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Original article

Quantitative and qualitative assessment on the suitability of seed oil from water plant (*Trichilia emetica*) for soap making

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ABSTRACT

Despite widespread and its local available as a naturalized hedge and shade plant, the potential of *Trichilia emetica* was not utilized in soap making by the majority of local community in various parts of Dodoma, Tanzania. This study aimed to assess the quantity (yields) and quality (Acid Values (AVs), %Free Fatty Acids (%FFAs) and Saponification Values (SVs) of seed oil from water plant (*T. emetica*), suitable for soap making application. Solvent extraction method was used during oil extraction, where by 50gm of preheated and powdered seed materials were immersed in 250 ml of n-hexane in 1:5 (w/v) to dissolve the oil contained in the seed cake. The oil was collected by vaporizing solvent out through Rotary evaporation at 60 °C. Also standard titration methods were used to obtain SVs, AVs and %FFAs of the extracted oil. Results showed that *T. emetica* seeds contained higher quantity of oil (48.4%–50.2%) than many reported commercial plant seed oils. Also, the study found higher AV (7.4 mgKOH/g–7.8 mgKOH/g), %FFA (3.7% to 3.9%) and SVs (189.5 mgKOH/g – 191.4 mgKOH/g) than the maximum acceptable limits of 0.50 mg KOH/g, 0.020% and 175 mgKOH/g – 187 mgKOH/g prescribed by ASTM standards (2002). The obtained results showed that, *T. emetica* seeds yielded high oil quantity with low qualities due to higher levels of acidity. But high SVs guarantees the possibility of using *T. emetica* seed oil in soap making. However, the oil requires purification in order to bring levels of acidity to acceptable standards and guarantee its normal use in soap making.

1. Introduction

Soap is a salt of a compound known as fatty acid, or it is a chemical mixture of Na^+ or K^+ ions with fatty acids (Bahl and Arun, 2012). Soap is formed by saponification of a fat or oil. Each fat or oil is made up of a characteristic combination of different triglycerides (Bahl and Arun, 2012). In a triglyceride molecule, three fatty acid molecules are attached to one molecule of glycerin (Bailey's., 2005). There are many types of triglycerides; each type is made of its own specific combination of fatty acid (Bernecke and Maruška, 2013). Fatty acids are the components of fats and oils that are used in soap making. They are classified into saturated and unsaturated. But, the most abundant saturated fatty acids are palmitic and stearic acids, whereas the most abundant unsaturated fatty acids are oleic and linoleic acids (Bailey's, 2005; Tao, 2015). Unsaturated fatty acids are more prone to oxidation than saturated fatty acids, because they are less stable against oxidative rancidity due to possession of double bonds. Rancidity of oil is initiated by free radical reactions at the double bonds of unsaturated fatty acids (Tao, 2015). This process affect the quality of oil since, during oil rancidity, triglycerides are converted into fatty acids and glycerol, resulting to an increase in AVs which decreases cleansing action for soap (Nielsen, 2002). Also, as oil undergoes rancidification within double bonds, short chain fatty acids are produced. The short chain fatty acids can raise SV to unacceptable standards, hence affecting important attributes in soap making (Friedman and Wolf., 1996; Nielsen, 2002; Bernecke and Maruška, 2013). In plants, lipids are contained in fruits and seeds which are designated as oil (Umar, 2005). It was reported that, among 95% of all saponifiable raw materials used in making soaps are originated from plant oils (Betsy and Jilu et al., 2013). One among important oil yielding plants in Africa is *T. emetica*, commonly called "water plant" in Tanzania. It contains 3–6 shiny black seeds (1.4 cm – 1.8 cm) with a large fleshy scarlet or orange-red aril. Its seed oil is rich in essential fatty acid (palmitic, stearic, oleic and linoleic

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fatty acids) which can be used in the production of natural soaps (Orwa et al., 2009). Studies have shown that, whole seed yields of *T. emetica* is in a range between 58% – 68% (Adinew, 2014). Due to this ability, it can be considered as an alternative to other potential common oilseed bearing plants in Tanzania such as *Sesamum indicum* L. (sesame), *Persea americana* (avocado), *Prunus armeniaca* (apricot kernel), *Brassica napus* (rapeseed), (*Linum usitatissimum* (linseed), *Helianthus annuus* (sunflower) and *Elaeis guineensis* (palm) (Lubbe and Verpoorte, 2011; Adinew, 2014).

