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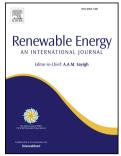
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1	A Closed Loop Biowaste to Biofuel Integrated Process Fed
2	with Waste Frying Oil, Organic Waste and Algal Biomass:
3	Feasibility at Pilot Scale
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11	ABSTRACT: Nowadays, the importance of recycle and energy savings is increasing due to the
12	current economic and environmental situation. Many different technologies were developed to
13	exploit biowaste to produce biofuels but they are not always easily available and economically
14	advantageous, especially at small scale. A possible solution could be to couple them in a closed
15	loop process. In this paper, we discuss the technological feasibility of a pilot plant producing
16	biofuels from waste frying oil, solid organic wastes and algal biomass. The crucial point of this
17	work is to the find the best layout and operative conditions in order to use organic wastes and by-
18	products in a closed loop process. The study is carried out through a complete experimental
19	campaign at both lab and pilot scale on the integrated process, consisting of three parts: I) biodiesel
20	and glycerol production by transesterification of waste frying oil added with oil extracted from algal
21	biomass; II) syngas production by gasification of biowaste, added with glycerol to increase the total
22	LCV; III) algal biomass production in airlift photo-bioreactors, fed by the recycled process
23	wastewater rich in glycerol, and capable of capturing carbon dioxide from flue gases and of
24	producing valuable biomass to be reintroduced in the process cycle. Waste oil and organic waste
25	were provided by the University Campus canteen and wood pellets were collected in the Campus
26	park. Quality levels of biodiesel cetane number ranged from 47.7 to 58.4 and LHVs ranged from
27	about 36080 kJ/kg to 36992 kJ/kg. A better syngas quality was found by adding glycerol, and flue
28	gas composition was suitable to partially feed the airlift reactors. On the basis of this first step of
29	experimentation, the technological feasibility of the proposed closed loop integrated process was
30	verified.

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