



Industrial Feather Waste Valorisation for Sustainable KeRatin-based MAterials

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The project, funded in the frame of Horizon2020 TOPIC SPIRE-03-2016: Industrial technologies for the valorisation of European bio-resources into high added value process streams, aims to the industrial manufacture and exploitation of sustainable raw materials from feather waste to develop innovative green products for high impact cross-sectorial markets.

The release of this 2nd project newsletter matches with the first year of life of our collaborative project! The 1st newsletter told you about the main objectives of the project and presented the partners involved. On this occasion, this newsletter will be dedicated to update you with the work carried out so far for each project partner.

WHICH IS THE PROJECT WORK PLAN?

KaRMA2020 is a 3-year long project, with a Work Plan divided in 4 phases:

- 1. Feather conditioning.** The feathers generated at the facilities of SADA are being sanitised and pre-treated through mechanical and/or physicochemical methods.
- 2. Conversion technologies.** The activities included in this phase are developing the research of conversion technologies to be adapted to the pre-treated feathers as feedstock to create intermediate raw materials at lab scale: hydrolysed keratin, bioplastic pellets, coatings, spun bonded non-woven and thermoset resins.
- 3. Raw materials manufacturing.** Thanks to the work carried out in phase 2, the industrial partners will be able to scale-up the raw material production at their facilities, adapting them to the novel feather-based feedstock.
- 4. Raw materials and end product validation.** The industrial end-users of the project will define the required raw material and end product properties according to regulatory and quality standards. A short industrial production will be carried out as a proof of concept and validation.

In parallel to these technical activities, several partners are assessing the economic and environmental impact of the new processes proposed to confirm the improvements with regards with the current techniques. Besides, a complete exploitation, dissemination and communication plan is being executed to ensure the maximum impact of the project even beyond its lifetime.



First year project results: CID has investigated on the formulation of feather reinforced biodegradable plastics at lab scale as well as in the preparation of bio-based composites combining bio-based epoxy resins and feather reinforced non-woven fabrics. The research carried out so far has demonstrated the possibility of preparing high feather content bio-composites (<http://www.mdpi.com/2073-4360/9/11/593>).



First year project results: SADA Group is in charge of carrying out the cleaning and sanitation feather process. This process is currently performed in 5 steps: manual trimming, feather washing, feather drying, feather sterilization and microbiological validation of the whole process in order to ensure the hygienic conditions. 100 kg of sterilized feathers have been sent so far to the different partners with satisfactory results.



First year project results: VTT has produced a batch of steam-exploded feathers that Fertiberia has utilized to formulate fertilizers. VTT has also developed and optimized a protocol to produce homogeneous keratin feedstock by using deep eutectic solvents in laboratory-scale. VTT has set up several analytical procedures to determine keratin content in solutions and chemical structure of feathers, both before and after their chemical or thermal treatment.



First year project results: RISE's role is mainly to perform the sustainability analysis within the project. This covers the environmental performance of the new processes and products, as well as their economic viability. Thus, business plans are developed for selected cases, taking possible new business models into consideration. An internal, preliminary report was delivered in November, to be fine-tuned and finalized after further feedback.



First year project results: Centexbel is able to produce very fine feather particles (~5 µm). These particles were added to technical textile coatings in order to improve the breathability and flame retardancy. First screening of the physical properties of the produced coatings is ongoing. Furthermore a first series of keratin based flame retardants were added to different textile coating systems. Compatibility issues between the FRs and the binder systems still need to be solved and will be the focus of the upcoming period.



First year project results: AIMPLAS is taking part on the technical work of phase 3 and 4 of the project. AIMPLAS is collaborating with DIabs in the production of fireproof additives from modified keratins and adapted to polyurethane based coatings. On the other hand, AIMPLAS is coordinating the definition of end-product specifications and validation guidelines of new products to be developed: Meat chicken packages, Fireproof paints, Coated fabrics, High performance and Fertilizers.



First year project results: IBWCh is in charge of carrying out the mechanical pretreatment process (grinding and fractionizing) as well as spun-bonded manufacturing. 39 kg of feathers from SADA Group were obtained. Partners were given 3.9 kg of grinded feathers as agreed. Several types of spun-bonded nonwovens were obtained. Two types of samples of spun-bonded PP / CF nonwovens were delivered to CTB and 3 types of samples of PLA / CF nonwovens to CID.



