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Integrated processes for the optimal valorization of food processing by-products: The case study of Tunisia

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Food industry generates high amounts of solid wastes and high volumes of effluents with an organic component. These by-products result into significant disposal problems that require urgent solution to avoid serious environmental contamination. In Tunisia, two typical by-products are yearly generated in huge amounts from the agri-food industries such as olive mill wastewaters (OMW) and tomato pomace (TP). Biomethanation was tested with success to valorize OMW into biogas using different bioreactor concepts like jet-loop anaerobic membrane bioreactor and anaerobic filter. Moreover, in order to enhance biogas production efficiency, we have detoxified crude OMW after its catalytic oxidation. In fact, a process combining catalytic oxidation operated at 50°C for OMW detoxification followed by anaerobic digestion process may be a promising technology for continuous industrial depollution process. Up to tomato pomace, we have demonstrated that crude enzymes extract produced by solid state fermentation of Fusarium solani pisi on TP is a fruitful method for the enhancement of lycopene extraction. The best lycopene extraction yield was obtained under the following enzymatic pretreatment conditions: Extraction pH=8, extraction temperature=50°C, solid-to-crude enzymes solution ratio =1/30 (w/v) and particle size between 0.8 and 1.25 mm. Moreover, along with lycopene, other bioactive compounds were detected such as phenolic acids and flavonoids which may contribute to the antioxidant activity of the extract. Therefore, industrial biotechnology can offer effective strategies and tools for the re-utilization and valorization of by-products from the food industry, thus achieving a significant increase of environmental, social and economic sustainability for Tunisia.

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Studies on acid value reduction of neem seed oil and biodiesel production

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Biodiesel produced from a wide variety of vegetable oils is expected to replace diesel fuel. Conventional biodiesel production method from edible or non-edible type oils is alkaline transesterification. The conflict between food and fuel led to identify more than fifty non-edible oil sources for biodiesel production. Neem seed oil, one of the easily available non-edible oils, had undergone two step acid esterification processes to reduce the high free fatty acid (FFA) content from 23.08% to 0.53%. Acid esterification was carried out by 50% (v/v) methanol with 1% (v/v) sulphuric acid (H_2SO_4) as the acid catalyst at a temperature of 45±5°C in 1 hour reaction time. The oil separated from the first step was subsequently treated in the second step by 30% (v/v) methanol and 1% (v/v) H_2SO_4 with 1 hour reaction time, at the same temperature. The acid esterified oil was subjected to alkaline transesterification with 1:9 molar ratio of oil to methanol and 1.5 % (w/w) potassium hydroxide as the base catalyst at a temperature of 50±3°C with 40 minutes reaction time. The result obtained shows better biodiesel yield compared with many studies in literature.

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