

KERA: Valorization of chicken feathers keratin towards new bio-based polymers

Kera project evaluated the feasibility of using renewable non-valorized keratin from chicken feathers for fabricating high value compostable injection molded parts and barrier films for packaging applications.

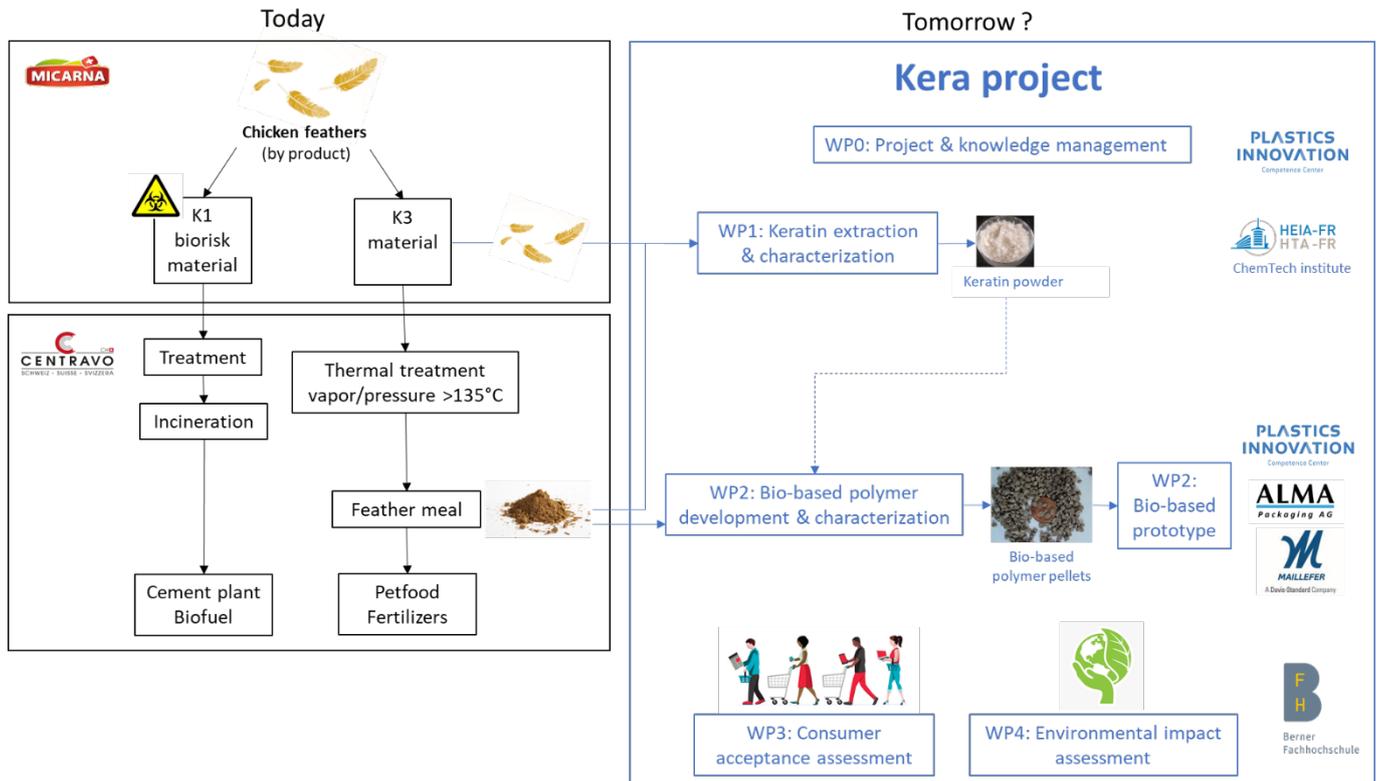
Context

In the European Union, around 15 million tons of poultry meat are transformed each year and this consumption is expected to increase in the coming years. Unfortunately, poultry industry generates huge amounts of waste (40% per chicken), including feathers which constitute 8-10% of chicken live weight and results in approximately 2.5 million tons of feather waste generated only in the European countries. This by-product is typically either converted into low-nutritional value animal feed or incinerated. Not only are these options unsustainable but they also miss an opportunity to contribute to the circular economy. With about ninety percent protein content (keratin), poultry feathers are potentially a rich and renewable source of protein. At present, the conversion and the use of the feathers as raw material in industrial applications are still very limited.

Objectives

The Kera project aimed to evaluate the feasibility of using renewable non-valorized keratin from chicken feathers for fabricating high value compostable injection molded parts and barrier films for packaging applications.

The project proposes an innovative alternative to fossil fuel-based plastics from a locally produced bio-feedstock with little commercial and nutritional value. It addresses the problem of wasting a protein, with valuable material properties, by incineration and aerobic decomposition as low value fertilizer, not to mention the associated greenhouse gas emissions.



Results

The use of feather meal being selected as a pathogen free feedstock of keratin posed several challenges. It was found that the processing of feathers into feather meal at elevated temperatures partially cross-linked the lipids and keratin as well as hydrolyzed components. Accordingly, it was difficult to extract pure keratin or process feather meal directly using conditions established in the art.

Nevertheless, feather meal can be used as a filler in combination with bio-based polyesters making very hard but brittle injection molded parts. The extracted keratin can be processed into a film but still contains cross-linked residuals (brown color and offensive odor).

The consumer study based on an on-line questionnaire addressing a diverse group of respondents indicated that there was no a priori concern raised towards the use of biomass from chicken feather for packaging applications.

The preliminary life cycle assessment indicated that the extraction using solvents is not recommendable and that the overall environmental impact is positive provided the processing is optimized (solvent free approach or water based) and scaled.

The KERA project was finalized in October 2021 and the generated knowledge is very valuable for a follow-up project starting from chicken feathers directly. Rudolf Koopmans, KERA project manager and PICC director added in conclusion “the vast amounts of biomass wasted including chicken feather are an important source of natural polymers that can replace non-renewable fossil-fuel based plastics. Moreover, and in the context of the urgent need to achieve a zero-emission carbon neutral economic system for the world, the present project leads the way towards a distributive and renewable sustainable economy from locally produced feedstock”.

Facts & Figures

Project Acronym	KERA
Number of partners	7
Research Area	Biomass valorization
Project Dates	Jan 2021 – Oct 2021
Project Cost	CHF 128'250
Project Funding	New Regional Policy of Canton Fribourg
Information	rudolf.koopmans@hefr.ch

Partners

