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Acidogenic valorization of food industry wastes for polyhydroxyalkanoate (PHA) biosynthesis

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A high variety of wastes/wastewater/surplus products from food industry are a promising source of organic matter (e.g. sugars) that can be valorized through biotechnological processes. Anaerobic acidogenesis converts these feed stocks into fermentation products (FP) with multiple applications, among which the production of polyhydroxyalkanoates (PHA) by mixed microbial cultures. The aim of this study was to examine acidogenic fermentation of twelve industrial wastes (including wastes or by-products of fruit, wine, beer and oil industries) for their potential as substrates for PHA production to be used in food packaging. It is known that the profiles of FP highly affect the properties of subsequently produced PHA, namely the proportion of HB (acetate, butyrate and ethanol): HV (propionate, valerate, and lactate) precursors. The physico-chemical characteristics of the feed stocks (organic matter, sugars, nutrients and solids) were analyzed, and batch tests were carried out to assess their acidogenesis potential. Based on these results and on estimated availability, seasonability and cost of each waste, the most promising feedstock (fruit processing waste) was further investigated. The latter studies were carried out in a continuous stirred tank reactor inoculated with sludge from a full scale anaerobic digester, to determine the operating conditions that maximize productivity and enable the manipulation of the FP profile. The FP stream was fed to a reactor containing a PHA accumulating mixed culture. The polymer produced was offline and online analyzed in terms of monomeric composition and physical/thermal properties determined. This study demonstrated that fruit pulp waste is a valuable feedstock for acidogenic fermentation, and that controlling the acidogenic reactor operational conditions (pH, OLR, HRT) it is possible to manipulate the acidogenic fermentation products in order to produce an appropriate proportion of HB/HV precursors for food packing applications.

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Biography

Maria A Reis has a PhD in Biochemical Engineering, and is Group Leader of the Biochemical Engineering Group at the Universidade Nova de Lisboa, Portugal. Her research area is Environmental/Industrial Bioengineering, with special focus on the development of sustainable bioprocesses for the removal of pollutants from water and wastewater streams, and for the exploitation of industrial wastes for the production of biopolymers. She is co-author of 4 National patents and 5 International patents. She has published over 200 papers in scientific journals, and she is presently Editor of Water Research.

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