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Extraction of Oil from Jatropha Seed Kernels: Optimization and Characterization

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Abstract : In this work, optimization of Jatropha seed oil extraction has been carried out using solvent extraction method accomplished in a Soxhlet apparatus with the aid of Design Expert. The effects of three factors (particle size, extraction temperature and extraction time) on the percentage yield of oil obtained from the seed kernels were considered. Using the Box-Behnken design approach of response surface methodology (RSM), seventeen experimental runs were generated. With n-hexane as the solvent, each experimental run was carried out in 250 ml Soxhlet extraction apparatus. The results obtained from the experiments together with the factors considered during the experiments were modelled and analysed by choosing a cubic model. The results obtained from the analysis of variance of the model developed for the percentage of oil yield as a function of particle size, extraction temperature and extraction time revealed the good representation of the system by the model because its square of correlation coefficient (R-squared) value was found to be 0.9956. Also, it was discovered that the model and all its terms were significant because their probability values (p-values) were discovered to be less than 0.05 that was chosen based on 95% confidence level. Comparing the results obtained from the physical and chemical analysis of the extracted oil with the available standards in the literature, it was seen that the liquid extracted from the seed kernels was actually Jatropha oil. Finally, the optimization of the extraction process carried out indicated 61.52%of oil yield could be attained if the particle is 0.62 mm, the extraction temperature is 52.13^{o}C and the extraction time is 4.06 hr. An experiment carried out using the optimum conditions estimated gave an oil yield of 60.46%. Thus, it can be concluded that Box-Behnken design based RSM has been used successfully in optimizing Jatropha oil extraction.
Keywords: Jatropha seed oil, extraction, Box-Behnken, response surface methodology, Design Expert.

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