conferenceseries.com

Martin Koller, J Chem Eng Process Technol 2017, 8:4 (Suppl)
DOI: 10.4172/2157-7048-C1-005

JOINT EVENT ON
5th International Conference on Bioplastics
and
6th World Congress on Biopolymers
September 07-09, 2017 | Paris, France

Production of polyhydroxyalkanoate (PHA) biopolyesters based on food-industrial waste- and surplus materials

Martin Koller
University of Graz, Austria

Scope: Value-added conversion of *waste streams form food industry* towards microbial biopolyesters [poly(hydroxyalkanoates), (PHAs)], used as biodegradable "*green plastics*", is presented by two case studies: The utilization of lipid-rich waste fraction from *slaughtering and rendering industry* and of carbohydrate-rich waste from *dairy industry*. Process viability is demonstrated based on experimental results and economic appraisals, and by introducing strategies for the r*ecycling of waste streams* of the PHA production process itself.

Background: Our increasing demand for safe and convenient packaging materials and other plastics motivated mankind to produce more than 300 Mt annually of highly recalcitrant plastics, which are predominately based on limited fossil resources. Resulting piles of plastic waste, greenhouse gas emissions, global warming, together with the ongoing depletion of the fossil resources, provoked a tremendously dynamic "green plastic" market. Critically analysing various available "green plastics" often reveals severe shortcomings regarding the attributes "*biobased", "biodegradable", "compostable*", and "*biocompatible*" that "green plastics" have to fulfil according to valid regulations. In this context, the life cycle of PHAs, accumulated as microbial intracellular carbon- and energy reserves, justifies classifying them as "green plastics". They are based on renewable resources and undergo complete biodegradation during composting. Molecular composition and material performance of PHA are pre-defined in *statu nascendi* during biosynthesis. Chemically, PHAs encompass thermoplastic short chain length PHA (*scl*-PHA) and elastomeric medium chain length PHA (*mcl*-PHA). Possible fields of implementation encompass compostable packaging, medical and pharmaceutical formulations and items, biodegradable latexes, or nano-particles. Low-quality PHAs can be converted to chiral compounds, novel biofuels or other green energy carriers. PHAs must compete with their petro-chemical opponents both in terms of material performance AND economically. Up to now, PHA production resorts to expensive feedstocks of nutritional value, thus contributing to the current "plate-vs.-plastic" controversy. Switching to carbon-rich waste-streams of diverse industrial processes upgrades industrial waste streams, preserves food resources, and enhances the economics of PHA production.

Our Case Studies: Availability of suitable carbon-rich feedstocks defines the location of an envisaged PHA production facility. Processes developed in our recently performed R&D projects (acronyms *ANIMPOL* and *WHEYPOL*), financed by the EC, resort to abundantly available waste streams of the European food industry:

ANIMPOL project: Surplus lipids from slaughterhouses (annual quantities in Europe: 500,000 t) can be transesterificated to crude glycerol (CG) and fatty acid esters (FAEs, biodiesel). Saturated FAEs (SFAE) counteract the application of biodiesel as engine fuel, but can be converted to PHA. Integrating PHA production into existing biodiesel facilities, SFAE-based PHA can be produced at less than 2 €/kg. Both SFAE and CG constitute precious carbon sources for production of either thermoplastic scl-PHA or highly elastic, amorphous mcl-PHA. [3-5]

WHEYPOL project: In Europe, more than 14 Mt of surplus whey accrue at dairies every year, which causes growing environmental concern. Especially in Northern Italian regions, numerous huge dairy companies are located, which dispose of around 1 million litres of whey daily, often by simply pouring it into the sea. We profited from the fact that lactose, whey´s main carbohydrate, acts as substrate in various bioprocesses like PHA production, and used it to produce thermoplastic scl-PHA. Here, cost estimations suggest an already competitive production price below 3 €/kg [6].

Biography

Martin Koller is a Senior Researcher at University of Graz, Austria in the institute of Chemistry. He has his expertise and research in many areas like Biotechnology, Polymers, Poly(hydroxyalkanoate), Fermentations technology.

martin.koller@uni-graz.at