of different types of additives and reinforcements (radiation susceptors, chain extenders, flame retardants and natural fibres) and post-annealing techniques based on non-conventional high frequency energy sources. This challenge makes NATURTRUCK a real "beyond of the estate of art" project, due to the smart combination of technologies and materials employed, which will permit for instance to increase the rate and percentage of the crystalline phase in the PLA biocomposite and in consequence to increase its thermal resistance and mechanical properties.

In the following table there are collected the expected objectives achieved along the project implementation.

Objectives of the project	*Related to WPs*	*Completion: Degree for the project (%)*
Development of complete thermoplastic biocomposite formulation based on at least 80% of renewable sources raw materials capable of meeting the exigencies of standard requirements of the heavy truck industry.	WP6	85[4]
increase the **PLA glass-transition temperature** at least 40ºC (i.e. HDT > 90ºC) and **Dimensional Stability after climatic cycle** (from current 4% until 0.5%).	WP3, WP5	100
The objective is to reduce the current time required for crystallization of PLA composites from 15 minutes to less than 8 minutes	WP5, WP6	100
Improvement of the **PLA long-term temperature, UV resistance and process stability** by using new sources of natural antioxidants	WP3	100[5]
Tailor made **mechanical properties using two types of European grown natural fibres**	WP3, WP6	100
The fibres will be modified to **increase thermal behaviour and to reduce the VOC (smell and fogging) emissions** using physical fibre treatments	WP2	100
To ensure technical feasibility of the processing using standard injection moulding process	WP4,WP6	100
high compatible and low viscosity polymeric plasticizers will be used to reach at least a **MFI of 15 g/10 min**	WP3	100
Fulfil the **burning requirements** (**ISO 3795:1989 and RENAULT standards**) for truck internal parts using halogen-free flame retardant and /or fireproof natural fibres.	WP3,WP6	100
Be **completely biodegradable after its use life** according to the UNE-EN 13432 standards and be **harmless after biodegradation**,	WP7	100
Life cycle analysis show, that bioplastics enable a CO_2 saving of 30 to 80% compared to conventional plastics.	WP7	100[6]
Competitive cost compared to current Flame retardancy **ABS grades** (3-4 €/kg).	WP7	100[7]
Fully recyclable part, up to a 30% of recycled materials will be added to the virgin material without significant loss of mechanical properties (less than 5% reduction).	WP7	100[8]

4 All mechanical and thermar requirements of truck part were fullfilled with the exception of the impact strenth at room temperatura for the footrest part. Additional optimization of the biocomposite formulation would be necessary to achieve this requirement and to improve ageing performance of the final parts.

5 Natural antioxidants improve the termal stability during process and improved drastically the performance of injected part after cyclic climate ageing.

6 for scenarios 3 and 4 (see D7.1)

7 The final NATURTRUCK compound price would be 4,54€/Kg. If we consider a non-treated fibre hemp, the price of NATURTRUCK compound will be 3.95€/Kg.

8 The recyclability study was carried out using up to 10%wt of recycled parts as it is the typical máximum reycled content accepted in automotive industry. This was corroborated by RENAULT and SME partners. See D7.2.

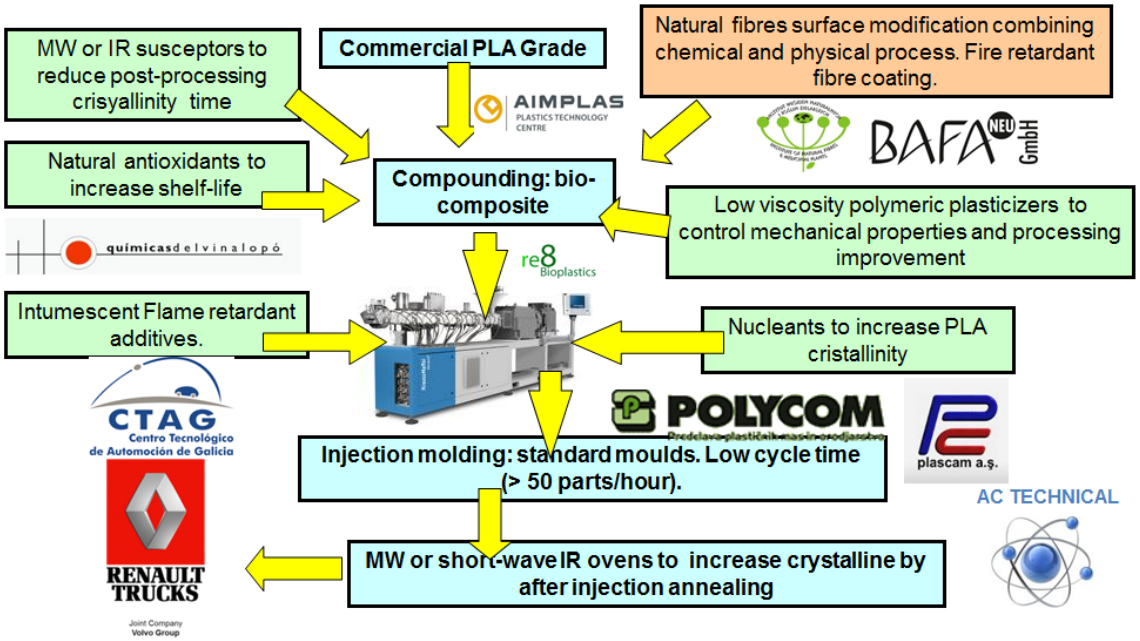


Figure 0. NATURTRUCK process and partners involvement.

Description of the main S&T results/foregrounds

This information is presented below more detail and on a WP basis:

<table>
<tr><th colspan="3">WP1: Definition of truck part requirements, selection of materials and additives and Risk management</th></tr>
<tr><td colspan="3"></td></tr>
<tr><th>OBJECTIVES</th><th>WORK DONE</th><th>FINAL RESULTS</th></tr>
<tr><td>To define the detailed requirements for the final applications foreseen of the two internal truck parts, currently manufacture from flame retardant ABS or filled polypropylene. Risk management</td><td rowspan="3">A study of the inner heavy truck injection moulding piece to determine the requirements derived from its manufacturing and use was carried out.
The parts to be use as case studies were identified. As well as the materials and additives to be tested.

The Risk indicators were defined for each WP taking into account the overall project progress, identifying the risks and potential impacts in the workflow.</td><td rowspan="3">A draft list of the parts was selected and the requirements established. The selected part were placed in different locations of the truck in order to cover different requirements. Finally, Bracket and footrest were selected and the requirements in terms of thermal, mechanical and chemical properties were defined. Bracket is a no visible part without sun exposure and with low mechanical requirements. Footrest is a visible part with sun exposure (not directly) and higher mechanical requirements.

In parallel, it was also prepared a list of raw materials and additives to be used in NATURTRUCK project to develop a fire resistant natural fibre composite based on PLA with high temperature resistance for applications in the interior cabin of trucks. Specific risks have been identified, compiled and assessed and the agreed contingency plans have been proposed.</td></tr>
<tr><th>PARTNERS INVOLVED</th></tr>
<tr><td>All</td></tr>
</table>

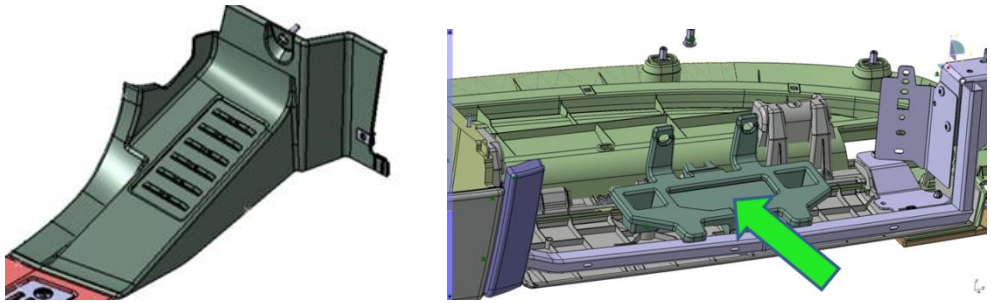


Figure 1. NATURTRUCK case studies. Left: footrest. Right: bracket.

