TITLE: MICROWAVE-ASSISTED ENZIMATIC MICROBIAL BIODIESEL PRODUCTION: SOYBEAN MOLASSES AS RAW MATERIAL FOR THE DEVELOPMENT OF A SUSTAINABLE BIOPROCESS

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ABSTRACT:

The feasibility of industrial synthesis of microbial bulk products relies on the general cost of the process. The cost of the cultivation substrate is often pointed out as a key factor in biotechnological process development. In microbial biodiesel production, the substrate represents nearly 70% of the total costs. Here, soybean molasses-based culture media was evaluated as substrate for *Mucor circinelloides* URM 4182 growth and lipid accumulation, and further biodiesel production of the extract lipid were performed by immobilized lipase, contributing to a fully sustainable and environmentally friendly process. Cultivations were carried out aerobically in a 1 L bioreactor at 26 ºC, 250 rpm for 120 h. Culture media consisted in soybean molasses diluted (40 g L^{-1} of total sugar content). Assisted-microwave extraction using ethanol as renewable solvent was applied and the obtained lipids were characterized by gas chromatography. Extracted lipids were submitted to transesterification using commercial immobilized lipase Novozym®435 at 60 ºC under microwave irradiation for 12 h. Biomass concentration of 6.5 ± 0.3 g L^{-1} were obtained, accumulating satisfactory lipid content (26.1 ± 0.4% wt.%). The lipids showed major composition of palmitic acid (C16:0, 31.20 wt.%) and oleic acid (C18:1, 13.72 wt.%) indicating similarity to vegetable oils and proper characteristics to be applied in biodiesel synthesis. Enzymatic produced biodiesel achieved 96.8 wt.% of ester content, which meet with international standards from ASTM and ANP. The results of this study suggested soybean molasses is a suitable raw material for microbial biodiesel production able to aid in the development of integrated industrial process in a biorefinery context, contributing to the establishment of a viable sustainable circular bioeconomy.

Keywords: Soybean molasses, biodiesel, enzymatic catalysis, microbial lipids, filamentous fungus.

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