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Extraction of *Balanites aegyptiaca* Seed Oil and Its Application in Soap Production from the Wood Ash

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Abstract: Balanites Aegyptiaca also called desert date is a common plant, indigenous that grows in all dry lands including arid and semi-arids. The plant has been identified to have several uses such as in food and medicinal function. The plant is also known to be a source of oil. This oil can be used as a food or as a raw material in processing products such as soap. The research on the application this plant's oil in soap production from the wood material is underscored. Therefore, this study was aimed at extracting oil from the seeds of desert date and applying it in soap production from the wood ashes. The research was conducted in the laboratory. The moisture content of the seed before extracting oil was determined and was found to be 4.57%. The *Balanites aegyptiaca* was found to contain 41.25% of the seed oil. The soap was then made from the wood ash filtrate and the oil of the Balanites aegyptiaca seeds. This soap was tested by washing a dirty piece of cloth with it. It removed the dirt just like the soap made from sodium hydroxide solution. The research findings recommend that the rural communities should be trained and supplied with the possible technological equipment for processing Balanites aegyptiaca seed oil in order to improve their standard of living. It was also recommended that the trees such as acacia and Balanites aegyptiaca should be prevented from random cutting down.

Keywords: *Balanites aegyptiaca, Wood Ash, Soap Production, Oil Extraction from the Seeds.*

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I. INTRODUCTION

Balanites aegyptiaca (Thou or Thau in Dinka) is an indigenous tree to all dry lands south of Sahara and extends southwards (Sidiyene, 1996; Hall and Walker, 1991; Sands, 2001; Shanks, 1991). This indigenous tree is also found in Pakistan, India and Iran (Shankarnarayan and Amalraj, 1986). The tree is more likely the species with widest natural range that occurs in all zones except in very high altitudinal areas or when the rainfall exceeds 1100mm per year in Sudan (Badi et al., 1989) and in South Sudan especially in Bor Town. The tree is about one third of the total population of trees in central region of the Sudan (NRC, 2008). Over thousands of years, Balanites aegyptiaca had been used (Von Maydell, 1986). The fruit's fleshy pulp can be eaten dried or fresh. The fruit contains about 64-72% carbohydrates plus crude protein, ethanol, steroidal saponins, vitamin C and other minerals (Abu Al-Futuh, 1983). All the parts of Balanites aegyptiaca such as the roots, barks and the fruits have medicinal uses**.** The steroidal saponins is the most important one which yields diosgenin as a source of steroidal drugs which include sex hormones, corticosteroids and the contraceptives (FAO, 1985; and Farid et al., 2002). The seed of the Balanites aegyptiaca tree is considered to be extremely useful edible product. It has a high protein content and a good quality oil (Mohamed et al, 2002; Abu Al-Futuh, 1983). The humans use the debittered seed as snacks or nuts.

In western Sudan, the remaining cake is used as a feeding for animals and the extracted oil is used for many uses**.** During the dry and drought periods, both the seeds and the fruits are widely used in many countries including Sudan (Grosskinsky and Gullick, 2001), Nigeria (Lockett et al., 2000) and Ethiopia (Guinand and Lemessa, 2001).

Although, the plant has several importance, its application in soap making using wood ash has not been fully explored. Therefore, this research was aimed at extracting the oil from the seeds of Balanites aegyptiaca and applying it in the production of soap from the wood ash. The soap produced was then tested with a piece of dirty cloth.

II. MATERIALS

The seed kernels of a Balanites aegyptiaca were purchased from Marol Market – Bor in Jonglei State, South Sudan. Their mass was initially 1.4 kg before they were well dried. They later, after drying, weighed 1.35 kg. The ash was

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collected from the bakery at Dr. John Garang Memorial University of Science and Technology – Bor. The ash was weighed and its weight was recorded as 500g.

Fig 1 Desert Date Growing at Dr. JGMUST Main Campus (Photo by Thiong Achol Thiong)

III. METHODS

The methods in this research were as follows.

➢ *Preparation of the Ash Solution*

Some ash of mass 300 g was put in a 1000ml beaker and diluted with water. This mixture was left to stand for three days in the Chemistry laboratory. After three days, the mixture of ash and water was then filtered using Whatman Filter paper No.3 with a pore size 125mm and collected in a 500 ml conical flask.

