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Increasing the use of biodegradable materials

Overview of biodegradable materials

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The polymers that are obtained from crops and the sea (plants and animals) are the ones most commonly used. Polysaccharides (cellulose, starch, and chitin) and proteins (casein, whey, collagen, and soy) are examples of commonly used biopolymers. These natural polymers can be utilized in different ways in the food industry. Polysaccharides have been the subject of the most intensive research, being used as materials for food packaging.

Different types of biomaterials are usually either combined with glass, metals, board and an assortment of fuel-based plastic polymers, or used as pure biomaterials for food packaging. These materials are applied in various combinations to provide unique properties which ensure safety and quality of packed food products from processing, through handling, storage and consumer use.

According to their origin and production method, biopolymers may be roughly divided into four fundamental classes:

- Class 1 - Biopolymers obtained by concentrating from biomass (polysaccharides, for instance, starch, pectin, chitosan and cellulose, etc., proteins, e.g. collagen, casein and gluten, etc.);
- Class 2 - Biopolymers obtained by usual chemical synthesis from bio-based monomers (polylactic acid and biopolyesters). The monomers themselves may be produced by fermentation of carbohydrates;
- Class 3 - Biopolymers produced by microorganism activity. The main representatives of this group mostly include polyhydroxyalkonoates (PHAs). However, materials based on bacterial cellulose are also in advancement;
- Class 4 - Biopolymers produced by chemical synthesis from both bio-derived monomers and petroleum-based monomers. These are polybutylene succinate (PBS), bio-based terephthalic acid (TPA) polytrimethylene terephthalate (PTT), bio-based PP and PE, etc.

TREND SOLUTIONS

USE OF BIODEGRADABLE MATERIALS

- **Biopolymers based on starch**

Starch is the most plenteous and ordinarily utilized renewable crude material.

- **Biopolymers based on cellulose**

A number of cellulose derivatives are produced commercially, most commonly carboxyl methyl cellulose (CMC), methyl cellulose (MC), ethyl cellulose (EC), hydroxyl ethyl cellulose (HEC), hydroxyl propyl cellulose (HPC).

- **Biopolymers based on chitosan**

Chitosan biopolymer films are strong and difficult to break, flexible, with mechanical properties similar to commercial petroleum-based polymers.

- **Polylactic (PLA) based biopolymers**

Polylactic acid (PLA) is a renewable, biodegradable thermoplastic polymer compatible with the human body. It is obtained from the polymerization of lactic acid, a chemical compound obtained from bacterial fermentation of polysaccharides or by chemical synthesis.

- **Polyhydroxyalkanoates (PHAs) biopolymers**

For food packaging applications such as those used for produce and meats, PHAs have moisture vapor barrier properties comparable to existing food-packaging materials such as polyethylene terephthalate and polypropylene.

The REINWASTE project tests new biodegradable and compostable materials with the aim to improve practices of inorganic waste handling in the food chain and to identify those new biodegradable and compostable materials that can replace the traditional plastics.

ADVANTAGES OF BIOPOLYMERS

Packaging is a system of preparing goods for transport, distribution, storage, retailing and end use. It is a means of safe delivery to the ultimate consumer at economic cost. There are basically three different kinds of packages categorized on the basis of their use, function, and containment. The need to replace the petroleum-based plastic with biopolymers is justified because producing conventional plastics consumes 65% more energy than producing biopolymers, conventional plastics are mostly toxic, plastics have a low decomposition rate and do huge damage to the environment. Therefore, unlike biopolymers, plastics are absolutely unsustainable. Biopolymers save 30%-80% of the greenhouse gas emissions and provide longer shelf-life than normal plastics.

REINWASTE ACTIONS

Monitoring of packaging materials

Monitoring the amount of waste and the methods of waste disposal is one of the conditions for maintaining a balance in nature. For Bosnia and Herzegovina and its neighboring countries, as well as for developing countries in general, it is important to take a systematic approach to addressing the problems of waste management.
Legislation needs to be refined to improve the way waste is stored by type.

Assistance and support to local producers

- Organizing trainings and working groups consisting of experts and representatives of local producers to contribute to the introduction of new materials across the country.
- Introducing new production technologies and incorporating them into the local and regional production processes.

Links to articles in relation with the subject

- Eva Pellicer, Danilo Nikolic, Jordi Sort, Maria Dolors Baró, Fatima Zivic, Nenad Grujovic, Radoslav Grujic, Svetlana Pelemis (editors of book); Advances in Applications of Industrial Biomaterials, ISBN 978-3-319-62766-3 ISBN 978-3-319-62767-0 (eBook) DOI 10.1007/978-3-319-62767-0, Springer Nature, Gewerbestrasse 11, 6330 Cham, Switzerland, 2017.
- Chapter 23 – Biodegradable Polymers, *https://www.sciencedirect.com/science/article/pii/B9780123983589000239*
- *Biodegradable polymers, https://www.toppr.com/guides/chemistry/polymers/biodegradable-polymers/*

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