Utilisation of food wastes and biodiesel industry by-products for Bacterial Cellulose production

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Abstract

Confectionery industries generate significant quantities of flour-rich waste streams produced either during processing or as end-of-date products returned from the market, while oilseed-based biodiesel production processes create large amounts of by-products (e.g. oilseed meals and crude glycerol). In this study, both streams (rich in carbohydrates, protein and various micro-nutrients) were utilized for the production of generic fermentation media through a two-stage bioprocess. Solid state fermentation (SSF) was employed for enzyme production that could convert the industrial side streams into nutrient-rich fermentation media for bacterial cellulose production.

Batch fermentations with the bacterial strain *Komagataeibacter sucrofermentans* DSM 15973 were initially carried out in synthetic media using commercial sugars and crude glycerol leading to bacterial cellulose concentrations of up to 4.9 g/L. The utilisation of hydrolysates from industrial side streams as the sole fermentation media resulted in bacterial cellulose production of around 13 g/L. The properties (i.e. water holding capacity, degree of polymerization, stress at break, viscosity and Young's modulus) and morphologies of bacterial celluloses developed when different fermentation media were utilized were determined. It was demonstrated that the utilization of industrial waste and by-products streams as the sole sources of nutrients leads to the production of bacterial cellulose with similar properties as those produced by commercial sources of nutrients.

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