bacteria, yeasts and molds. This would explain the high degree of success in the topical use of the oil for treating such ailments as ringworm, keratoses (non-cancerous, wart-like skin growths), skin inflammation, abrasions, fungal-infected finger- and toenails, acne and chronic pruritus (itching). Generally, for these conditions the area involved is simply wrapped in cloth soaked with castor oil each night, or if the area is small enough, a castor oil soaked Band-Aid can be used. (For persistent infections and those finger- and toenails that have discolored and hardened, a good 10 to 20 minute soak in Epsom salts, prior to applying the castor oil, usually speeds up the healing process.). Castor oil's antimicrobial activity, while very impressive, comprises only a small part of the story concerning this mysterious oil. While castor oil has been thoroughly investigated for its industrial uses, only a minimal amount of research effort has been directed toward its medicinal benefits [7]. In Tanzania many old people indicated that they used the oil for lighting and softening the skin [9]. There are different varieties of castor seeds but on the average, they contain about 46.55 % oil by eight [10]. The rich oil content and its high quality suggest that the oil is suitable for commercial exploitation as an industrial raw material in various preparations such as in cosmetics and in paints [11]. Castor oil is one of the most useful plant oils. It is the source of a number of useful oleochemicals in addition to its application in Cosmetic and Polymer industries.

1.1 Varieties of Castor

Varieties of castor differ regarding the branching habits of the plant, colour of the stem, the branches and leaves, the nature of the capsule, the duration of maturity and the size of the seeds. Two varieties were found in northern Nigeria; the big seed variety the cultivated type and small seed variety which is the wild variety.

In this review an attempt was made to have insight at the chemistry of castor oil and its industrial potential for cosmetics production. Concise overview of literature reports favours a step for the development of an indigenous cultivation of the plant and better extraction methods for its seed oil that could substantially be used for cosmetic preparations.

**Keywords:** Castor bean, oil extraction, chemistry, soap, cosmetics.
1.2 Chemistry of Castor oil

This oil differs from all other commercial oils in being rich in ricinoleic acid (~90%, 12-hydroxyoleic). Compared with the common vegetable oils, castor oil is more viscous, less soluble in hexane, and more soluble in ethanol, all as a consequence of the presence of the hydroxy acid. This hydroxy acid has several interesting properties by which it can be converted to useful products

\[ \text{CH}_3(\text{CH})_2\text{CHOHCH}_2\text{CH}=\text{CH}(\text{CH})_2\text{COO ricinoleic acid (12-hydroxyoleic acid)} \]  

[12]. Sulfation converts the hydroxyl group to a sulfate (-\(\text{OSO}_2\text{OH}\)) with improved surfactant properties. Apart from soap, it is the earliest anionic surfactant (dating back to 1874) and is still used in textile processing, leather treatment, and as an additive for cutting oils and hydraulic fluids. The sulfated hydrogenated oil has the consistency of an ointment and gives adjustable viscosity to water-based formulations with excellent skin compatibility [3].

Dehydration of castor oil and of castor acids gives products enriched in diene acids, some with conjugated unsaturation. These products are valuable alternatives to drying oils such as tung oil. Hydrogenated castor oil and hydrogenated castor acids, with higher melting points than the nonhydrogenated material, are used in cosmetics, coatings, and greases. Greases prepared from tallow are much improved when salts of 12-hydroxystearic acid are added. Splitting ricinoleic acid with steam gives C7 and C11 products. This splitting process has been much improved by the development of a continuous steam cracking process. Heptanal is used in perfumes, and 10-undecenoic acid can be converted to a polyamide (Rilsan) while its salts show antifungal properties. Several new uses developed for these C7 and C11 compounds have been described [13]. The ester linkages, double bonds and hydroxyl groups in castor oil provide reaction sites for the preparation of many useful derivatives.

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Chemical composition

\[
\begin{align*}
\text{CH}_2=\text{CH}-\text{COO-R} & \quad \text{CH}_2=\text{CH}-\text{COO-R} \\
\text{CH}_3-\text{COO-R} & \quad \text{CH}_2=\text{COO-R} \\
\text{CH}_3-\text{COO-R} & \quad \text{CH}_2-\text{COO-R} \\
R & = \text{-(CH)}_2=\text{CH}=\text{CH}-\text{CH}=\text{CH}-\text{CH}(\text{CH})_2=\text{CH}_2 \\
R' & = \text{other fatty acid derivatives}
\end{align*}
\]

Fig 1.2a: Ester linkages in the structure of castor oil

Fig 1.2b: Equation showing the constitution of castor oil
1.3 Properties of Castor oil
Castor oil, like all other vegetable oils, has different physical and chemical properties that vary with the method of extraction. Cold-pressed castor oil has low acid value, low iodine value and a slightly higher saponification value than solvent-extracted oil, and it is lighter in colour. The chemistry of castor oil is centered on its high content of ricinoleic acid and the three points of functionality existing in the molecule. These are: (1) the carboxyl group which can provide a wide range of esterifications; (2) the single point of unsaturation which can be altered by hydrogenation or epoxidation or vulcanization; and (3) the hydroxyl group which can be acetylated or alkylated, may be removed by dehydration to increase the unsaturation of the compound to give a semi-drying oil. The hydroxyl position is so reactive the molecule can be split at that point by high-temperature pyrolysis and by caustic fusion to yield useful products of shorter chain length. The presence of hydroxyl group on castor oil adds extra stability to the oil and its derivatives [14].