<table>
<tr><th colspan="3">WP2: Natural fibre selection, treatment and functionalization</th></tr>
<tr><th>OBJECTIVES</th><th>WORK DONE</th><th>FINAL RESULTS</th></tr>
<tr>
<td>Development of chemical and physical treatments to produce natural fibres, with specific requirements and suitable for PLA biocomposites formulations for injected truck part applications.

PARTNERS INVOLVED

AIMPLAS, BAFA and IWNIRZ</td>
<td>Different fibres were tested as natural reinforcement for PLA composites (Kenaf, flax, and hemp). Hemp fibres were finally selected due to their better balance of properties, low cost and availability within Europe.

Hemp fibres used as natural reinforcement for the PLA composites were modified to increase thermal behaviour and to reduce the VOC emissions using the combination of chemical and physical treatments. The aim of the fibre modification was to improve the compatibility with the PLA polymer matrix and to reduce the flammability of the fibres.

The fibre modification consisted in the osmotic degumming of hemp stemp to extract the bast fibres from hemp. The osmotic degumming method is based on natural physical laws: water diffusion, osmosis and osmotic pressure and it is used to obtain higher quality of fibre in comparison to traditional methods like dew retting.

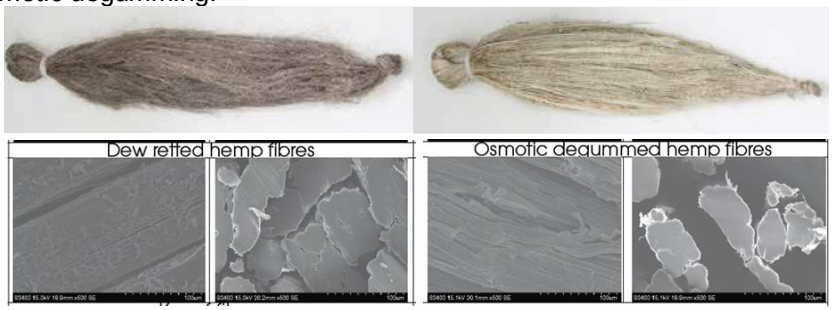
Then the osmotic degummed hemp fibres were surface treated in two steps; silanization, and plasma.</td>
<td>The osmotic degumming of hemp fibres improved the fibre quality, colour, and aspect ratio (lower diameter, fibre bundles were better divided into elementary fibres, light colour, higher aspect ratio, absence of smell). See in Figure 4 the differences between conventional dew retting treatment and osmotic degumming.
 

Figure 2. Left: dew retted hemp fibres. Right: Osmotic degummed hemp fibres.

The surface treatment after osmotic degumming was carried out in two steps;
• Silanization to improve compatibility with the polymer matrix. During this treatment flame retardant additives were also incorporated.
• Plasma: to enhanced the silanization results and compatibility with the polymer.
The result was a successful reduction of natural fibres flammability. A reduction over 50% in the HRRmax was determined in combustion calorimetry tests in comparison with degummed hemp. See figure 3.</td>
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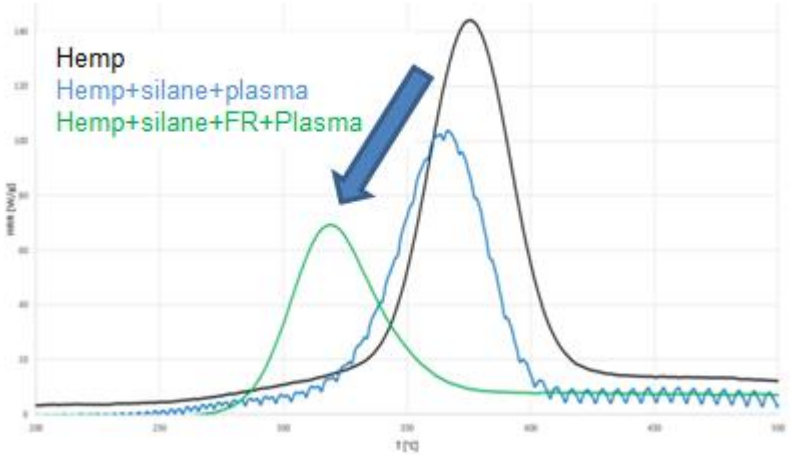

Figure 2. Evolution of Heat Release Rate HRR with hemp fibre treatment.

Figure 3. Left: Reference untreated hemp. Right: NATURTRUCK treated hemp fibre.

<table>
<tr><th colspan="3">WP3: PLA blend compounding and material characterization</th></tr>
<tr><th>OBJECTIVES</th><th>WORK DONE</th><th>FINAL RESULTS</th></tr>
<tr><td>Development of the PLA formulations suitable for the defined case studies. Obtain a suitable compatibilization of the additives and reinforcements in a traditional compounding equipment with the current commercial PLA grades.</td><td rowspan="3">Development of PLA/natural fibre biocomposites with improved thermal and fireproof properties by using commercial additives and PLA by means of the compounding process in a co-rotating twin screw extruder.

Different fibres and natural antioxidants were also tested in a Brabender mixer.

The point for the fibre addition and the format of fibres (loose fibres or pelletized pellets) were studied.

Natural antioxidants were obtained with an extraction and purification processes antioxidants from the Cistaceae plant family.

A commercial halogen free flame retardant was used to reduce the flammability of PLA/natural fibre biocomposites.

The use of susceptors of microwaves (MW) or Infra Red (IR) radiation was originally planned, however due to the polar nature of raw materials and natural fibres it was not necessary.</td><td rowspan="3">AIMPLAS and RE8 carried out the compounding process and CTAG and PLASCAM validated the injection moulding process and characterize the obtained samples.

QUÍMICAS DEL VINALOPÓ developed natural antioxidants from the Cistaceae plant family that were evaluated as natural antioxidants in PLA and PLA biocomposites. The extracts rich in polyphenols improved drastically the thermal stability of non-plasticized PLA/natural fibre composites (the onset of degradation temperature was improved by 45ºC). In PLA treated hemp biocomposites the results showed a slightly better mechanical and heat deflection temperature (HDT) performance of the biocomposites with natural antioxidants compared with synthetic antioxidants.

PLA was formulated with 15wt% of hemp fibres, and different additives, including flame retardants, impact modifiers, nucleant agents and plasticizer. The PLA/natural fibre biocomposites was carried out in two pilot plant scale co-rotating twin screw extruders (TSE). See figures 10 and 11. Biocomposites with high heat resistance HDT(B)>100ºC and burning fastness <80mm/min were obtained. Final formulations used almost 80% of renevable raw materials.

Developed NATUTRUCK formulations fulfilled the mechanical, fire and thermal resistance requirements of the “bracket” part. However, the impact strength at room temperature required for the “footrest” application was no achieved. Additional effort must be made in this area.</td></tr>
<tr><th>PARTNERS INVOLVED</th></tr>
<tr><td>AIMPLAS, QdV, RE8, PLASCAM and CTAG</td></tr>
</table>

Figure4. LEISTRITZ ZSE 27 MAXX twin screw extruder.

Figure 4. Left: COPERION ZSK25 TSE during the scale-up of NATURTRUCK compound. Center: NATRUCTRUCK compounds with reference and treated hemp fibres. Right: injected tensile and UL94 test specimens obtained from NATURTRUCK biocomposites.

<table>
<tr><th colspan="3">WP4: Prototype case studies design and injection moulding processing optimization</th></tr>
<tr><th>OBJECTIVES</th><th>WORK DONE</th><th>FINAL RESULTS</th></tr>
<tr><td>Prototype component design
CAE studies (process simulation)
Tools manufactuing
Component manufacturing by injection moulding
Preliminary laboratory test characterization</td><td rowspan="3">The selected case studies (footrest and bracket) were re-designed in order to simplify the current part geometry and to adapt it to the biopolymers requirements.

