

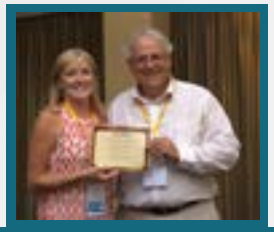


Posters

26th Global Congress on
Biotechnology
2nd World Biotechnology Congress
July 11-12, 2022
WEBINAR

Upcycling of Polyethylene terephthalate (PET) wastes to generate biodegradable bioplastics for food and drink packaging

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Plastic packaging is highly problematic for waste management and the environment; rates of littering and environmental leakage of plastics remain unacceptable. Polyethylene terephthalate (PET) is one of the primary plastics used in food and beverage packaging, around 19%. The sustainable management of these plastic wastes has become a challenging problem for the global society. There is a significant challenge to developing technologies to deal with the upcycling of plastics for food & drink packaging, transforming them into new materials or products of better quality. The European upPE-T project aims to turn plastic food and drink packaging waste into a valuable resource for making PHBV biodegradable bioplastics. To achieve this goal, we are working on developing biocatalytic degradation routes to break down one of the most commonly used packaging plastics: PET. PET wastes from post-consumer bottles were subjected to a combined treatment of heat plus quenching to decrease molecular weight and the crystallinity of PET and facilitate the enzymatic degradation by PET-degrading enzymes. PETase was produced in Escherichia coli, and differently treated PET samples were tested for enzymatic degradation, and PET samples with high degradation were identified. The resulting products from enzymatic PET degradation (mainly terephthalic acid, TPA) were used in fermentation strategies as feedstock to produce polyhydroxyalkanoates (PHAs), which are biodegradable bioplastics. The adapted protocol was successfully scaled up for the degradation of 150 g of PET. The upPE-T project has achieved the upcycling of PET wastes obtaining high-value products (biodegradable bioplastics) of applicability in different sectors.

Biography

Salvador García holds a degree in Biotechnology from the Faculty of Experimental Sciences of the University of Almería (Spain) and a MS in Biotechnology applied to Health and Sustainability. He is a specialist in the synthesis of biopolymers from bacteria and archaea. He is currently pursuing a PhD in the production of polyhydroxyalkanoates from different waste sources using halophilic microorganisms as cell factories to achieve a circular economy.

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Effective biologically active additives for animals based on compositions of α-tocopheryl acetate with micellar nanocarriers

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Encapsulation of biologically active substances, such as vitamins and antioxidants, into hydrophilic, biocompatible, and biodegradable nanocarriers is one of the possibilities for creating effective food additives for humans and animals. At the same time, the encapsulation processes make it possible to protect active agents from oxidation and rapid elimination from the body, thereby increasing their effectiveness. Current work is devoted to the development and research of non-toxic micellar nanocarriers based on diblock and triblock copolymers (DBCs and TBCs) with biocompatible and biodegradable polyethylene oxide and poly(acrylic acid) blocks for encapsulation and delivery of poorly soluble vitamin E and its analogs, in particular, α-tocopheryl acetate (α-TOCA), in animal organisms. DBCs and TBCs are intramolecular polycomplexes that form special micellar structures of the "cut" and "hairy" types with a complex "core" in aqueous solutions at pH <5. The special structure of DBC and TBC micelles, in particular, the ability of the complex “core” stabilized by a system of hydrogen bonds to self-adjust during drug encapsulation, pH-sensitivity of micelles turned out to be very effective for encapsulation of poorly soluble vitamin E and its analogs (Figure 1). The obtained compositions of -tocopheryl acetate with both types of micellar carriers showed high stability over time in a wide range of pH=3.5-9.0 and in physiological solution. However, in the case of “hairy” micelles, the developed “corona” of longer unbound segments of the polyacrylic acid block provided more reliable protection of the encapsulated drug molecules from the “salting out” effect. The composition of -tocopheryl acetate with given nanocarrier was tested in vivo on a group of sows as a dietary supplement. The positive effect of the micellar form of the drug on metabolic processes in sows, as well as on increasing the productivity of sows, stress resistance and safety of born piglets has been established.

Biography

Nataliya Permyakova graduated from the Faculty of Chemistry of Taras Shevchenko National University of Kyiv in the specialty of physical chemistry of polymers and colloids. From 1980 to 2018 she worked as the scientific researcher at the Department of Macromolecular Chemistry of Faculty of Chemistry, Kyiv National University. She defended of the PhD thesis on "Intermolecular polycomplexes formed by hydrogen bonds as new functional materials." Since 2019 and to the present, she works as the scientific researcher at the Department of Polymer Physics of the Institute of Macromolecular Chemistry of the NAS of Ukraine. Research direction and interests: design and research of physicochemical and functional properties of heteropolymers, polymer/inorganic hybrids and multicomponent systems, based on them, for nanotechnology, biomedicine, environment and agriculture, in particular, creation of micellar nanocarriers for drug delivery.

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