Editorial

Biopolímeros y su aplicación en medio ambiente

Biopolymers and its aplication on environment

Sonia Ospina [*]

DOI: 10.15446/rev.colomb.biote.v17n2.54295

The use of disposable packaging has resulted in the world generating millions of tons of non-biodegradable waste. For many years, we have used non-degradable plastic packaging derived from petroleum. We have realized too late that if we continue at this rate of contamination, we will soon cause irreparable damage to the environment. Therefore, all efforts for finding alternatives to the use of non-biodegradable packaging are of great importance in order to recover the damage already caused to the environment, as well as preventing future harm. Consequently, research in different areas of biotechnology has permitted the creation of biodegradable packaging from microbial biopolymers.

As they are biodegradable, have environmentally-friendly manufacturing processes and have a wide range of application, biopolymers are important alternatives to unsustainable products and can be produced through biorefineries as part of integrated bioprocesses (1). The development of fermentation processes together with obtaining recombinant, over-producing microorganisms of this kind of compound, as well as progress in purification processes, has made it possible for different processes to be carried out on an industrial scale to obtain biopolymers.

Some of these compounds are the polyhydroxyalkanoates (PHAs) (2), which have been some of the most studied biodegradable polymers because of their good characteristics for producing packaging. These are intracellular biopolymers produced as inclusive bodies in microorganisms of genera including Pseudomonas and Azotobacter. They are thermoplastic, compatible and completely biodegradable compounds, which are enantiomerically pure, non toxic, insoluble in water, inert, stable in air, and present good processability in equipment. They also have potential use in orthopedics, in cardiovascular delivery systems, and in the production of microspheres for pharmaceutical delivery systems. However, the production processes still need to be improved to obtain competitive products on the market (3).

Other biopolymers that have been studied a lot are exopolysaccharides (EPS), which are extracellular polymeric substances. These are compounds excreted by some microorganisms such as Pseudomonas, Lactococcus and Bacillus, which participate in the microorganisms' adhesion to the surface, matrix formation, control of microbial physiology, and stability of sludge (4).

An interesting application of the use of EPS in bioremediation of the environment consists of its addition to the soil in order to control the soil's desertification. Its application has the potential effect of reducing soil erosion because of the increase in interparticle cohesion, as well as improvement in plant germination and the water retention characteristics of the soil against evaporation (4). Additionally, EPS have been used to increase the fixation of nitrogen in soil. Also, recent studies have demonstrated that the addition of biodiesel co-product (BCP), an organic complex formed during the transesterification of lipids, increases the transfer of EPS in the soil, improving the soil's nitrogen fixation (5).

Another recent application of biopolymers consists of the production of biodegradable, modified atmosphere packaging produced from polylactic acid. This is permeable for gases, permitting an increase in the shelf life of fresh fruits and vegetables, while maintaining features of freshness, color and aroma (6).

Another important source of contamination in modern society consists of the use of oils with different applications, which ultimately end up polluting the municipal water of the different cities (7). These oils have very diverse origins, from their use in food, to use in skincare products, lubricants and fuels. They can

* Departamento de Farmacia, Facultad de Ciencias, Instituto de Biotecnología, Universidad Nacional de Colombia. Sede Bogotá. saospinas@unal.edu.co

form emulsions when entering into contact with water, which is facilitated by the high concentration of surfactants present in different kinds of products. This makes it more difficult to separate them, increasing the water's level of contamination, because they are non-degradable products. Furthermore, many of the additives used in the production of processed products, such as emulsifiers, surfactants, inhibiting agents of corrosion and biocides, lose their lubricant properties and generate toxic waste. Therefore, different methods have been proposed to remove this kind of compound, which include adsorption, flocculation, electroflocculation, and electroflotation. One of these methods, adsorption, has been used to process some locally produced biopolymers, which makes it a cheap method for the decontamination of the water to separate the oil. These compounds include chitin (α-1-4 2- acetamido-2-deoxy δ–glucan), a component of the cuticles of crustaceans, insects and molluscs, as well as the cell wall of fungi. These compounds have been studied with the aim to remove oil from aqueous dispersions.

Biopolymers have also been used because of their flocculant activity. They consist of protein, carbohydrate or lipid, extracelluar biopolymers obtained from diverse microbial genera, which are used in water treatment, dredging, textiles and mining, among others. Their feature of biodegradability grants them advantages over other kinds of flocculant agents. They are obtained from different microbial genera (8).

A recently implemented application of biopolymers is the use of natural rubbers for the elimination of uranium from this industry's effluents. Rubber's capacity to trap toxic metals is very important in an environment increasingly more contaminated by this kind of compound (9).

As can be appreciated, there is a very wide range of application of biopolymers, because of their features of biodegradability and possibility of use in different processes. Therefore, studying and obtaining this kind of compound is important, and every day, we see the development of new products and new applications of these compounds.

References

(1) Sukan, A., Roy, I., & Keshavarz, T. (2015). Dual production of biopolymers from bacteria. *Carbohydrate polymers, 126*, 47-51.

(2) Moreno, N., Gutiérrez, I., Malagón, D., Grosso, V., Revelo, D., Suárez, D.,C, González, J, Aristizábal, F, Espinosa, A. & Montoya, D. (2007). Bioprospecting and characterization of poly-bhydroxyalkanoate (PHAs) producing bacteria isolated from Colombian sugarcane producing areas. *African Journal of Biotechnology*, *6*(13), 1536-1543.

(3) Leong, Y, Show, P, Ooi Ch, Ling, T, Lan, J. (2014). Current trends in polyhydroxyalkanoates (PHAs) biosynthesis: Insights from the recombinant *Escherichia coli*. *Journal of Biotechnology, 180*, 52-56

(4) Chang, I, Prasidhi, A, Im, J, Shin, H and Cho, G. (2015). Soil treatment using microbial biopolymers for anti-desertification purposes. *Geoderma, 253,* 39–47.

(5) Redmile-Gordon, M, Evershed, R, Kuhl, A, Armenise, E, White, R. Hirsch, P, Goulding, K and Brookes, P. (2015). Engineering soil organic matter quality: Biodiesel Co-Product (BCP) stimulates exudation of nitrogenous microbial biopolymers. *Geoderma*, *259–260*, 205-212.

(6) Mistriotis, a, Briassoulis, D, Giannoulis, A and D´Aquino S. (2016). Designs of biodegradable bio-based equilibrium modified atmosphere packaging (EMAP) for fresh fruits and vegetables by using micro-perforated poly-lactic (PLA) films. *Postharvest Biology and technology, 111,* 380-389.

(7) Elanchezhiyan, S, Sivasurian, N and Sankaran Meenakshi. (2014). Recovery of oil fromo oil-in-water emulsion using biopolymers by absorptive method. *International Journal of Biological Macromolecules*, *70, 399-407*.

(8) Salehizadeh, H and Yana, N. (2014). Recent advances in extracellular biopolymer flocculants. *Biotechnology Advances*, *32, 8*, *1506-1522.*

(9) Sashidhar, R, Kalaignana Selvi, S, Vinod, V, Kosuri, T, Raju, D and Karuna, R. (2015). Bioprospecting of gum kondagogu Cochlospermum gossypium for bioremediation of uranium (VI) from aqueous solution and synthetic nuclear power reactor effluents. *Journal of Environmental Radioactivity*, *148,* 33-41.