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Sustainable Treatment of Vegetable Oil Industry Wastewaters by Xanthomonas campestris

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Abstract : Increasing industrialization as a response to the demands of the consumer society greatly exploits resources and generates large amounts of waste effluents in addition to the desired product. This means it is a priority to implement technologies with the maximum utilization of raw materials and energy, minimum generation of waste effluents and/or their recycling (secondary use). Considering the process conditions and the nature of the raw materials used by the vegetable oil industry, its wastewaters can be used as substrates for the biotechnological production which requires large amounts of water. This way the waste effluents of one branch of industry become raw materials for another branch which produces a new product while reducing wastewater pollution and thereby reducing negative environmental impacts. Vegetable oil production generates wastewaters during the process of rinsing oils and fats which contain mainly fatty acid pollutants. The vegetable oil industry generates large amounts of waste effluents, especially in the processes of degumming, deacidification, deodorization and neutralization. Wastewaters from the vegetable oil industry are generated during the whole year in significant amounts, based on the capacity of the vegetable oil production. There are no known alternative applications for these wastewaters as raw materials for the production of marketable products. Since the literature has no data on the potential negative impact of fatty acids on the metabolism of the bacterium Xanthomonas campestris, these wastewaters were considered as potential raw materials for the biotechnological production of xanthan. In this research, vegetable oil industry wastewaters were used as the basis for the cultivation media for xanthan production with Xanthomonas campestris ATCC 13951. Examining the process of biosynthesis of xanthan on vegetable oil industry wastewaters as the basis for the cultivation media was performed to obtain insight into the possibility of its use in the aforementioned biotechnological process. Additionally, it was important to experimentally determine the absence of substances that have an inhibitory effect on the metabolism of the production microorganism. Xanthan content, rheological parameters of the cultivation media, carbon conversion into xanthan and conversions of the most significant nutrients for biosynthesis (carbon, nitrogen and phosphorus sources) were determined as indicators of the success of biosynthesis. The obtained results show that biotechnological production of the biopolymer xanthan by bacterium Xanthomonas campestris on vegetable oil industry wastewaters based cultivation media simultaneously provides preservation of the environment and economic benefits which is a sustainable solution to the problem of wastewater treatment.

Keywords : biotechnology, sustainable bioprocess, vegetable oil industry wastewaters, Xanthomonas campestris
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