In Tanzania, Dodoma region in particular, *T. emetica* plants grow around home yards, along roads for protection, erosion control and being used as shade trees in gardens. This shows that the plant is abundant and naturalized locally in Tanzania. However, quantitative and qualitative studies on suitability of seed oil for soap making, are scarce. Furthermore, oilseed production in Tanzania is mainly focused on ground nuts (40%), sunflower (36%), sesame (15%), cotton (8%), palm oil (1%) etc., (RLDC, 2008). However, there were limited oil yield records (%) associated to soap production revealed by previous authors. Similarly, reported records (%) based on *T. emetica* seed oil yields are scant in Tanzania. Thus, the attention was given to the underutilized oilseeds from *T. emetica* trees grown in Dodoma region, where approximately 50% of farmers are engaged in oilseed production (RLDC, 2008).

Furthermore, most commercial soaps are produced with low quality due to the use of low quality oils that contain non-saponifiable fatty acids (Idoko et al., 2018). With unsaponified fatty acids, the quality of the produced soap could be lowered below the maximum accepted levels set by the international standard authorities for the quality soap. Therefore, the objective of the study was to assess the quantity (yield) and quality of seed oil from water plant (*T. emetica*), suitable for soap making in Dodoma Region, Tanzania. To achieve this objective, the quantity and quality of oil were determined in terms of yields and important quality parameters such as AVs, %FFAs and SVs.

2. Materials and methods

2.1. Description of the study Area.

The study was carried out at the CNMS, UDOM in Dodoma Region. The administrative City of Dodoma region is the city of Dodoma (Fig. 1) which lies between Latitudes 6.00° and 6.30° south, and Longitude 35.30° and 36.02° east. According to the 2012 population and housing census of the United Republic of Tanzania, Dodoma city had the total population of 410,956 people (Ringo, 2016). Most of this population is located within the urban capital city area and the rest is living in villages scattered around the capital city district. Dodoma city was selected as the study site because, it is experiencing rapid urbanization following the decision of the government to shift the administrative capital from Dar es Salaam to Dodoma. This is expected to cause an increase in the demands for oil and its usability in soap making. Also according to the Rural Livelihood Development Company (RLDC), the majority of farmers (about 50%) in Dodoma region are involved in oilseed production (RLDC, 2008). Thus making *T. emetica* seed oil to be one of the most useful plant seed oil for production of soap in Dodoma, Tanzania.

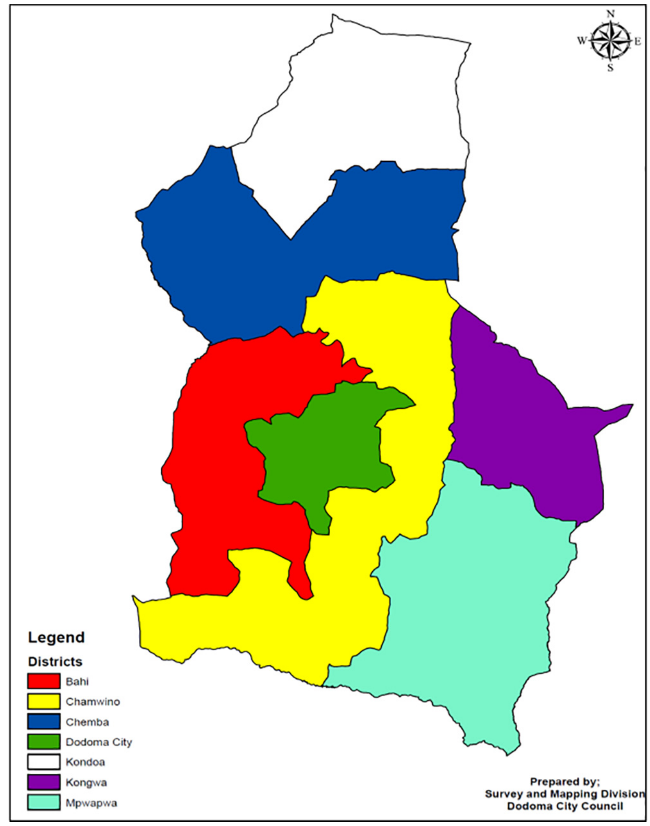

Fig. 1. Map of Dodoma Region Showing Dodoma City (Dodoma City Council, Survey and Mapping Division, 2019).