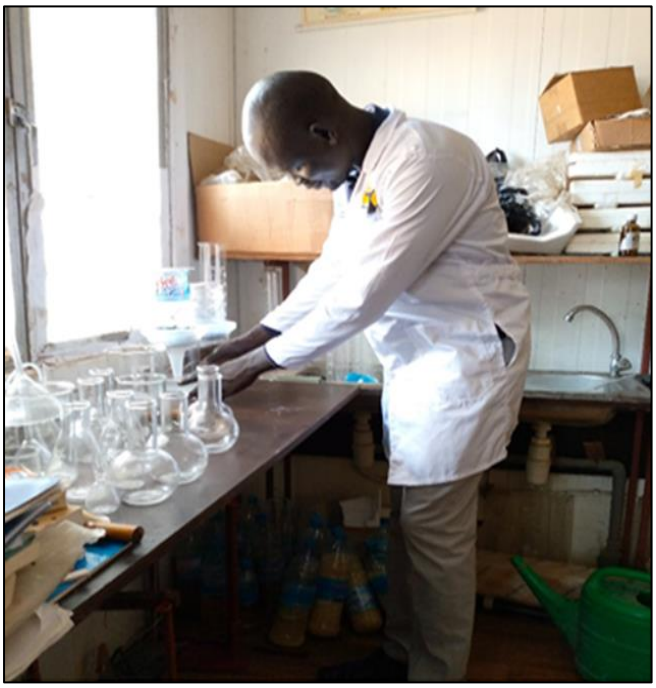

Fig 2 Filtration of Ash Solution in Progress (Photo by Daniel Majur Dum)

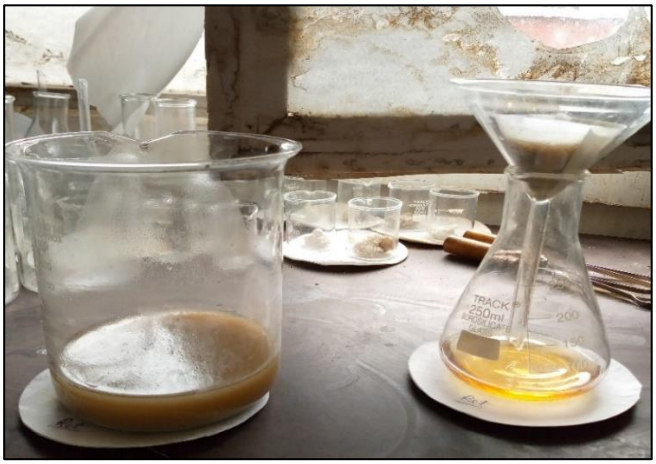

Fig 3 The Ash Filtrate Collected in the Conical Flask (Photo by Lueth Peter Reng)

➢ *Extraction of the Balanites aegyptiaca Seed Oil*

The moisture content of the seed kernels was determined by conventional method. The seed kernels were weighed before full drying and their weight was recorded as 1.4 kg. These seed kernels were placed outside the laboratory and dried for 6 hours of the day during a sunny day. They were later reweighed after 6 hours and their weight was recorded as 1.35 kg. Then, 1.35 kg seed kernels of the Balanites aegyptiaca were crushed into powder by use of a mortar and pestle. The crushed seed kernels were now ready for further extraction processes. After grinding, the powdered kernels were now mixed with water and boiled for about 30 minutes. The temperature was first constant at 75^0C within a duration of 14 minutes then at 95^0C for about 16 minutes. After boiling, the hot mixture was subjected to pre-separation whereby the solid particles were removed from the liquid components. The solid particles settled to the bottom leaving the liquid part up. This was separated by scooping the upper layer with a spoon. The scooped liquid was collected in four 500 ml separatory funnels. After pre-separation, the liquid mixture was allowed to cool in the separatory funnels for 16 hours in the laboratory. The cold mixture was separated by use of the separatory funnel. The oil was then collected in a container. The figures below show the extraction process.