Then, both case studies were calculated by Moldflow software, in order to simulate the injection moulding process and detect possible problems (sink marks, deformations, etc.). This analysis was also used to determine the best gate location and geometry.

The prototype moulds were manufactured according to this analysis and some minor modifications were carried out after the first injection moulding trials.

Once the final moulds were ready, the injection parameters were optimised using the Scientific Moulding Methodology, in order to obtain good-quality parts.

Once the material was tested in CTAG facilities, POLYCOM and PLASCAM tested the compound in an existing tool in their facilities, in order to compile more information about the Naturtruck compound processability.

Finally, the prototypes were tested according to RENAULT requirements .</td><td rowspan="3">According to the injection moulding tests, NATURTRUCK compound is easy to process, following certain process rules, common among biocomposites.

Almost all the recorded defects are avoidable changing the parameters, and other problems, like the sink marks in the bracket, are inherent to the geometry of the part.

In the bracket and the footrest parts, the mould temperature was the key factor.

The production cadence exceeded the goal of 50 parts/hour for the bracket, and it is slightly lower for the footrest; in any case, the cycle time was reduced during the WP6. “scale-up”, reaching high productivity levels that surpassed the expectation.

Regarding the validation of the parts, all of them met the requirements, except the fogging test. The compound was reformulated for the scale-up (WP6) taking into account these results, and those compounds with reference fibres passed the fogging test.</td></tr>
<tr><th>PARTNERS INVOLVED</th></tr>
<tr><td>POLYCOM, PLASCAM, RENAULT, CTAG</td></tr>
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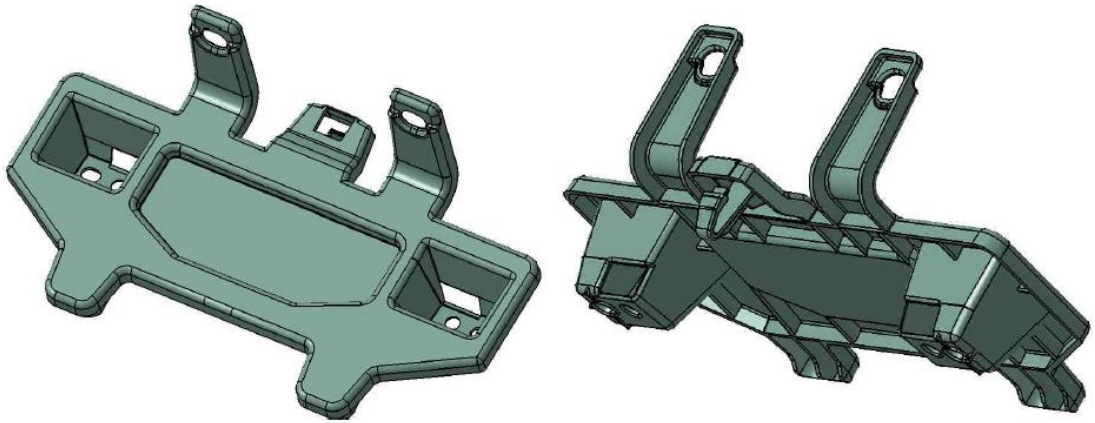


Figure 6. Final design of NATURTRUCK Bracket part

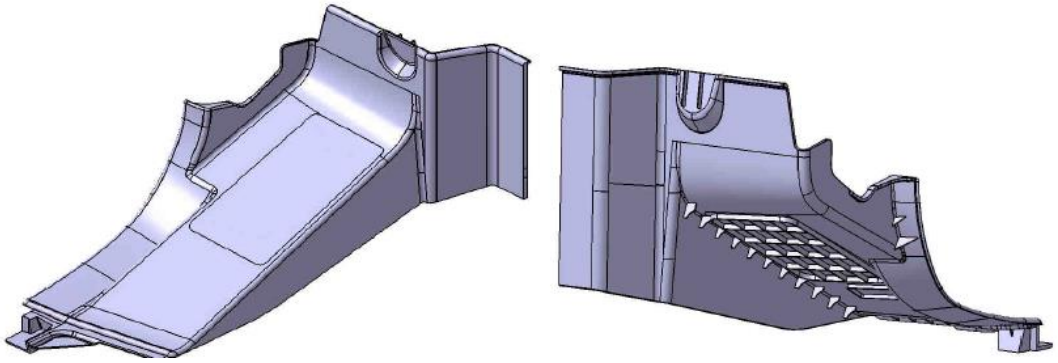


Figure 7. Final design of NATURTRUCK Footrest part

WP5: In-line annealing process and final part characterization		
OBJECTIVES	**WORK DONE**	**FINAL RESULTS**
Develop and optimize annealing system based on MW or IR as heating energy to increase the crystallinity of biocomposites by >20% and HDT >100ºC **PARTNERS INVOLVED** AIMPLAS, POLYCOM, PROAC, RENAULT, CTAG	First BULMA and later PROAC in collaboration with AIMPLAS, studied the effect on MW and IR as source of energy to heat the biocomposites in the annealing step. The annealing step consisted in first heating the biocomposites / parts and then let them to crystallize at room temperature to increase the crystallinity. As the crystallinity increases the heat deflection temperature (HDT) increases to levels useful for trucks / automotive applications. Both microwaves (MW) and Infra-Red (IR) technologies were studied at laboratory scale. Finally, IR technology was used in pilot plant scale to study the annealing of NATURTRUCK parts. The continuous annealing process with IR was optimized for Bracket part. Additional experiments for the crystallization of NATURTRUCK biocomposites in hot mould (100ºC) were carried out and compared with the annealing process after injection moulding in cold mould (20-30ºC) plus annealing with IR.	The annealing process was successfully carried out using MW as heating source. One magnetron (open antenna) guided by a robot in a faraday cage was used in the tests. Results showed that residence time of the heating step for annealing using MW was < 3.5 min. In contrast, annealing in conventional oven took more than 1h. Raw materials are susceptible to MW and IR due to their polar nature, PLA, plastizicers and natural fibres, therefore there was no need of using additional MW or IR susceptors. The crystallinity of PLA was enhanced from <30% of non-annealed samples to >55% after annealing. The HDT(B) was increased from 40- 57ºC to >100ºC after annealing and up to 150ºC for non-plasticized formulations. After annealing the biocomposites are stiffer but more brittle, additional effort was focused on impact modification of the biocomposites. The main drawback is to control the dimensional stability of the parts after annealing. The warpage must be controlled, the use of masters is recommended to avoid part deformation (shrinkage / warpage) during the annealing is required. A silicon master with the negative shape of the part was tested successfully. The annealing of Bracket part was studied at pilot plant scale, resulting in a residence time of 4.5min for heating the part from room temperature to > 80ºC and below 120ºC, and a cooling step of 6-7min to cool down the part to 40ºC. The injection moulding plus annealing resulted in similar crystallinity and HDT levels. Moreover, parts injected in hot mould showed higher dimensional stability and better aesthetics.

