Combining high-value biotechnological processes: from wastewaters bioremediation to bacterial bioenergy feedstock production

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The significant increase of global industrialization has been promoting the generation of large amounts of residues and wastewaters. In particular, oily wastewaters (contaminated with hydrocarbons) must be considered, since their disposal into the surrounding environments can represent a serious threat to several types of environmental resources. Simultaneously, the drastic depletion of fossil fuel resources demands for search of alternative feedstocks with environmental and economic advantages. Therefore, the production of bacterial lipids using inexpensive substrates, as wastes, has attracted much attention. Hydrocarbonoclastic bacteria are important players in bioremediation of hydrocarbon contaminated wastewaters with additional capacity for the accumulation of storage lipids such as triacylglycerols and wax esters [1, 2]. These compounds are relevant raw materials for biofuels and oleochemicals production. The present work aims at developing an indigenous hydrocarbonoclastic bacterial community able to produce storage lipids using a lubricant-rich wastewater and identify the influence of several cultivation parameters on storage compound accumulation. The obtained community was mainly composed by members of the genera *Rhodococcus*, *Acinetobacter* and *Pseudomonas* which are known for their ability to produce TAG, WE and PHA, respectively. In the applied conditions, the enriched community was able to fully degrade short chain hydrocarbons, while longer chain hydrocarbons were also degraded, but at a lower extent. By applying a five-level-three factor central composite circumscribed design based on surface response methodology it was found that nitrogen concentration and the interaction between carbon and nitrogen concentrations positively influenced neutral lipids production. Neutral lipids produced were essentially triacylglycerol (TAG) (33 % cdw), presenting a highly diversity of chemical structures composed by a narrow range of fatty acids. Therefore, the obtained mixed microbial community enriched in hydrocarbonoclastic and storage compound accumulating bacteria can be an effective inoculum to establish a more cost-effectively and ecofriendly biotechnological process combining valuable compounds production and treatment of hydrocarbon contaminated wastewater.

References

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