Fraunhofer IFAM

Polymers from sustainable raw materials

Building blocks for a powerful circular economy

Resource-efficiency is increasingly becoming the focus of business and consumers. In this context the development of new sources of raw materials from residues and biogenic origin opens the way to climate-neutral economy. The use of CO_2 as a raw material is also being considered as an attractive alternative. The Fraunhofer IFAM supports companies in the implementation of climate-neutral processes by researching and developing of environmentally compatible polymers.

Environmentally compatible polymers

The development of polymers from up to 100 percent renewable or sustainably sourced raw materials enables applications in adhesives and potting compounds through to coatings and matrix resins. The approaches to replacing petrochemical raw materials and the development of new solutions are manifold and range from monomers and polymers to additives and catalysts. In addition to the increasing demand for biobased raw materials, recycling and knowledge of the degradation profile are continuously gaining in importance.

Competencies of Fraunhofer IFAM

- Practical, joint development of individual solutions and their utilization
- Development of new raw materials and formulations
- Opening new areas of application for potential raw materials
- Focus on industrial needs such as feasibility, recycling management, CO_2 reduction and economic efficiency

CO_2 as a raw material of the future

CO_2, along with other greenhouse gases, is of particular importance. One of the goals is to utilize it for monomers and polymers as a raw material. Currently, ways are being explored to use CO_2 as a building block for carbonates, urethanes and their conversion into polymers are being developed. This covers wide areas of the of the value chain. The particular focus here is on usability for industry, among other things, in terms of mild reaction conditions.

Re- and upcycling concepts

To transfer recyclable materials into cycles, concepts for recycling and upcycling processes are necessary. Using the example of PET residues, solutions are developed in an industrial context. This will result in synergies for the future of the individual establishment of new recycling concepts.

Lactose, hydroxyalkanoates and epoxidized oils as raw materials for adhesives and potting compounds

Lactose, hydroxyalkanoates, and plant-based epoxidized oils are classical raw materials suitable for the formation of adhesive resins. At Fraunhofer IFAM, research is being carried out into the correlation between the molecular structure of the raw material, polymer morphology, and the mechanical properties of the adhesive, thus providing the basis for the development of novel products in further areas of application. On this basis e.g. polyurethane-based potting compounds for electronics applications made from renewable raw materials can be developed.

Starch and protein-based adhesives

Plant proteins or proteins from waste streams of animal products, such as glutin, offer much potential as raw materials. The same applies to starch from corn, wheat or potatoes. Starch-based adhesives are used for bonding paper and to produce paper bags. For this purpose, the native starch is broken down and modified in industrial processes. In addition to starch, borax is added as an additive in the production, which is classified as a CMR substance "of very high concern". After its substitution by harmless crosslinking systems innovative borax-free Stein-Hall adhesives are about to be transferred to industrial practice. Starch in adhesive formulations for other applications such as wood bonding is also the subject of ongoing research work.

Chitosan as a coating additive

The polysaccharide chitosan is produced from the chitin of shellfish. Due to its chemical structure, it has antimicrobial and hemostatic properties and forms hydrogels. Fraunhofer IFAM is trying to make these attributes of chitosan technically usable and is conducting research antifouling coatings in particular.

Upgrading of lignin as a raw material

Lignin is an aromatic polymer that gives plants strength. It has a complex chemical structure and must first be made accessible for technical use through modification. Chemoenzymatic and chemomicrobial processes are combined for this purpose. By transforming standardized lignin starting materials, this raw material can be used in a wide variety of products. For example, the controlled depolymerization carried out at Fraunhofer IFAM enables it to be used as a primer in adhesives and paints.

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