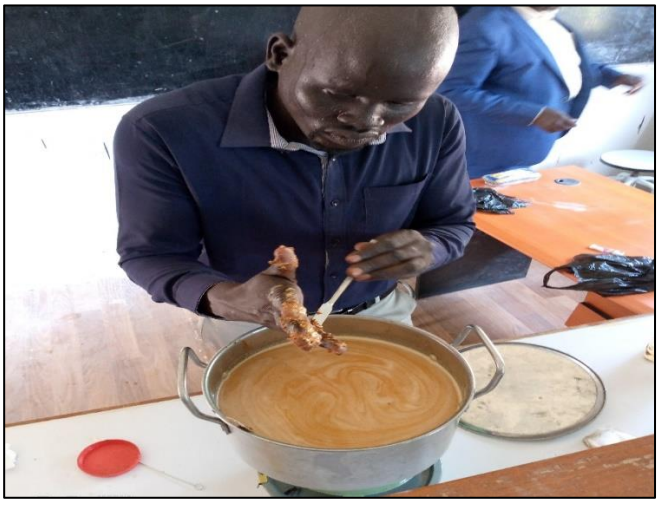

Fig 4 The Boiling of the Powdered Kernels as the First Step in Oil Extraction (Photo by Lual Abraham Deng)

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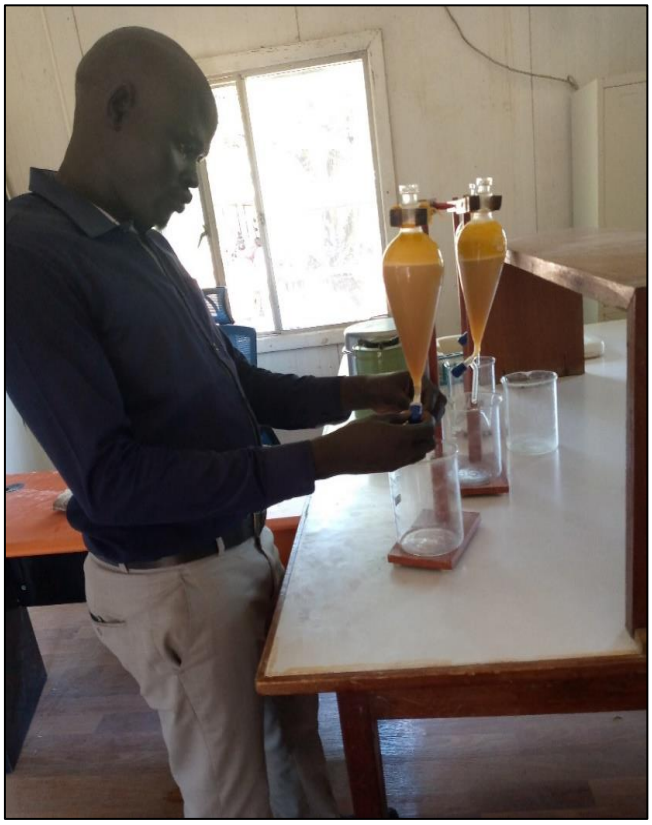

Fig 5 Separation of Oil from Water after Boiling
(Photo by Deng Manyang Anyieth)

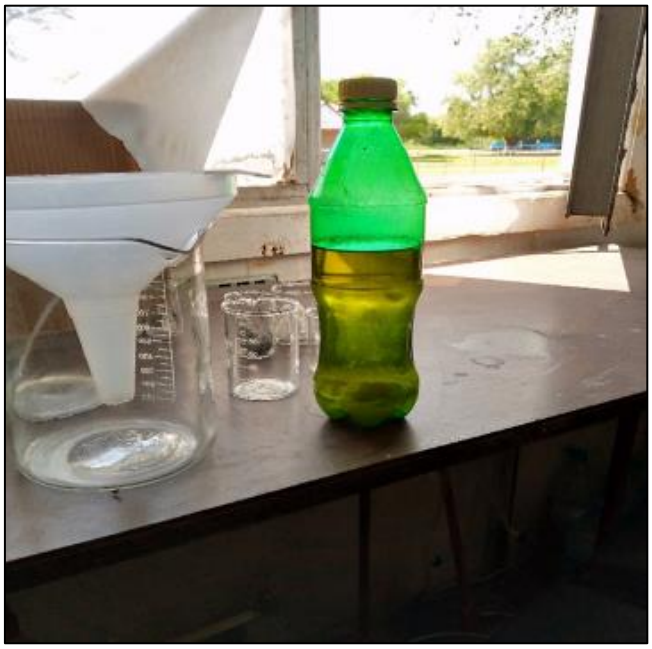

Fig 6 The Extracted Oil from the Seeds of *Balanites aegyptiaca* (Photo by Lin Yar Bol Riak)