First year project results: Sioen is a producer of technical textile coatings. Later on the project an industrial run will be performed with the keratin incorporated coating system developed in the project. Therefore a mapping of the complete coating process has been done, next to technical properties of the coating pastes, technical requirements of the obtained coatings as possible difficulties which have to be taken into account during the lab scale trials.



First year project results: CNRS has focused the research on the preparation of different humins based formulations with different i) technical humins, ii) crosslinking agents and iii) additives. Promising results have been achieved. The second part of the work has been the investigation of keratin/humins composites.



First year project results: Avantium is preparing formulations involving humins and keratin aiming at the production of thermosets. Other keratin sources (coarse chicken feathers, grinded chicken feathers (powder) and grinded chicken feathers treated with H₂O₂) are also employed for the preparation of blends together with humins.



First year project results: FKUR has performed dosing trials in the extruder using whole feathers. For dosing, a gravimetric feeder was selected with two different screws: i) Ø20mm solid screws and ii) Ø28mm hollow screw. Further trials will be carried out with grinded feathers.



First year project results: Fertiberia has started the preliminary research in feathers treated by steam explosion procedure (from VTT and Processum) and alkali treated feathers (from Cidetec). Chemical analysis have been carried out, focused on N forms content. Furthermore, first granulation tests are currently being made in order to observe the compatibility of these new materials with the usual fertiliser raw materials and accepted quality standards.



First year project results: During the first year of the project, Vertech Group has taken care of the project's risks by implementing a Risk Management process. Up to the first year of life, the work plan is running smoothly in alignment with the objectives and milestones posed by the consortium. In addition, Vertech has made a thorough literature review of the processes involved in the project and started talking with partners about the modelling and simulation of the intermediate products production.



First year project results: CTech developed and released the project website (available at <http://www.karma2020.eu/>), and also set up a solid strategy to ensure KärMA2020 project visibility, as part of the strategy the partners attended the following vents during the first project year:

- **IFIB 2017** - Italian Forum on Industrial Biotechnology and Bioeconomy, Rome, Italy
- **Ecomondo** - International trade fair of material & energy recovery and sustainable development, Rimini, Italy
- **3rd European Conference on Fire-safe Textiles & Plastics**, Gent, Belgium
- **Nordic poultry conference**, Malmö, Sweden
- **TechTextil2017** - International Trade Fair for Technical Textiles and Nonwovens – Frankfurt, Germany
- **12th Annual Public Conference of the European Technology Platform for the Future of Textiles and Clothing**, Brussels, Belgium

As part of the Exploitation, to identify the market and technology trends and the most important stakeholders involved of the Karma2020 project, CTech is using its own innovation intelligence methodology. This method was based on the analysis of external technologies, innovators, end users and suppliers, by using a combined database of 5 million research projects, European, US, WIPO, Japanese and Chinese patents – overall more than 40 million – all translated in English, as well as 18 million papers and scientific articles published in Open Access.



First year project results: Daren labs has incorporated several types of keratin into phosphorus based non-halogenated flame retardants. Syntheses have been scaled up to the 4 kg scale. Tests designed to gage dispersibility and flame retardency in polyurethane are ongoing and compositions and process changes are being developed in order to improve both.



First year project results: Processum has visited Otaniemi to explore the possibilities together with VTT. Although the optimization of the laboratory processes is not yet complete Processum has initiated scale-up of DES-experiments. In total eight batches of steam exploded feathers have been shipped from Processum. Four batches have been shipped to VTT for further treatment such as fermentation and four batches have been sent to Fertiberia to be evaluated for slow release fertilizer properties.



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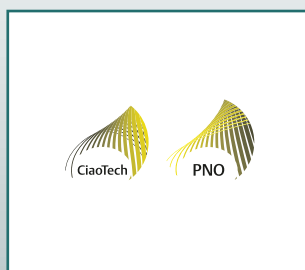
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For more info about the project visit the KaRMA2020 website at www.karma2020.eu or contact us: Project Coordinator Sarah Montes, smontes@cidetec.es



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