2.0 PRODUCTION OF TRANSPARENT SOAP FROM CASTOR BEAN OIL
Production of transparent soap from an Indigenous Castor bean oil extracted using n-hexane solvent was reported. The soap solution prepared was yellow, transparent and completely soluble in distilled water [15]. The quality control parameters have shown that the seed oil is utilizable for soap production on industrial scale. The saponification value of the oil 123.3 ± 3.428 mg KOH/g obtained even though was lower than that of Terminalia catappa seed oil 207± 0.13 saponification index of use in the production of liquid soap, shampoos and lather shaving creams [16] but is higher than that of beeswax (93 mg KOH/g, [17] and shea nut fat [18] 136.32 ± 1.943 mg KOH/g which are commonly used in soap making. This indicates that the oil could be used in soap making since its saponification value falls within the range of these oils. Higher saponification justifies the usage of fat or oil for soap production. Iodine value of 76.93 ± 0.397 g I2/100 g (less than 100) was reported [15] which shows that the oil belongs to the class of Non-drying oils, which are completely soluble in distilled water [15]. The quality control parameters have shown that the seed oil is utilizable for soap production on industrial scale. The saponification value of the oil 123.3 ± 3.428 mg KOH/g obtained even though was lower than that of Terminalia catappa seed oil 207± 0.13 saponification index of use in the production of liquid soap, shampoos and lather shaving creams [16] but is higher than that of beeswax (93 mg KOH/g, [17] and shea nut fat [18] 136.32 ± 1.943 mg KOH/g which are commonly used in soap making. This indicates that the oil could be used in soap making since its saponification value falls within the range of these oils. Higher saponification justifies the usage of fat or oil for soap production. Iodine value of 76.93 ± 0.397 g I2/100 g (less than 100) was reported [15] which shows that the oil belongs to the class of Non-drying oils, which are completely soluble in distilled water [15].

Table 2.1: Quality characteristics of an indigenous castor bean oil

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saponification value mg KOH/g</td>
<td>123.3 ±3.428</td>
</tr>
<tr>
<td>Iodine value I2/100g</td>
<td>76.93 ± 0.397</td>
</tr>
<tr>
<td>Acid value mg KOH/g</td>
<td>2.39 ± 0.065</td>
</tr>
<tr>
<td>Oil yield (%)</td>
<td>42</td>
</tr>
<tr>
<td>Physical state at room temperature</td>
<td>Liquid</td>
</tr>
</tbody>
</table>

The values are the mean and standard deviation of triplicates determinations. Source: [15]

2.1. Justification for Cosmetic Applications
As stated earlier Castor oil is rich in very unique hydroxy fatty acid; ricinoleic acid C18 H34 O3, structurally as cis-12-hydroxysteic acid-9-enoic acid, 18-carbon hydroxylated fatty acid having 1 double bond.

The hydroxyl group provides additional functionality and polarity in a mid-chain position. Compared with common vegetable oils, castor oil is more viscous, less soluble in hexane, more soluble in ethanol, and is optically active. It can be converted to a range of interesting and useful materials [25]. Sulfation converts the hydroxyl group into a sulfate (-OSO3H) with improved surfactant properties. Hydrogenated castor oil and hydrogenated castor acids, with higher melting points than the nonhydrogenated material, are used in cosmetics [26]. The physical properties of castor oil, including high viscosity and miscibility with polar and nonpolar compounds, make it a widely used ingredient in cosmetics, such as lip-stick. Its noncomedogenic interaction with skin underlies its widespread application in skin creams. Salts of ricinoleate, zinc ricinoleate in particular, also have deodorant properties and are used in personal deodorant applications. Because of the midchain hydroxyl group in ricinoleate, soaps made from castor oil have very good emulsifying properties. Chemical modification of the hydroxyl group can be used to alter these properties. The first synthetic surfactant was the sulfated product of castor oil, known as Turkey Red Oil. It is still produced and is used in the tanning process, textile manufacture, and in cosmetic applications. Since it is completely soluble in water, it is an effective emulsifying agent for water immiscible substances. The hydrogenated form is solid and has no harmful effect on the skin, so it is used in skin creams as an emulsifying agent [25].

3.0 CONCLUSION
Conclusively, Castor seed oil appears to be a thick, golden viscous liquid which has gained popularity for its various applications especially its potential cosmetic application.

REFERENCES