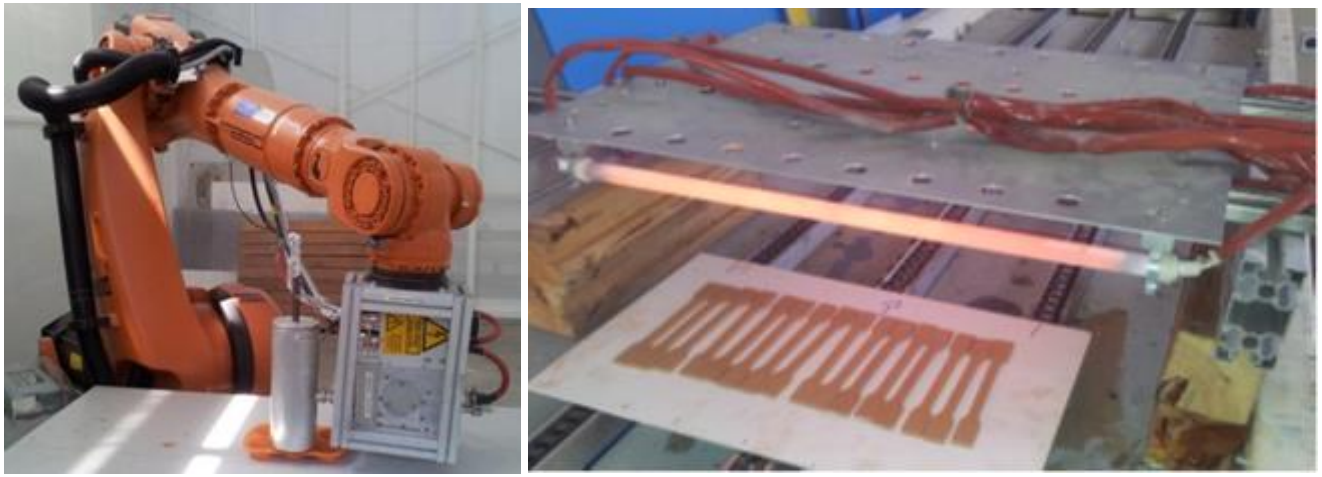


Figure 8. Left: Microvawe magnetron guided by a Robot for annealing process with MW. Right: Continuous annealing of NATURTRUCK biocomposite test specimens with threated hemp fibres using IR technology.

WP6: Industrial scale-up and heavy truck part validation		
OBJECTIVES	**WORK DONE**	**FINAL RESULTS**
Scale up of NATURTRUCK processes from laboratory / pilot plant to industrial process to obtain parts that fits the requirements of trucks. Optimization of the production of truck parts using developed PLA biocomposites and final characterization. **PARTNERS INVOLVED** AIMPLAS, QdV, BAFA, RE8, POLYCOM, PLASCAM, PROAC, RENAULT, IWRINZ, CTAG	Scale-up of natural fibre modification and pelletization of the treated fibres. Optimization of the production of natural antioxidants and description of the potential process for industrial scale production. Scaling-up of the biocomposites production (>300kg) for characterization and injection molding of the final parts. The injection moulding of the case study parts "bracket" and "footrest" was optimized and carried out. The annealing of “bracket” parts obtained from biocomposites using reference and treated hemp was carried in a pilot plant (continuous process). The obtained parts after annealing were assessed against the requirements for the truck industry. Finally, a last set of experiments was carried out with the objective of improving the impact strength of developed biocomposites.	High quality hemp fibres with improved flame resistance developed in WP3 were scaled-up from the laboratory scale to 20kg with success. The fibres were pelletized for better handling and dosing to the extruder. Fibre pelletization was revealed as the best way to manage and feed natural fibres into the compounding process Cistus extracts rich in polyphenols are suitable to be used as natural antioxidants in PLA / natural fibre biocomposites. They can be used as thermal stabilizers and showed drastic improvement in impact properties after cyclic ageing. The compounding process was scaled to >300kg for the production of injected truck parts. The biocomposites showed good flowability for the injection moulding process, despite their narrow processing window. Concerning the mechanical properties, the biocompounds obtained using reference hemp fibres showed the best mechanical properties in general but, the biocomposites with treated hemp fibres showed the lowest flammability. The tensile and flexural modulus of the injected biocomposites at both temperatures, at room temperature (not crystallized) and at 100ºC (crystallized) were above the requirements. However, the impact strength at room temperature for the “footrest” part (35kJ/m^2) was not achieved. The injection moulding scale-up of footrest and bracket part was successfully made. From the technological point of view, it can be concluded that NATURTRUCK biocomposite is an easy moulding material, even though that a production window in serial production will be rather narrow, especially the melt temperature. The processability is better when the part is moulded in hot mould condition and the warpage is avoided due to the homogenous crystallisation in-mould. However, the cycle time increases slightly. The thermal resistance HDT (B) of crystallized biocomposites (injected at 100ºC of mould temperature) was well above the requirements (up to 140ºC). This result allows the use of PLA biocomposites in applications of high temperature of use such as in the interior of cabin trucks and other vehicles in general. All biocompounds passed the flammability requirement (speed of flame spread ≤ 80mm/min) and were also classified as HB according the UL94. The last set of experiments revealed that there is still room to improve the impact resistance of NATURTRUCK biocomposites for applications where high impact strength is required.

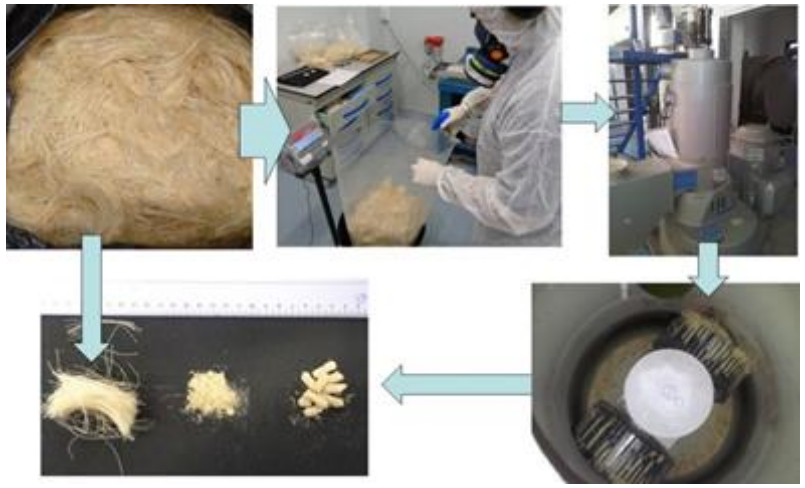


Figure 95. Top: Reference hemp and treated hemp fibres before pelletization. Bottom left: Steps of the pelletization process for treated hemp in NATURTRUCK.

Figure 10. NATRUTRUCK moulds and injected truck parts. Left: footrest parts. Right: Bracket parts.

Figure 61. Continuous annealing of “bracket” part with IR using PLA biocomposite with threated hemp fibres.

WP7: Environmental, Economic and Regulatory studies. Biodegradability and Ecotoxicity		
OBJECTIVES	**WORK DONE**	**FINAL RESULTS**
Analyze the environmental suitability by a LCA. Develop a guide for its use, recycling and end of life management Economic viability of the product. Assess biodegradability of the product. **PARTNERS INVOLVED** AIMPLAS, QdV, BAFA, RE8, POLYCOM, PLASCAM, PROAC, RENAULT, IWNIRZ, CTAG	A Life Cycle Analysis (LCA) was carried out to evaluate the environmental effect of new biocomposite materials based on PLA and natural fibres, as alternative to commonly used ABS and PC/ABS materials. A study of the re–processability of industrial scrap of truck parts was carried out to establish if the recycled material may be incorporated to some extent without influencing negatively the properties of the new products. The biodegradability of NATURTRUCK biocomposites and parts was evaluated according to the standard UNE–EN 13432. the final economic report was performed to define whether the truck parts would be economically viable, using data available at the end of the project.	For the LCA different scenarios were considered depending the use of reference or treated hemp fibres and different processing options to obtain crystallized parts. The results showed that in two of four scenarios the environmental impact of NATURTRUCK biocomposites was lower than for commercial materials (ABS and PC/ABS). Those scenarios corresponded with the use of reference fibres instead of treated fibres (due to the high energy consumption required for the osmotic degumming and fibre drying). Therefore, NATURTRUCK material/part can have lower overall impact to the environment than commercially available ABS or PC/ABS. NATURTRUCK parts can be recycled at levels allowed by the automotive industry (up to 10wt%), without any impact on the processability or mechanical properties of the material. Therefore, NATURTRUCK compound can be considered as recyclable. NATURTRUCK compound is considered as a biodegradable material according the standard EN 13432: 2000. If treated properly it can be also considered as compostable (with size reduction before composting). In the same way NATRUTRUCK injected parts are biodegradable, but the biodegradation rate depends on the final crystallinity of the part. According to RENAULT, there is no regulation or safety issue to be concerned. In addition, safety recommendations were made for each NATURTRUCK process. A guide was prepared collecting the recyclability, regulatory and safety assessment report, as well as information about materials, processes and final waste management of the package. Concerning the economic viability of NATURTRUCK biocomposites and parts, NATURTRUCK compound reaches affordable prices per Kg using reference hemp fibres and lower bio-content than 80%. In this case, the cost in the same level of a conventional FR-ABS or even less expensive. However, for certain applications it is needed to use treated fibres in order to pass the ageing tests, which it implies an additional cost of 0.59 €/Kg due to the expensive reagents needed for the treatment. Depending on the part requirements, this overrun could be acceptable by the market. The inherent higher density of PLA-based biocomposites compared to conventional plastics plays a major role in the final cost of NATURTRUCK parts. Even using a NATURTRUCK compound less expensive than the reference FR-ABS (3.26€/Kg vs 3.87€/Kg), the final part is 8% more expensive. This is explained by the higher density of NATURTRUCK biocomposite in great extent. Other minor contribution is the higher energy required due to the annealing / crystallization step. In any case, the increment in the final cost of the parts seems reasonable and it could be affordable for end-users, due to the added value of using an ecological plastic.