➢ *Preparation of Soap.*

100 ml of oil was put in a flat-bottomed flask and heated to 100^0C. 150 ml of ash filtrate was gradually added with constant stirring until a viscous liquid was obtained. The white viscous liquid was transferred into a 500 ml beaker for cooling and drying. After drying for two days, the viscous liquid solidified. A control soap sample was prepared in which 100 ml of oil was put in a flat-bottomed flask and was boiled to 100^0C. 85 ml of 0.5M NaOH was gradually added until a complete saponification was achieved. The soap was transferred into 500 ml beaker for cooling and drying. The soap solidified after drying for two days.

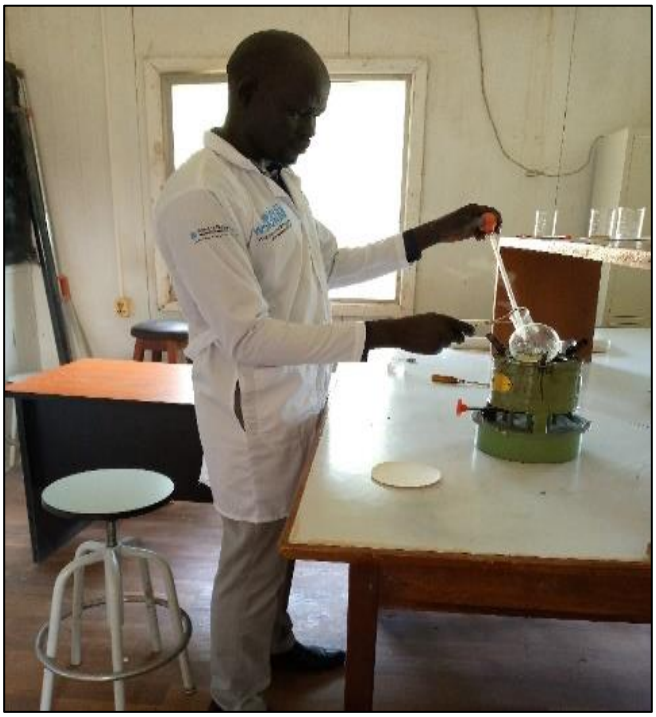

Fig 7 The Reaction between the Boiling oil and the Ash Filtrate as a Soap Production Step
(Photo by Ajah Deng Neka)

IV. RESULTS AND DISCUSSION

➢ *Moisture*

The moisture content of the Balanites aegyptiaca seeds was found to be 4.57%. This is slightly higher than the 3.10% reported by Babeker (2013) and Lohum (2012). The moisture content of the seed kernels was calculated as follows;

$$\text{Moisture content (\%)} = \frac{W1-W2}{W1} \times 100$$

$$= \frac{1.4-1.35}{1.4} \times 100 = 4.57\%$$

Where,

W_1 = weight of the seed kernels before drying
W_2 = weight of the seed kernels after drying

➢ *Oil Content of the Balanites aegyptiaca Seeds*

The oil content of the Balanites aegyptiaca seed was found to be 41.26%. This is slightly lower than 42.95%, according to the literature.

➢ *Soap Made from the Ash Filtrate.*

The soap made from the ash filtrate and the Balanites aegyptiaca seeds oil was white in colour and soft as shown in the figure 8 below. It was tested with a dirty piece of cloth. It removed the dirt just like the soap made from sodium hydroxide solution.