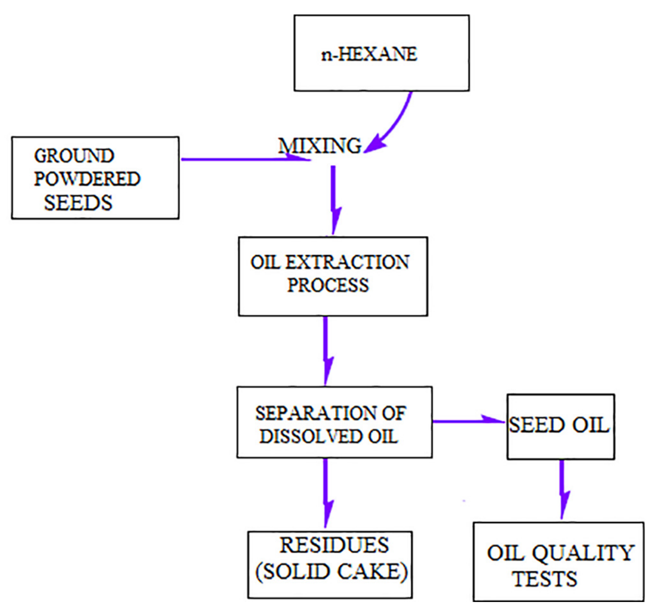

Fig. 2. Oil Extraction Flow Chart.

2.2. Seed collection and Pre-treatment

Oilseeds with husks (Plate 1) were randomly collected under *T. emetica* trees planted in areas around the UDOM compounds (Plate 2) between December and March 2018. After collection, they were packed in polythene bags and transported to the Chemistry laboratory at the CNMS at the UDOM. In the laboratory, pre-treatment of dry seeds was carried out, whereby dry husks were separated from seeds because husks have no use in the proposed experiment. Thus, seeds were obtained by physical peeling of dry husks. Then, seeds were thoroughly washed with running water to remove impurities and kept in sun light for further drying (Plate 3). During drying, clean dried seeds were periodically weighed until constant

Plate 1. *T. emetica* seeds containing husks.

Plate 2. *T. emetica* trees planted in areas around the CNMS, UDOM compound.

Plate 3. *T. emetica* seeds after removal of dry husks and kept in sun light for further drying.

weight was obtained and then stored in the laboratory for further analysis.

2.3. Extraction of oil from T. Emetica seeds

In the laboratory, 1000 gms of seeds were ground into powdered form using an electrical blender in order to increase surface area for oil extraction processes. Then triplicate 50gms of the powdered samples of seeds were extracted with 250mls of n-hexane using maceration method for 24hrs. During oil extraction process, further mixing of solvent with powdered sample was carried out using a Stuart SB162 heat-Stir. The sample residues, solvent and oil were separated using separating funnel. In that partitioning, oil fractions dissolved in solvent (n-hexane) while residues (Solid cakes) remained at the bottom (Plate 4). The solvent was recovered using rotavac evaporator (Plate 5) at 40 °C to give a yellowish oil which was collected in a previous weighed empty flask (Plate 6) and left to cool down for about 5 min before weighing the flasks again. Oil yield (g) was determined by subtracting the weight of the empty flask from the weight of the flask with oil and the obtained oil yields (all in g) was stored in a refrigerator at 4 °C for further use in the investigations. The procedures were repeated three times for each oil sample and the average weight (g) of oils were calculated before determining their percent yields. Fig. 2 shows oil extraction flow chart.

2.4. Determination of the percentage (%) oil yields

The obtained oil yields (g) were recorded, their averages were calculated and then the percentage (%) yield was calculated using equation (1) as follows;

$$\text{The percentage yield of oil}(\%) = \frac{\text{Weight of the Oil Extracts}}{\text{Dry Weight of the Sample}} * 100 \quad (1)$$

2.5. Determination of the quality of oil

The quality of oil were determined in terms of AV, %FFA and the SV as follows;

2.5.1. Determination of the acid value (AV)

The AV was determined by titrimetric method according to the methods by A.O.A.C, (1990). In this method, 2.0 g of *T. emetica* oil was weighed and then dissolved in a 50 mls of methanol. The mixture was shaken and then two drops of phenolphthalein solution

Plate 4. Separating Funnel Showing Oil with Solvents and Residues.