<table>
<tr><th colspan="3">WP8: Dissemination, exploitation and training</th></tr>
<tr><th>OBJECTIVES</th><th>WORK DONE</th><th>FINAL RESULTS</th></tr>
<tr>
<td>Establish the suitable protection and exploitation mechanisms for the project results, Technology Transfer, Exploitation and Dissemination of knowledge generated in the project

PARTNERS INVOLVED

All</td>
<td>Plan for the use and dissemination of the foreground has been carried out along the whole project duration.

Dissemination material has been prepared and updated along the project implementation, project presentation, project website, etc,

Different dissemination activities have been carried out by the Consortium partners, press release, participation in several conferences and fairs,… the dissemination strategy has been defined in the early stages of the project.

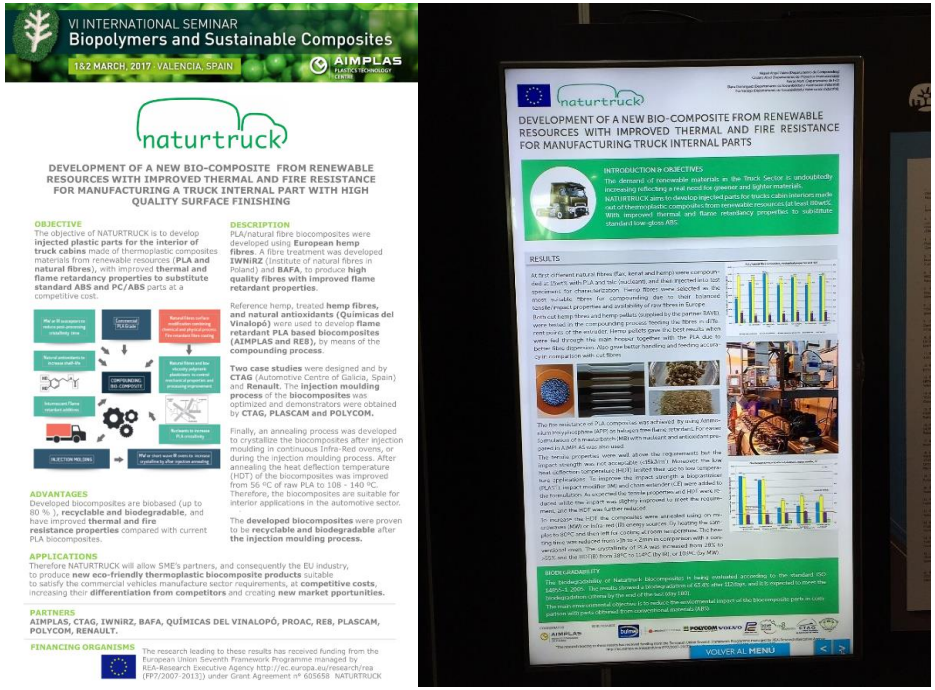
Technology Transfer was ensured with the assistant of RTD performers to the partners during the industrial scaling-up. A Workshop was organised in AIMPLAS facilities on the 1st March 2017 in order to present the project results into a Seminar named “Biopolimers and Sustainable composites”.

Exploitable Project Results and the Exploitation Strategy been agreed and highlighted in the final version of the PUDF.</td>
<td>Plan for the use and dissemination of the foreground (PUDF) has been defined.
Final version of the exploitation strategy of the results has been summarized in the PUDF.
There are 5 project results:
1. New fibre treatments based on combination of chemical and physical methods.
2. High performance natural antioxidants for the protection of biocomposites for car industry.
3. Biocomposites based on PLA, natural fibres and additives with improved thermal and mechanical properties.
4. Biocomposites based on PLA, halogen free flame retardants with improved fire resistance.
5. Continuous oven design and methodology for biocomposites part annealing.

All of them will be protected as Industrial secret
General conditions were established for the ownership in the D 8.11
The PUDF include an update on the dissemination programme. It has been a living document and has been updated throughout the project.
The project web site (http://www.naturtruck.eu/), active since the early stages of the project has also been an efficient instrument to disseminate the project apart of being used for the partners document interexchange. A video presenting the project is available in youtube: https://www.youtube.com/watch?v=6s2FzPPV-BA
There is also a Public report on training activities (D8.10), which collect all the information related to the events of the RTDs assistance to the SMEs to develop their product at the SMEs facilities.
A best practice guideline (D8.9) collected all the information related to the products and processes in order to ensure an easy and efficient technology transfer to SME’s. Specific examples of materials and processes are described and its advantages and limitations highlighted in order to help transfer the foreground generated along NATURTRUCK project.</td>
</tr>
</table>

Figure 7. Flyer front page

Figure 8. Flyer back page



VI INTERNATIONAL SEMINAR
Biopolymers and Sustainable Composites
1&2 MARCH, 2017 · VALENCIA, SPAIN
AIMPLAS PLASTICS TECHNOLOGY CENTRE

naturtruck

DEVELOPMENT OF A NEW BIO-COMPOSITE FROM RENEWABLE RESOURCES WITH IMPROVED THERMAL AND FIRE RESISTANCE FOR MANUFACTURING A TRUCK INTERNAL PART WITH HIGH QUALITY SURFACE FINISHING

OBJECTIVE

The objective of NATURTRUCK is to develop **injected plastic parts for the interior of truck cabins** made of thermoplastic composites materials from renewable resources (**PLA and natural fibres**), with improved **thermal and flame retardancy properties to substitute standard ABS and PC/ABS** parts at a competitive cost.

DESCRIPTION

PLA/natural fibre biocomposites were developed using **European hemp fibres**. A fibre treatment was developed **IWNiRZ** (Institute of natural fibres in Poland) and **BAFA**, to produce **high quality fibres with improved flame retardant properties**.

Reference hemp, treated **hemp fibres, and natural antioxidants (Química del Vinalopó)** were used to develop **flame retardant PLA based biocomposites (AIMPLAS and RE8),** by means of the **compounding process**.

Two case studies were designed and by **CTAG** (Automotive Centre of Galicia, Spain) and **Renault**. The **injection moulding process** of the **biocomposites** was optimized and demonstrators were obtained by **CTAG, PLASCAM and POLYCOM.**

Finally, an annealing process was developed to crystallize the biocomposites after injection moulding in continuous Infra-Red ovens, or during the injection moulding process. After annealing the heat deflection temperature (HDT) of the biocomposites was improved from 56 ºC of raw PLA to 108 - 140 ºC. Therefore, the biocomposites are suitable for interior applications in the automotive sector.

The **developed biocomposites** were proven to be **recyclable and biodegradable** after **the injection moulding process.**

ADVANTAGES

Developed biocomposites are biobased (up to 80 %), **recyclable and biodegradable**, and have improved **thermal and fire resistance properties** compared with current PLA biocomposites.

