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The Effect of Solvent on the Oil Yield of Treculia Africana Seed Flour

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***Abstract*— This paper looks at the extraction of oil from African Breadfruit (Treculia Africana) seeds using different solvents. The seeds were crushed into powder and the oil was extracted from the powder. The method of extraction employed was soxhlet (Solvent extraction method). The solvents used were Acetone, N-hexane, Ethanol, Petroleum Ether and Diethyl ether. The amount of oil extracted by each solvent was recorded and the % yield was calculated.Conc. Diethyl ether had the highest % yield of 15.02 while Ethanol had the lowest % yield of 0.2. Also there was a significant difference in the yield of oil extracted byDiethyl ether and Conc. Diethyl ether showing that the concentration of a particular solvent has an effect on the quantity of oil yield.**

***Index Terms*— Extraction, Solvent, Extracting Power, Seeds.**

I. INTRODUCTION

Treculia Africana (African breadfruit) is a tropical tree crop belonging to member of the Moraceae family and is a native of the East Indies [1]. It is a large tree which grows in wet and forest areas of tropical Africa; it is generally cultivated in the tropics and its tree could grow up to be 40-50 ft high [2]. The seeds from the fruit are edible and are of high nutritional values [3]. It has been estimated that the fruit may contain as much as 1,500 seeds [4]. It was originally seen as a tropical rain forest plant, but presently, it is a well-known source of food, grown in compound farms, village settlement, plantations in most rain forest region and part of the derived savannah areas of Southern Nigeria, Angola, Sudan, Senegal, Sao Tome [5]. The crop is always grown from the seeds which must be planted when fairly fresh as they lose viability in few weeks. The seeds of the African breadfruit are of high nutritional value, the fruit bears seeds which are coated with a hard endocarp and the seeds contain oil.

There are several methods to extract oil from seeds such as pressing, solvent extraction and supercritical fluid extraction [6]. Soxhlet (solvent) extraction is the standard technique where the fresh solvent contacts the sample frequently [7]. It is widely used technique because it is simple and easy to run. Extraction depends on the nature of the solvent and oil, contact time of sample with solvent, extraction temperature, particle size and solvent ratio. It is required to select a suitable solvent for the extraction of oil. Hexane is a widely used solvent in oil extraction due to its low boiling temperature and low corrosiveness [6], Apart from hexane, other polar and non-polar solvents used for the oil extraction are petroleum ether [8], ethyl ether [7], pentane, isopropanol, toluene, ethyl acetate, cyclohexane, acetone, chloroform, ethanol [9, 10, 11] and methanol [12]. But no detail data is available in the literature regarding oil extraction from castor seed with different solvents as well as their physico-chemical properties estimation. Therefore, the study has been conducted to compare the efficiency of oil extraction from castor seed by different solvents and their properties estimation.

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II. MATERIALS AND METHODS

A. *Sample Preparation*

The matured fruit head of the African breadfruit (Treculia Africana) was harvested from a nearby farm in Anambra State in Nigeria. It was allowed to ferment for 4-6 days. The seeds were selected mechanically, washed, parboiled for 10 minutes to soften the endocarp for easy removal and dried. The seeds were crushed, winnowed and milled into powder form.

B. *Oil Extraction*

Soxhlet extraction is recognized by the Association of Analytical Chemists (AOAC) as the standard method for crude fat analysis. Fat is extracted through repeated washing, or percolation, with an organic solvent under reflux in special glassware. Lipid extraction by Soxhlet is usually performed with polar solvents such as n-hexane. Since n-hexane is considered to be a hazardous air pollutant, interest in alternatives to n-hexane as an extraction solvent has been stimulated.

III. EXPERIMENT

The oil was extracted from 10 g seed flour samples in a Soxhlet AOAC (2000) with N-hexane, at 60^{o}C – 80^{o}C respectively. The solvent was recovered by distilling off at a temperature of 80^{o}C. The process is repeated for Acetone, Ethanol, Petroleum Ether and Diethyl Ether and Conc. of Diethyl Ether respectively. The percentage of oil content of the seed was calculated from the weight of oil and weight of sample. Oil yield was calculated based on the oil weight. The same method was followed for the extraction with other solvents.

$$\% \text{ Oil yield} = \frac{\text{Weight of Oil}}{\text{Weight of Sample}} \times 100 \quad (1)$$

IV. RESULT AND DISCUSSION

The oil extracted from the breadfruit seeds had a light yellow colour which may be due to the pigment extracted along with the oil. The odour of the oil is a characteristic of breadfruit and it resembles that of the seed. The oil remains liquid at room temperature and the oil content was given for the various solvents.

Table 1: Weight of Oil Extracted

Solvents	Weight of Oil Extracted (g)
Ethanol	0.02
N-hexane	0.56
Acetone	0.74
Petroleum Ether	1.05
Diethyl ether	1.5
Conc. Diethyl Ether	1.502

Using Equation 1 the percentage yield of the extracted oil is shown in Table 2.

Table2: Percentage of Oil Extracted %

Solvents	Percentage of Oil Extract %
Ethanol	0.2
N-hexane	5.6
Acetone	7.4
Petroleum Ether	10.5
Diethyl ether	15
Conc. Diethyl Ether	15.02

From Table 1, it is seen that the various extracting solvents yields different amount of oil. This is due to the extracting power of the solvent. Some solvents have high extracting power than others. This is shown in Fig. 1.

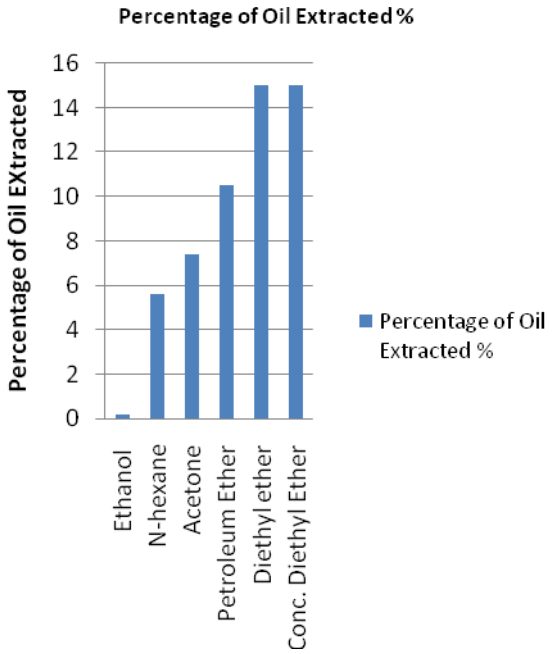

Figure 1: Effect of Solvent on the Oil yield of the Seed

From "Fig." 1 above there is a large difference that the amount of oil yielded by each of the extracting solvent differs. The difference between Diethyl ether and Conc. Diethyl Ether in terms of the oil yield showed that the concentration of a solvent has an effect on the yield of oil extracted.

V. CONCLUSION

From the result, it is evident that the choice and concentration of a solvent has an effect on the amount of oil extracted from the African Breadfruit seed; this is due the solvent power of the solvents. It could be recommended that an increase in the concentration of the solvent would yield a better volume of oil. This research also shows that vegetable oil industry could improve their process by choosing a solvent with high solvent power.

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