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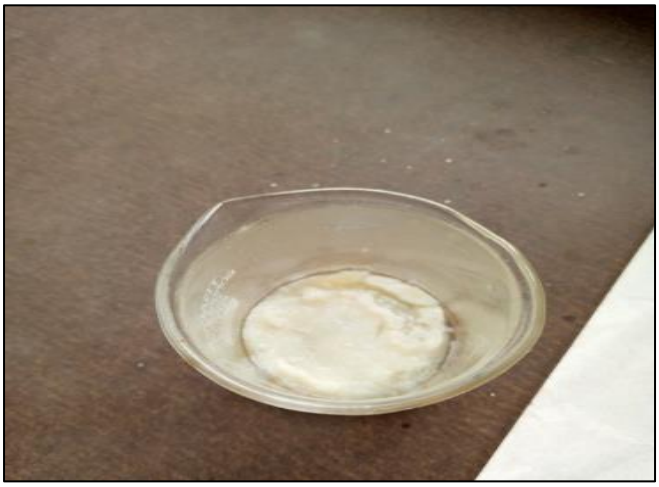

Fig 8 Soap Produced from the Desert Date Seeds Kernels and Wood Ash (Photo by Nyankiir Wal Toor)

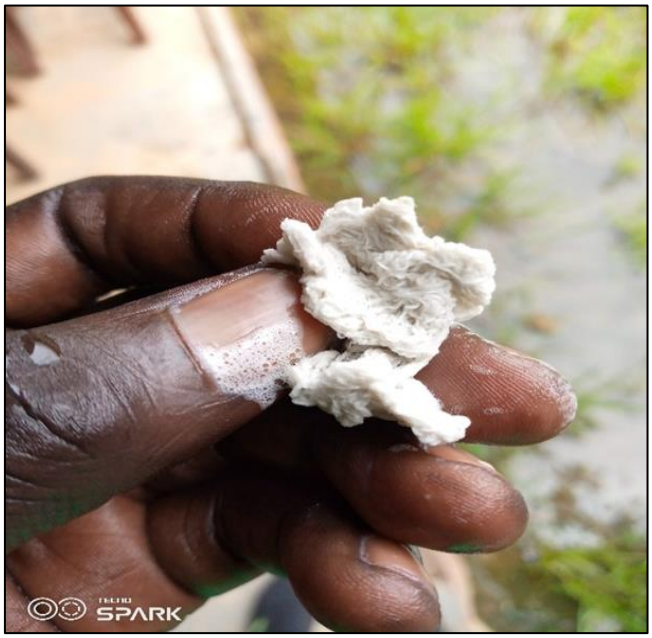

Fig 9 The Soap Action being Tested with a Piece of Dirty Cloth (Photo by Kech Bior Biok)

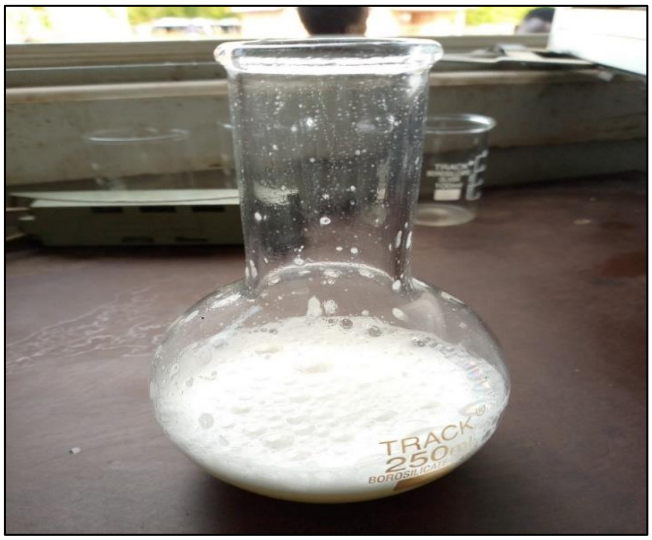

Fig 10 Foaming Action of the Soap (Photo by My wife Akoi Garang Thuch)

V. CONCLUSION

The results show that the Balanites aegyptiaca seeds have a high oil content of about 41.25%. This oil has a high saponification value, so it is a good source for making soap as shown by the result. The ash is a good source of the base for making soap as shown by the results. Therefore, cheap sources of making soap would involve using the available traditional sources of oil and base.

RECOMMENDATION

- The rural communities in Bor and parts of South Sudan should be trained and supplied with proper equipment and possible technology for the processing of Balanites aegyptiaca seed oil in order to improve their livelihoods through income generating money.
- The acacia variety of plants should be prevented from random cutting down as their ashes are a good source of the base for making soap and lotions.
- More studies should be conducted in order to determine the possible effects of a long term usage and consumption of the Balanites aegyptiaca oil.

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➢ *Conflict of Interest*

The authors have not any conflict of interest to disclose.

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