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PRODUCTION OF BIOPLASTIC FROM WASTE OILS BY RECOMBINANT *Escherichia coli*: A PIT-STOP IN WASTE FRYING OIL TO BIO-DIESEL CONVERSION RACE

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Abstract

Waste frying oil (WFO) is a complex and heterogeneous waste collected mainly from restaurants and, to a lesser extent, from food processors and households. In the last decades, interest for this waste has deeply grown and a strong competition in grabbing this raw material has begun. About 90% of WFOs collected in Europe is recycled for biodiesel production, being the high free fatty acids (FFAs) concentration in WFOs one of the main drawback limiting the yield of the conversion process. In this study we proposed a pit stop in the WFO to biodiesel conversion race by introducing an upstream microbial fermentation step aimed at reducing the FFAs content through its conversion into biopolymers, i.e. Polyhydroxyalkanoates (PHA). A properly engineered *Escherichia coli* strain, able to produce PHA exclusively from FFAs, but not secreting lipases, was tested in this process. Recombinant production of a near P(HHx) homopolymer was achieved in a process requiring an aqueous pretreatment step aimed to reduce the content of non-lipid carbon sources, which compete with FFAs for microbial growth impairing the PHA production. A WFO with a halved FFAs content was recovered after fermentation, thus rendering it more attractive for further conversion in biodiesel. Despite the quite low production yield achieved at this stage, the idea of no-competitiveness behind the process was verified, leaving space to further strain improvement strategies to boost PHA yield.

Key words: biodiesel, circular process, polyhydroxyalkanoates, FFAs reduction, WFO

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