APPLICATIONS

Therefore NATURTRUCK will allow SME's partners, and consequently the EU industry, to produce **new eco-friendly thermoplastic biocomposite products** suitable to satisfy the commercial vehicles manufacture sector requirements, at **competitive costs**, increasing their **differentiation from competitors** and creating **new market portunities.**

PARTNERS

AIMPLAS, CTAG, IWNIRZ, BAFA, QUÍMICAS DEL VINALOPÓ, PROAC, RE8, PLASCAM, POLYCOM, RENAULT.

FINANCING ORGANISMS

The research leading to these results has received funding from the European Union Seventh Framework Programme managed by REA-Research Executive Agency http://ec.europa.eu/research/rea (FP7/2007-2013)) under Grant Agreement nº 605658 NATURTRUCK

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DEVELOPMENT OF A NEW BIO-COMPOSITE FROM RENEWABLE RESOURCES WITH IMPROVED THERMAL AND FIRE RESISTANCE FOR MANUFACTURING TRUCK INTERNAL PARTS

INTRODUCTION & OBJECTIVES

RESULTS

BIODEGRADABILITY

VOLVER AL MENU

Figure 9. Poster design

Figure 10. Project website

<table>
<tr><th colspan="3">WP9: Project Management</th></tr>
<tr><th>OBJECTIVES</th><th>WORK DONE</th><th>FINAL RESULTS</th></tr>
<tr><td>Overall project co-ordination and management. Optimization of the resources and insurance that all EC requirements for communication are met.

PARTNERS INVOLVED

All</td><td>Management of internal project communication including project communication tools
• Report to the Commission on work done, results obtained and costs incurred.
• Management of issues arisen during project development
• Fluent communication with the several Project officers and the Consortium partners</td><td>Project completed successfully and resources manage efficiently. Communication among partners between meetings have functioned smoothly using email distribution lists and conference calls.
The following meetings have been held:
• Kick-off meeting held on 30th January 2014 in AIMPLAS (Valencia - Spain).
• Conference call held among partners VOLVO, CTAG and AIMPLAS on the 13th February 2014.
• 6th month meeting held on 15th July 2014 in VOLVO (Lyon - France).
• 1st review meeting in CTAG (Vigo - Spain) on the 29th January 2015.
• 18th month meeting in IWNiRZ (Poznan – Poland) on the 7th July 2015.
• 27th month meeting in AIMPLAS (Valencia – Spain) on the 15th March 2016

Several conference calls have been arranged along the project development.
Financial reports (including Form C from all partners) have been submitted to the Commission for P1, P2 and P3. Internal economic control was carried out every 6 months. All Deliverables have been submitted and Milestones achieved.
The replacement of partners BAVE, BULMA and VOLVO by BAVE, PROAC and RENAULT has been duly managed by the coordinator and the foreseen amendment was generated.</td></tr>
</table>

Potential impact, including the socio-economic impact and the wider societal implications of the project and the main dissemination activities and the exploitation of results

The impact for the participating SMEs and their members will result in an improvement of the competitiveness of the SMEs and the sectors concerned; commercial vehicles and vehicle manufacturers sector, plastic sector, biocomposites and natural fibres sectors.

NATURTRUCK results will contribute to maintain and/or improve the SMEs leadership in EU, specifically within the plastic and commercial vehicles sector, opening a new market opportunity to existing SMEs or fostering the creation of new ones. Regarding the EU plastics industry, more than 1.6 million people are working in about 50,000 companies (mainly SMEs in the converting sector) to create a turnover over 280 billion € per year[9]. The EU converters used 52 million tonnes of plastics in 2011. From them, the 8% is used in automotive industry (more than 4,2 Mt) and the ABS and PC/ABS consumption is around 9%, representing a potential market of 378 kt/year for the NATURTRUCK partners.

Natural fibres (NFs): Flax and hemp hold second rank position in the global production of natural fibres (150kt in 2009). Both are traditional EU crops nowadays at risk. Projects as NATURTRUCK focused on enlarging the capability to employ natural fibres for industrial applications is a key for this industry. According to the EU Industrial Hemp Association (EIHA), only 4.1% of flax production and 12.9% of hemp productions are used for composites. Nowadays the main reinforced fibre used is the glass fibre, which are energy intensive in production, heavy (double density than natural fibre), could cause human injuries (irritations and cuts) and difficult to recycle. These two natural fibres, flax and hemp have been chosen because they offer competitive advantages regarding technical performance and because, the impact at EU level will be significant. NATURTRUCK allows a notorious scientific advance due to the development of new biocomposites adapted to the automobile industry, being potentially patentable due to their worldwide scientific and technical innovative character.

High performance PLA biocomposites: This means a clear scientific advance, presenting properties of hydrolysis and thermal resistance, low volatile emission and mechanical characteristics comparable to oil-based technical polymers such as ABS or PC/ABS used currently in the truck industry. Project goals are the development of new PLA biocomposites based on the optimisation of a synergic combination of different additives and fillers, with the aim to overcome the current limitations of the PLA: thermal and fire resistance, ageing, mechanical properties, etc.

The fact of not only developing biocomposites but also adapting their processing method to their own peculiarities, allowed obtaining valid samples, maximizing their properties and process ability by means of increase their crystallinity. Therefore, the potential application of biopolymers will be even increased in the truck sector and other sectors with similar requirements such as automotive, electric-electronic, telecommunications, aeronautic, defence, household appliances, etc.

On the other hand, the recycling rate for truck plastics waste is lower than 8% in 2008. This recycling rate is rather low in comparison with other sectors (average around 20%) due to the difficulty to separate individual plastics from vehicles shredded at the end of their useful lives. Most of these residues (approx. 20% w/w) are land filled, without considering alternative valorisation routes. The use of biopolymers with less embodied energy and with capacity of biodegradation could be a solution to reduce the car shredder residues going to landfill, as the plastic waste can be composted.

For the initial economical evaluation and taking into account that RENAULT (Volvo Group) produces around 70,000 trucks each year, which means a consumption of thermoplastics in the inner truck parts of around 1700 tn of NATURTRUCK parts per year was estimated. Considering the use of the compound in parts of four different models of Volvo trucks and a possible introduction in other similar sectors, as automotive, naval, trains, etc. Table 3.1 calculations are focused on those partners who will benefit more directly from the project

[9] http://www.plasticsconverters.eu/

results: PLA, natural additive producers, mould and injected parts manufacturers, compounders and MW or IR heating ovens manufacturers. The following considerations were made:

Table 3.1 Economic impact estimations for NATURTRUCK partners.

Partners project role	Turnover (M€)	Profit (M€)
PLA, antioxidants & fibres suppliers	13.8	2.2
Compounders	5.2	0.8
Injection moulding & mould makers	5.2	0.8
Total	**24.2**	**3.6**

To calculate the turnover and benefit of the **PLA, natural additives supplier and compounders**, the cost calculation of the PLA biocomposite and the percentage of each component of the best material formulation was used.

Considering an estimated growth of plastic consumption in the selected sector of 3% p.a., table 3.2 shows the market penetration over the first 5 years of the compounder production, the approximate annual turnover and the profit calculated assuming that it is 15% of the turnover is 12.9 M€ and 1.9M€ respectively. For plastic converters, medium clamp force injection moulding machine cost could be estimated in 40 €/h.

Table 3.2 Economic impact estimations for compounding company

Year	Potential Market (kt)	Market penetration		Turnover (M€)	Profit (M€)
		(%)	(kt)		
1	7.4	4.0%	0.30	0.79	0.12
2	7.6	8.0%	0.61	1.63	0.24
3	7.9	12.0%	0.94	2.52	0.38
4	8.1	16.0%	1.30	3.46	0.52
5	8.4	20.0%	1.67	4.46	0.67
		Total	**4.8**	**12.9**	**1.9**

If they are capable to produce 7.3 Million parts/year of an average 229 g/part, according to the results obtained in the parts produced in NATURTRUCK project. The **use of the NATURTRUCK technology will represent for injection mould and mould makers[10] of 5.2M€ turnover and a direct return of 0.8 M€ within 5 years.** A standard injection moulding machine processes around 45 t/year[11]. A standard continuous oven cost is estimated in 75,000 €, this means a turnover of 3.4 M€ and 0.5 M€ of industrial benefit in the same period.

