A Comparison of Oil Extraction Methods

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Abstract

The time, cost, safety, and quality of oil, of an oil extraction method are important selection criteria in the oil industry. A detailed investigation of the relationship between extraction methods and product quality is therefore necessary. In this study, the extraction of oil from Njangsa (Ricinodendron heudelotii) seed was evaluated using three methods; the classical Folch method (FM), hexane extraction (HE), and enzyme-assisted extraction (EAE), and their influence on the recovery and quality of oil was determined by gravimetric analysis, free fatty acid (FFA) content, peroxide value (PV) and thiobarbituric acid (TBA) value assays. There were significant (P<0.05) differences between the extraction methods. The content of FFA and formation of peroxides were dependent on the extraction method, and the lowest TBA value was obtained by EAE.

Introduction

In recent years, there has been increased interest in plants that produce functional (health impacts) fatty acids [1]. Njangsa (Ricinodendron heudelotii) seed oil is unusually rich in polyunsaturated fatty acid (PUFA), which account for about 75% of the total fatty acids [2]. Njangsa is native to Central and West Africa. Njangsa seed with commercial levels of oil and PUFA would have potential as a high-value oil crop. Several conventional and emerging methods are available for oil extraction [3, 4]. However, the choice of method is often dictated by time, cost, and safety of the method and the yield and quality of oil extracted. To increase the industrial application and utilization of oil from Njangsa seed, extraction methods that result in high yields without compromising the quality of the extracted oil are required. The objectives of this study were to: 1) evaluate the extraction of oil from Njangsa seed using three methods, and 2) determine the quality of the oil extracted.

Materials and Methods

Njangsa seeds were obtained from a local African store in Smyrna, DE. All reagents were purchased from Sigma-Aldrich (St. Louis, MO).

Results & Discussions

The yield of Njangsa seed oil from the FM, HE, and EAE methods were: 19.99, 53.22 and 15.07%, respectively (Fig. 2). The result suggest that oil yield is dependent on the method of extraction.

Both the Folch and hexane extraction methods produced oils with higher PV (10 - 20 mEq/kg oil) compared to the EAE method (Fig. 2).

The TBA values of the oil extracted by the HE and FM were both 0.13 mg of malonaldehyde/kg oil. This is more than 4-fold higher than the TBA value from the EAE method (0.03 mg of malonaldehyde/kg oil) (Fig. 2). This indicates that there was comparably lower secondary oxidation during EAE.

Conclusion

Both the hexane and enzyme-assisted extraction (EAE) methods afforded simple extraction processes and recovery, whilst the Folch method was laborious and time-consuming. EAE and chloroform-methanol extraction (Folch method) recovered similar amount of oil, however the yields of these two methods were lower than hexane extraction (HE). Nonetheless, there was no exposure to toxic and potentially carcinogenic solvents in the EAE method. The quality of oil produced by the EAE method was found to be comparable or even superior to that obtained from the FM and HE methods, further demonstrating the viability of enzyme-assisted extraction.

References


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