Plate 5. Rotavac Evaporator for Recovery of Solvent.

Plate 6. Recovered Yellowish Oil after Solvent Evaporation.

were added and agitated vigorously. Then, the mixture was further titrated with 0.1 M NaOH with vigorous shaking until a pink colour was observed which persisted for almost 30 s. The volume of sodium hydroxide titrant used was measured. Triplicate measurements were conducted for each oil sample and the AVs were calculated according to the following equation:

$$\text{The AV mg KOH/g of Oil} = \frac{V_{NaOH} \times 5.61}{W} * 100 \quad (2)$$

where, $V_{\mathbf{NaOH}}$ **=** Volume of sodium hydroxide titrant used (mL),
W **=** Weight of the oil being examined (g).

2.5.2. Determination of the percentage Free fatty acids (%FFAs)

The acidity is frequently expressed as %FFAs present in the oil sample. The %FFA in most of the oils and fats is calculated on the basis of oleic acid (A.O.A.C, 1990). Thus, in the present study, the %FFAs of *T. emetica* seed oil was calculated in triplicate on the basis of oleic acids for each oil sample using the equation (3) as follows:

$$\%\,\text{FFA in terms of Oleic acid, percent by mass} = \frac{28.2 \times VN}{M} \quad (3)$$

where,

V = Volume in ml of standard potassium hydroxide solution used,

N = Normality of standard potassium hydroxide solution, and

M = Mass in g of the oil sample considered for the test.

2.5.3. Determination of the Saponification value (SV)

The SV of *T. emetica* oil was determined according to the A.O.A.C, (1990) method. In this test method, 5 g of *T. emetica oil* was dissolved in 100 ml of (0.5 M) ethanolic potassium hydroxide and refluxed for 2 h. On cooling, three drops of phenolphthalein were added to the mixture and titrated with 1 M hydrochloric acid until the pinkish color disappeared. Each oil sample was treated in triplicate and then the average end point was used. The SV of samples were calculated using the equation (4) as follows:

$$\textit{Saponification Value (SV) of oil} \frac{56.1M(V_2 - V_1)}{W} \quad (4)$$

where,

Molarity of hydrochloric acid = **M**

Volume of hydrochloric acid used in test = $\mathbf{V_1}$

Volume of hydrochloric acid used in the blank = $\mathbf{V_2}$

Mass of oil (g) used in the test = **W**

Molecular weight of KOH (g/mole) = 56.1

3. Statistical analyses

The data obtained in this study were subjected to the Microsoft Excel 2010 software. Using descriptive statistics, they were calculated into averages and percentages and then presented using tables.

4. Results and discussion

4.1. Oil yields from T. Emetica seeds

Table 1 shows the percentage yield of *T. emetica* seed oil. From the obtained results, it was observed that the yield for *T. emetica* seed oil ranged from 48.4% to 50.2%. This indicates that, the *T. emetica* seeds are good sources of oil for soap making application. The extracted oils were observed with a characteristic yellowish in colour which were solid at room temperature.

Results of the present study compares very well with findings on a comparative study of the seed arils of *T. emetica* from Maputo, Mozambique which repoted oil yields from *T. emetica* seeds in a range between 42.2% and 53.8%. Their reported results are related to the *T. emetica* seed oil yields of 48.4% to 50.2% obtained in the present study with very slight variations. Such slight variations were possibly due to the variations in climatic and ecological conditions of the countries (Tanzania and Mozambiques) under which the studied *T. emetica* plants were grown (Amália et al,. 2016). Thus, those slight differences possibly affected oil yields from *T. emetica* plants resulted to slight differences in the results obtained. Also, the obtained yields results are higher than 14% – 35% reported on similar tree species by Saka and Msonthi, (1994), Adinew, (2014) and Orwa et al., (2009). Nevertheless, the obtained

Table 1
Oil Yields from *T. emetica* seeds.