Adding all the figures which have been calculated, (Table 3.1), we will obtain a direct return of 3,6M€ over the 5-year period. This means an approximate return on investment ratio of 2.4 for the involved partners over the 5-year period, considering the total cost of the project (~1.5 M€, including the EU funding).

All the partners expect to improve their competitive position in their own markets. It is important to highlight that the environmental costs have not been included in these calculations but they are even much more significant for the society as a whole**.**

Bioplastics have the additional advantage of using renewable resources. This does not necessarily go along with an advantage over conventional plastics, but it has often proven advantageous when the criteria "consumption of fossil resources" and "reduction of CO_2 emissions" are being assessed. Using agricultural resources also allows a regional closed loop management. Especially in countries with lack of humus (arid-

[10]Mold and master costs is calculated as 20% of injection moulding cost.

[11] For this calculation we estimate: 250 work-days per year, 16 hours by day and process 10 kg of plastic per hour.

zones), compostability offers an additional advantage, as allow the production of compost, which can be used as fertiliser and substrate to improve soil quality.

As a result of the project the SMEs are owners of the following IPR:

- New fibre treatments based on combination of chemical and physical methods
- High performance natural antioxidants for the protection of biocomposites for car industry.
- Biocomposites based on PLA, natural fibres and additives with improved thermal and mechanical properties.
- Biocomposites based on PLA, halogen free flame retardants with improved fire resistance.
- Continuous oven design and methodology for biocomposites part annealing.

As agreed among the Consortium partners the IPR will be protected as an Industrial Secret, the ownership will be distributed as collected in the table "Type of Exploitable Foreground"

Address of the project public website and relevant contact details.

Coordinator: AIMPLAS - Instituto Tecnológico del Plástico
C/ Gustave Eiffel, 4 (València Parc Tecnològic)
46980 - PATERNA (Valencia) – SPAIN
Tlf. (+34) 96 136 60 40
Email: proyectos@aimplas.es

Use and dissemination of foreground

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES								
N	**Type of activity**	**Partner**	**Event**	**Date**	**Place**	**Type of audience**	**Size of audience**	**Countries addressed**
1	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Starting up Porject website	01/03/2014	-	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		worldwide
2	Press releases	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	The European Project NATURTRUCK develops biocomposites for the internal parts of trucks	01/05/2015	Press	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		European Countries
3	Flyers	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Tripych designed by AIMPLAS	01/03/2014	Distributed among all partners to disseminate the project	Industry		European Countries
4	Oral presentation to a scientific event	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Presentation of the NATURTRUCK PROJECT	15/01/2014	CEEI Valencia, Centro Europeo de Empresas Innovadoras de Valencia	Scientific community (higher education, Research) - Industry - Medias		Spain
5	Oral presentation to a wider public	QUIMICAS DEL VINALOPO SL	Conference on employment options in sustainable branches of industry.Presentacion of NATURTRUCK project as	04/04/2014	Alicante, Spain	Scientific community (higher education, Research) - Industry - Civil		Spain

			an example of sustainable project			society - Policy makers - Medias		
6	Oral presentation to a wider public	POLYCOM PREDELAVA PLASTICNIH MAS IN ORODJARSTVO SKOFJA LOKA D.O.O.	Presentation of the NATURTRUCK PROJECT	05/06/2014	Conference on Biopolymers, Polymer Technology College in Slovenj Gradec, Slovenia	Scientific community (higher education, Research) - Industry - Medias		Slovenia
7	Web sites/Applications	FUNDACION PARA LA PROMOCION DE LA INNOVACION, INVESTIGACION Y DESARROLLO TECNOLOGICO EN LA INDUSTRIA DE AUTOMOCION DE GALICIA	Wikipedia page: http://en.wikipedia.org/wiki/NATURTRUCK	19/09/2014	Wikipedia,Internet	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		worldwide
8	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo Naturtruck crea plásticos compostables para el interior de camiones	14/10/2014	Izaro Manufacturing Technology	Industry		European Countries
9	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo Naturtruck crea plásticos compostables para el interior de camiones	10/10/2014	Izaro Manufacturing Technology -NewsLetter	Industry		Spain
10	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Naturtruck, proyecto europeo que crea plásticos compostables para el interior de automóviles	03/06/2014	Tecnología del Plástico	Industry		Spain
11	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y	El proyecto europeo NATURTRUCK crea plásticos compostables	02/06/2014	Valencia & Business	Scientific community (higher education,		Spain

		CONEXAS - AIMPLAS	para el interior de • camiones			Research) - Industry		
12	Articles published in the popular press	BAVE BADISCHE FASERVEREDELUNG GMBH	El proyecto europeo Naturtruck crea plásticos compostables para el interior de camiones	23/05/2014	Interempresas PLASTICO	Industry		Spain
13	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	The European Project NATURTRUCK develops biocomposites for the interna! parts of t rucks	22/05/2014	Jec Grouup Knowledge & Networking	Industry		worldwide
14	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo NATURTRUCK crea plásticos compostables para el...	20/05/2014	AIMPLAS linkedin	Scientific community (higher education, Research) - Industry - Medias		worldwide
15	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo NATURTRUCK crea plásticos compostables y procedentes de fuentes renovables para el interior de camiones	20/05/2014	AIMPLAS google+	Scientific community (higher education, Research) - Industry		worldwide
16	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	European Project NATURTRUCK Develops Biocomposites for Internal Truck Parts	20/05/2014	http://www.netcomposites.com/news/european-project-naturtruck-develops-biocomposites-for-internal-tr	Industry		worldwide
17	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	The European Project NATURTRUCK develops biocomposites for the internal parts of trucks	20/05/2014	AIMPLAS facebook	Scientific community (higher education, Research) - Industry - Civil society		worldwide
18	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y	PROYECTO NATURTRUCK: PLASTICOS COMPOSTABLES PARA	20/05/2014	http://www.residuosprofesional.com/	Industry		worldwide

		CONEXAS - AIMPLAS	EL INTERIOR DE CAMIONES					
19	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Aimplas drives Naturtruck	20/05/2014	Compounding Word	Industry		worldwide
20	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo Naturtruck crea plásticos compostables para el interior de camiones	19/05/2014	El Periódico de Aquí	Scientific community (higher education, Research) - Industry		Spain
21	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo Naturtruck crea plásticos compostables para el interior de camiones	19/05/2014	Te interesa	Scientific community (higher education, Research) - Industry - Civil society		Spain
22	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo Naturtruck crea plásticos compostables para el interior de camiones	19/05/2014	Gente Digital	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		worldwide
23	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo Naturtruck crea plásticos compostables para el interior de camiones	19/05/2014	La informacion WEB	Scientific community (higher education, Research) - Industry		worldwide
24	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo Naturtruck crea plásticos compostables para el interior de camiones	19/05/2014	La Vanguardia WEB	Scientific community (higher education, Research) - Industry - Civil		worldwide

						society - Policy makers - Medias		
25	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo Naturtruck crea plásticos compostables para el interior de camiones	19/05/2014	Europa Press	Scientific community (higher education, Research) - Industry		European Countries
26	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	The European Project NATURTRUCK develops biocomposites for the interna! parts of trucks / El proyecto europeo NATURTRUCK crea plásticos compostables para el interior de camiones	19/05/2014	AIMPLASINFO	Scientific community (higher education, Research) - Industry - Medias		worldwide
27	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Proyecto europeo NATURTRUCK, AIMPLAS desarrolla un nuevo plástico biodegradable para el interior de camiones	19/05/2014	RETEMA, Spanish technical enviromental magazine	Scientific community (higher education, Research) - Industry		Spain
28	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El proyecto europeo NATURTRUCK crea plásticos compostables para el interior de camiones	19/05/2014	Econoticias	Scientific community (higher education, Research) - Industry		worldwide
29	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	NATURTRUCK: plásticos compostables para el interior de camiones	30/05/2014	Mundoplast WEB	Scientific community (higher education, Research) - Industry		worldwide
30	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Un proyecto europeo coordinado por Aimplas. permite crear plásticos compostables para automoción	19/05/2014	Industria Química website	Scientific community (higher education, Research) - Industry		worldwide

