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Developing a Process and Cost Model for Xanthan Biosynthesis from Bioethanol Production Waste Effluents

Authors : Bojana Ž. Bajić, Damjan G. Vučurović, Siniša N. Dodić, Jovana A. Grahovac, Jelena M. Dodić

Abstract : Biosynthesis of xanthan, a microbial polysaccharide produced by Xanthomonas campestris, is characterized by the possibility of using non-specific carbohydrate substrates, which means different waste effluents can be used as a basis for the production media. Potential raw material sources for xanthan production come from industries with large amounts of waste effluents that are rich in compounds necessary for microorganism growth and multiplication. Taking into account the amount of waste effluents generated by the bioethanol industry and the fact that it contains a high inorganic and organic load it is clear that they represent a potential environmental pollutants if not properly treated. For this reason, it is necessary to develop new technologies which use wastes and wastewaters of one industry as raw materials for another industry. The result is not only a new product, but also reduction of pollution and environmental protection. Biotechnological production of xanthan, which consists of using biocatalysts to convert the bioethanol waste effluents into a high-value product, presents a possibility for sustainable development. This research uses scientific software developed for the modeling of biotechnological processes in order to design a xanthan production plant from bioethanol production waste effluents as raw material. The model was developed using SuperPro Designer® by using input data such as the composition of raw materials and products, defining unit operations, utility consumptions, etc., while obtaining capital and operating costs and the revenues from products to create a baseline production plant model. Results from this baseline model can help in the development of novel biopolymer production technologies. Additionally, a detailed economic analysis showed that this process for converting waste effluents into a high value product is economically viable. Therefore, the proposed model represents a useful tool for scaling up the process from the laboratory or pilot plant to a working industrial scale plant.

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