Bacterial cellulose production utilizing Zante currants' side-streams: A preliminary novel biorefinery concept

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Abstract

The prospect of utilizing agro-industrial by-products and side-streams as carbon donators for the production of high value-added products, especially in the framework of an integrated biorefinery concept, is nowadays of industrial interest.

Zante currants' industrial production process leads to losses of >15%, while at the same time large amounts of water are wasted during the raisin washing procedure (more than 6 million liters, only in the case of Zante Cooperative). Those loses are currently directed, mostly, for fructose syrup or vinegar production. Nevertheless, these side streams, rich in assimilable carbon sources, micronutrients and phenolic compounds could be employed for the production of phenolics and BC, within the concept of a novel biorefinery.

Bacterial cellulose (BC), produced mainly via fermentative processes of *Acetobacter* species, is a highly functional biopolymer that can be produced from numerous carbon sources. Possessing properties such as high mechanical strength, high crystallinity, high water binding capacity and an ultra-fine and highly pure fiber network, BC can be applied in numerous sectors including pharmaceutical, broadcasting, food industry, paper manufacture and mining.

In the frame of that, the present study proposes the development of a novel biorefinery based on utilization of side-streams from raisin (Zante currants) processing industry. Zante currants were initially treated in order to obtain a sugar-rich and a phenolic-rich fraction. Mass balances of different extraction procedures were evaluated, in order to select the most appropriate scheme. Total phenolics and antioxidant activity index were determined in both cases. In addition, quantitative analyses by means of HPLC-DAD revealed that the main phenolics present in Zante currants were caffeic acid, ellagic acid, 4-hydroxybenzaldehyde, catechin and rutin, while homoprotocatechuic acid, epicatechin, vanillic acid and gallic acid have been also detected in lower concentrations. Subsequently, the sugar-rich stream has been utilized, in batch mode, for the fermentative production of BC, by the bacterial strain *Komagataeibacter sucrofermentans* DSM 15973. The obtained results showed that BC was efficiently produced, reaching higher concentrations than previous study, where synthetic fructose- and glucose-based media were used. To the best of our knowledge, BC production utilizing currants' production side-streams, has not been previously reported in literature.

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