31	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Un proyecto europeo coordinado por Aimplas. permite crear plásticos compostables para automoción	19/05/2014	Industria Ambiente website	Scientific community (higher education, Research) - Industry		worldwide
32	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Innovadores plásticos compostables para el interior de camiones	19/05/2014	www.innovaticias.com	Scientific community (higher education, Research) - Industry		worldwide
33	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Desarrollan plásticos biodegradables para el interior de la cabina de camión	19/05/2014	www.lasprovincias.es	Scientific community (higher education, Research) - Industry		worldwide
34	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	The European Project NATURTRUCK developes #biocomposites for interna! parts of #trucKs aimplas.neUblog/europea n- ...	20/05/2014	Twitter @aimplas	Scientific community (higher education, Research) - Industry		worldwide
35	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	AIMPLAS to Conduct Research on Development of Biocomposites for Auto Using TOTAL's PLA	20/05/2014	website SpecialChem	Scientific community (higher education, Research) - Industry		worldwide
36	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Project aims at PLA truck cabins	19/05/2014	Website Eco composites	Scientific community (higher education, Research) - Industry		worldwide
37	Web sites/Applications	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	El interior de las cabinas de los próximos camiones de Renault tendrá sello vigués	27/05/2014	www.elfarodevigo.es	Scientific community (higher education, Research) - Industry		worldwide

38	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Un proyecto estudia crear plásticos biodegradables para el interior de los camiones	03/06/2014	Logistica Profesional	Scientific community (higher education, Research) - Industry		Spain
39	Posters	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	CONAMA Local 2015	07/10/2015	Málaga (Spain)	Industry - Policy makers		Spain
40	Oral presentation to a scientific event	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Advances in Plastics Technology (APT'15)	14/10/2015	Katowice (Poland)	Scientific community (higher education, Research) - Industry - Policy makers - Medias		worldwide
41	Flyers	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Jornada de Plásticos de origen Renovable	20/10/2015	Valencia (Spain)	Scientific community (higher education, Research) - Industry - Policy makers - Medias		Spain
42	Posters	INSTYTUT WLOKIEN NATURALNYCH I ROSLIN ZIELARSKICH	EPNOE International Polysaccharide Conference	18/10/2015	Warsaw (Poland)	Scientific community (higher education, Research) - Industry - Policy makers - Medias		worldwide
43	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Aimplas is developing PLA/natural fi bre composites with increased HDT for the Naturtruck project (article in Compounding World magazine)	01/03/2015	worldwide	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		worldwide

44	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	NatureWorks is expanding the property and applications envelope for its Ingeo PLA bioplastic (article in Compounding World magazine)	01/06/2015	worldwide	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		worldwide
45	Articles published in the popular press	ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS - AIMPLAS	Producers of natural fi bres and compounds are striving to deliver performance that can match traditional plastics (article published in Compounding World Magazine)	01/03/2016	worldwide	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		worldwide
46	Flyers	QUIMICAS DEL VINALOPO SL	BIOCULTURA exhibition	27/02/2015	Valencia (Spain)	Scientific community (higher education, Research) - Industry - Medias		Spain
47	Flyers	QUIMICAS DEL VINALOPO SL	MENSA CIVICA exhibition	20/11/2015	Zaragoza (Spain)	Scientific community (higher education, Research) - Industry - Medias		Spain
47	Conference	AIMPLAS	Advances in Plastics Technology (APT'15)	13th-15th October 2015	Katowice, Poland (Expo Silesia 2015),	Industry representatives	80 participants	Europe
48	Seminar	AIMPLAS	Jornada de Plásticos de origen Renovable: Tendencias y oportunidades	20th October 2015	Valencia, Spain		50 participants	Spain
49	Conference	IWNiRZ AIMPLAS	Textile Institute World Conference	24-27th April 2016	Poznan, Poland	Science, research and industry representatives	220 participants	Global reach

						from 40 countries,		
50	Fair	AIMPLAS	International show for environmental solutions – ECOFIRA	28th-29th September 2016	Valencia, Spain			
51	Industrial Fair	IWNiRZ	InnovaTex 2016	12-13 October 2016	Lodz, Poland	Industry Science, research,	200 participants	Poland
52	Seminar	IWNiRZ	COST ACTION Final Meeting MP 1105	27-28 April, 2016	Poznan, Poland	Science, research	50 participants	Global reach
53	Promotional spot	AIMPLAS Re8	Title: Video Naturtruck (European Enterprise Network)	-	-	Science, research, industry	-	Europe
54	Business meeting	PLASCAM	Aston Martin	1st March 2017	Gaydon, Wielka Brytania	Industry, end-user	-	-
55	Industrial fair	re8	K-fair	18-20 October 2016	Hannover, Germany	industry	30 participants	Europe
56	Cooperation meeting	re8	Natural Fiber Composite Meeting	23-24 November 2016	Orsa, Sweden	Industry, regional cluster, regional investment agency,	7 participants	Sweden
57	Seminar	re8	Information and inspiration day The Wood Region	8th August 2016	Sysslebäck, Sweden	Public agencies, inventors, enterprises	30 participants	Sweden

58	Workshop	AIMPLAS	VI International Seminar "Biopolymers and Sustainable Composites"	1st March 2017	Valencia, Spain	Science, research, industry		Global reach

Section B (Confidential[12] or public: confidential information to be marked clearly)
Part B1

The applications for patents, trademarks, registered designs, etc. shall be listed according to the template B1 provided hereafter.

The list should, specify at least one unique identifier e.g. European Patent application reference. For patent applications, only if applicable, contributions to standards should be specified. This table is cumulative, which means that it should always show all applications from the beginning until after the end of the project.

TEMPLATE B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.					
Type of IP Rights[13]:	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant (s) (as on the application)

[12] Note to be confused with the "EU CONFIDENTIAL" classification for some security research projects.

[13] A drop down list allows choosing the type of IP rights: Patents, Trademarks, Registered designs, Utility models, Others.

Part B2

TEMPLATE B2: Type of Exploitable Foreground

Type of Exploitable Foreground [14]	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application[15]	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
New fibre treatments based on combination of chemical and physical methods		Yes	March 2019	*Fibres materials*	Fibre processing sector	Further research is necessary for feasible scale-up of the treatments before commercial use	Industrial secret	BAFA Owner Re8 Licensing
High performance natural antioxidants for the protection of biocomposites for car industry.		Yes	March 2019	*Antioxidants materials*	Production of stabilizers for polymers	Further research is necessary for feasible scale-up of the treatments before commercial use	Industrial secret	QdV Owner Re8 Licencing

[19] A drop down list allows choosing the type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, exploitation of results through EU policies, exploitation of results through (social) innovation.

[15] A drop down list allows choosing the type sector (NACE nomenclature) : http://ec.europa.eu/competition/mergers/cases/index/nace_all.html

Type of Exploitable Foreground [14]	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application[15]	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
Biocomposites based on PLA, **natural fibres and additives with improved thermal and mechanical properties.**		yes	March 2019	*Composite Material*	Biocomposite production for automotive sector	Possible commercialization within next 3 years	Industrial secret	QdV Co-Owner BAFA Co-Owner Re8 Co-Owner POLYCOM Co-Owner PLASCAM Co-Owner PROAC Co-Owner
Biocomposites based on PLA, **halogen free flame retardants with improved fire resistance.**		Yes	March 2019	*Composite Material*	Biocomposite production for automotive sector	Possible commercialization within next 3 years	Industrial secret	QdV Co-Owner BAFA Co-Owner Re8 Co-Owner POLYCOM Co-Owner PLASCAM Co-Owner PROAC Co-Owner
Continuous oven design and methodology for biocomposites part annealing.		yes	March 2019	*Technology*	Biocomposite production for automotive sector	Further research is necessary for ensuring good the dimension stability at lower costs	Industrial secret	POLYCOM Licensing PLASCAM Licensing PROAC Owner