S/N	Sample Type	Oil Yield (g) under Replicates			Average Yield (g)	% Yield (50 g on dry weight)
		R1	R2	R3		
1	Sample A	23.0	25.9	23.8	24.2	48.4
2	Sample B	23.8	25.0	25.9	24.9	49.7
3	Sample C	24.6	25.8	25.0	25.1	50.2

Oil sample type (A - C), reported in 3 replicates (R1, R2 and R3)

results are in agreement with the most common commercially grown seed oil content of castor (50%) and sesame (50%) seed oil and groundnut (46%), but greater than oil content of rapseed (37%), linseed oil (38%), palm kernel (36%), mustard (35%), sunflower (32%), palm fruit (20%), soybean (14%) and cotton seed (13%) (Bockisch, 1998; Agriculture Research Data Book, 2002; Adinew, 2014). Also, the current results are higher than oilseeds from *Canarium schwenfurthii* (36.1%) and *Jatropha curcas L* (30–40%) as reported by Nzikou et al., (2007) and Divakara et al., (2010) respectively. Because of high oil yields (48.4 to 50.2%) obtained in the present study, seeds from *T. emetica* trees can be excellent source of commercial oil for non-food uses in Dodoma, the central part of Tanzania where they thrive well.

Furthermore, high yields of oil from *T. emetica* in Dodoma (48.4 to 50.2%) could be possibly due to the fact that, the species has been described as being of warm, frost-free and low-altitude areas, with low rainfall (Grundy and Campbell, 1993). These suitable climatic conditions for proper growth of *T. emetica* relates to those of Dodoma city (semi-arid climate with warm temperatures and low precipitations) (Ringo, 2016). Despite the fact that Trichilia oil is wildly distributed and possibly being used in soap making industries in Swaziland, South Africa, Zimbabwe, Cameroon, Sudan and Uganda (Germishuizen and Meyer, 2003). But studies based on suitability in quality and quantity (yields) of oil from the study plant in soap manufacturing are scarce in Tanzania, especially in semi-arid areas like Dodoma City where *T. emetica* plant thrives well, and produces higher oil yields. The oil yielding attribute from *T. emetica* plants grown in Dodoma, Tanzania is higher than many reported commercially grown seed oils such as rapseed (37%), linseed oil (38%), palm kernel (36%), mustard (35%), sunflower (32%), palm fruit (20%), soybean (14%), cotton seed (13%) and *Jatropha curcas L* (30–40%) (Agriculture Research Data Book, 2002; Adinew, 2014; Divakara et al., (2010). Thus, Trichilia oil can be the most feasible and economically potential oil crop that can be used in soap-making industrial development than many other oil yielding candidates in Tanzania at present. Therefore, the obtained high oil yields from the studied *T. emetica* plant can be suitable for soap making applications and possibly used as a current alternative to replace the most commercial edible oils used for soap making in Tanzania.

4.2. Acid value (AV) of T. Emetica seed oil

AV is the weight of KOH in mg needed to neutralize the organic acids present in 1 g of oil, or a measure of FFAs present in the fat or oil (Amos et al., 2013). AV is used as a common parameter in the specification and quality control for oils and fats. It is also used as an indicator of physicochemical property of oil which is used to indicate the quality, age, edibility and suitability of oil for use in industries (Amos et al., 2013). Table 2 presents AVs of the extracted *T. emetica* seed Oil. In view of the results shown in Table 2, it was observed that the AV ranged from 7.4 mgKOH/g to 7.8 mgKOH/g. This AV was very high when compared with cashew nut oil (0.82 mg KOH g-1), refined (0.869 mg KOH g-1) and crude (1.148 mg KOH g-1) castor oil (Akpan et al., 2006; Aremu et al., 2008) as reported by Akintayo and Bayer (2002). Thus, all the oil samples under investigation have revealed higher AV values than the acceptable standard of below 0.50 mg KOH/g prescribed by the American Society for Testing and Materials (ASTM, 2002).

The observed higher AVs may be attributed to the presence of higher amount of FFA in the oil (Roger et al., 2010). According to Asuquo et al., (2012) and Anderson-Foster et al., (2012) a high AV means that an oil sample contains high FFAs. These increase its exposure to oxidative degradation, thus reducing its quality for industrial applications. Thus, the obtained oil needs to be refined to minimize acidity to the recommended standards in order to suit soap making industrial applications.

