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## **COLLAMELT – COLLAGEN-BASED THERMOPLASTIC ADHESIVES AND SEALING MATERIALS FOR TE PAPER INDUSTRY**



### **ABSTRACT**

Paper-based packaging offers environmentally friendly and sustainable packaging solutions for a wide variety of goods. Thanks to its renewable raw materials and high recyclability, paper is an environmentally conscious alternative to many plastic-based options. The production of finished paper packaging often requires a series of processing and finishing steps, such as gluing and sealing the paper structure.

Adhesives, particularly hot-melt adhesives, are used in a wide range of applications due to their versatility and ease of use, especially in the field of cardboard packaging. Owing to their excellent properties and unrivalled value for money, conventional hot-melt adhesives are currently manufactured almost exclusively from petrochemical raw materials. Climate change and the finite nature of fossil raw materials make it essential for industry, policymakers and consumers alike to rethink their approach and replace these raw materials with bio-based materials. For example, recent research has shown that, by utilizing and modifying renewable raw materials such as starch, hot-melt adhesives can be developed that have a high bio-based content and are competitive with conventionally produced synthetic hot-melt adhesives in almost all key parameters. Besides starch however, there is a plethora of available biopolymers which are currently incurred as byproducts of industrial processes, and whose potential is currently underused. Hence, there is great potential in developing novel biobased adhesives for paper processing.

Collagen is the most common structural protein in the animal body. The main sources of collagen are the skin, but also tendons, bones and other animal tissues from cattle, pigs, horses and fish. These are produced in large quantities as by-products, for example in meat production. Although collagen is an easily available, technically versatile protein that has already established itself in numerous applications, it has not yet been investigated in the field of hot-melt adhesives and sealing materials. The reason for this is the lack of melt behavior. Intensive research in the field of collagen processing has led, among other things, to the development of thermoplastic collagens, which show great potential for use in hot-melt adhesives and sealing applications.

In the recently started research project Collamelt the PTS alongside the FILK are working to develop novel hot-melt adhesives and thermally bondable sealing materials based on collagen. The aspired hot-melts would be renewable, entirely of biological origin and could replace fossil based synthetic polymers as raw materials for adhesives and sealing materials. By exploiting the special properties of collagen, formulations suitable for both applications in the packaging sector are to be developed, and limits of use in terms of adhesive strength, adhesion and durability are to be identified. The extent to which the developed bio-based collagen adhesive or thermally bondable sealing material influences the recyclability of the associated substrates for the paper cycle will be investigated. For the production of the thermoplastic collagen, by products that were previously not or scarcely usable are utilized in the interests of efficient resource use; in other words, the hides that would otherwise be disposed of as waste are not primarily used for energy recovery (CO<sub>2</sub> emissions), but are instead returned to the recycling cycle.