INCREASING THE YIELD OF BACTERIAL CELLULOSE USING COFERMENTATION ON BREWING WASTE

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Abstract - Bacterial cellulose (BC) is a unique biomaterial that is inherently pure, unlike other biopolymers that require extraction and purification. BC fibers are an order of magnitude thinner than plant-based cellulose fibers. BC is a highly porous three-dimensional network. In addition, BC is a biodegradable, biocompatible, non-toxic and non-allergenic polymer. BC also has good elasticity, flexibility, plasticity, water absorption capacity and gas permeability. BC is an exceptionally versatile biomaterial and is of commercial interest due to its natural purity, biocompatibility and non-cytotoxicity. This study is aimed at investigating the possibility of using brewing industry wastes (autolysate of residual brewer's yeast) as a cheap nutrient medium for obtaining BC, as well as obtaining BC by co-fermentation of the Komagataeibacter xylinus MS2530 strain with yeast strains (Pichia fermentas 10169, Kluyveromyces marxianianus-10049, Candida stellata-10280, Candida kefyr-10035). Fermentation was carried out in Hestrin-Schramm (HS) medium and on autolysate of residual brewer's yeast (RBY) under static conditions at a temperature of 30 ° C, pH 5.5 for 5 days. The films obtained after fermentation were purified and then compared for the main parameters that arethe most important for the application of BC. Scanning electron microscopy, Fourier transform infrared spectroscopy, X-ray diffraction and differential scanning calorimetry studies were performed to compare BC obtained on autolysate of residual brewer's yeast and on HS medium. The results showed that BC obtained on autolysate of RBY had a typical cellulose structure, characteristic peaks of typical cellulose functional groups and crystal diffraction peaks of natural BC. Static co-fermentation of K. xylinus MS2530 with the K. marxianianus – 10049 strain on autolysate RBY resulted in an almost twofold increase in the BC yield (3.9 g/l) compared to the BC film obtained by fermentation of the K. xylinus MS2530 strain (2.0 g/l). The film obtained by co-fermentation demonstrated good tensile strength, water absorption capacity, as well as high thermal stability, high crystallinity compared to the film synthesized by the K. Xylinus MS2530 strain. As a result of the study, a method has been discovered for using autolysate of RBY as an environmentally friendly, inexpensive and highly productive nutrient medium for the production of BC. By using production waste, it is possible to reduce the costs of obtaining BC with improved characteristics, which will make it possible to impart new properties to BC through modifications with exogenous compounds and use it as a biopolymer matrix for various applications.

Keywords - Bacterial Cellulose, Komagataeibacter xylinus,Co-fermentation, Brewing Industry Wastes, Autolysate of Residual Brewer`s Yeast