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Cultivation of the Microalgae Chlorella Sorokiniana in Various Agro-industrial Wastewaters and Characterization of Biomass Extracts for Bioactive Compounds

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Abstract

Agro-industrial wastewater are characterized by high concentrations of organic matter and nutrients while important differences are noticed on their characteristics depending on the type of industry and raw material. During the last decade considerable interest has been focused on utilizing microalgae to remove pollutants from various wastewater matrices. Previous studies have shown that the microalgae Chlorella sorokiniana achieves satisfactory removal of organic load and total nitrogen from several categories of wastewater. Additionally, it has been shown that the biomass produced is characterized by high nutritional and economic value as it contains several groups of bioactive compounds. Such as chlorophylls, carotenoids and phycobilins. This research investigated the cultivation of Chlorella sorokiniana in different types of agro-industrial wastewater originated from breweries, wineries, cheese, chili sauce and natural citrus juice production units. The collected agro-industrial wastewater were initially characterized for their physicochemical characteristics (pH, electrical conductivity) and major pollutants (COD, NH_4-N). Afterwards, four experiments were performed with Chlorella sorokiniana cultured under mixotrophic conditions, with or without the addition of a nitrogen source and with or without agitation. The duration of each experiment was 21 days (3 experimental cycles of 7 days duration each). The biomass collected at the end of the experiments was centrifuged, washed and lyophilized. The dried biomass was analyzed for protein content. In addition, the dry biomass was extracted with ethanol in an icy, ultrasound-assisted water bath. The extracts were characterized using high performance liquid chromatography with diode array detector (HPLC-DAD). The results show that Chlorella sorokiniana can grow efficiently in all types of wastewater used while a satisfactory removal of COD (up to 85%) was achieved. The protein content of collected biomass was measured up to 58%. Finally, the biomass grown in different types of wastewater was enriched with bioactive substances to different degrees.

Keywords: microalgae; wastewater; nutrient recovery

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