4.3. Percentage Free fatty acids (%FFAs) of T. Emetica seed oil

FFAs are fatty acids that are produced from triglycerides of oils by hydrolytic reactions in any of the steps of the process (Shahidi, 2005). FFAs content in oil is one of the most frequently used parameter to assess the quality of oil during oil production, storage and marketing and it is also used to classify the oils (Almeida et al. 2013). It was reported that higher FFA levels indicates a decrease in the quality of oil (Kirk and Sawyer, 1991). Table 3 presents %FFAs of the extracted *T. emetica* seed Oil. As can be seen in Table 3, the % FFA content ranged from 3.7% to 3.9% based on oleic acid. These %FFAs are higher than the acceptable limit of below 0.020% as prescribed by the American Society for Testing and Materials (ASTM) (2002). The obtained values were higher than those reported by Dorodo et al (2002) (3%). Also, higher %FFAs levels of seed plant oils were reported by Ankapong, (2010) for Palm Oil (5.05%), Palm kernel oil (4.81%), refined soybean oil (1.73%), unrefined soybean oil (3.51%) and *J.curcas* oil (4.76%) respectively.

The %FFAs in oils is an indicator of its overall quality. It was reported that, high value of %FFAs in oils is an indication of poor quality of the oil and could result from contamination with impurities that could cause the hydrolysis of the ester linkage thereby increasing the %FFA (Musa et al, 2012). However, low %FFA levels is an indication of good quality of the oil and eludes the oil from becoming rancid and odorous, thus, increases its suitability for use in soap making industry (Musa et al, 2012). Being an important indicator of oil quality, usually, fatty acids in oils are found in the triglyceride form particularly in most unrefined oils, but, during processing, the fatty acids may get hydrolyzed (react with water) into FFAs (Young and Zechner, 2013). This hydrolysis is possibly caused by different factors such as presence of high moisture content in the oil, elevated temperature (above room temperature) and, most important of all, lipase enzymes emanating from the source or contaminating microorganisms (Rajko et al., 2010). Long storage of the oil seeds before or after processing could also be responsible for hydrolysis and high FFAs of the oil. These observations were also verified by previous studies, which reported that unrefined oils usually have higher %FFAs resulting to a decrease in quality (Rajko et al., 2010).

Furthermore, high %FFAs levels of oil entails high degree of unsaturated fatty acids contained in oils. Unsaturated fatty acids

Table 2
AVs of T. emetica seed Oil from Dodoma, Tanzania.

S/N	Sample Type	AV (mgKOH/g)			Average AV in mgKOH/g
		R_1	R_2	R_3	
1	Sample AV_1	8.1	7.3	7.7	7.7
2	Sample AV_2	7.8	8.3	7.3	7.8
3	Sample AV_3	7.4	6.9	8.0	7.4

AV = Acid Value, reported in 3 replicates (R1, R2 and R3)

Table 3
%FFA of *T.emetica* seed Oil from Dodoma, Tanzania.

S/N	Sample Type	%FFA			Average %FFA
		R_1	R_2	R_3	
1	Sample FFA_1	4.1	3.7	3.9	3.9
2	Sample FFA_2	3.9	4.2	3.7	3.9
3	Sample FFA_3	3.7	3.5	4.0	3.7

FFA = Free Fatty Acid, reported in 3 replicates (R1, R2 and R3)

are largely more prone to oxidation than saturated fatty acids. These unsaturated fatty acids permit less stability of the oil against oxidative rancidity and can provide a shorter shelf-life of oil (Tamzid et al., 2007). These affect the quality of oil for industrial processes including soap making industries (Tamzid et al., 2007: Nwinuka and Barine, 2009: Roger et al., 2010). During industrial soap making processes, FFAs are converted into soap, thus it is important that industrial users know the amount of FFAs present in the oil (Muhammad et al., 2011). It is with these factors, the % FFAs and SVs of the extracted *T.emetica seed* oil were evaluated. Hence, in order to get suitable oil quality for the best industrial use, the fatty acid composition of the oil plays a key role (Knothe and Steidley, 2009). Thus, due to high FFA content of the *T. emetica* seed oil obtained in this study, the oil requires refining in order to minimize content acidity before being utilized in industries for soap making.

4.4. Saponification value

SV can be defined as the mg of KOH needed to saponify 1 g of oil or a measure of the alkali-reactive groups in fats and oil (Shahidi, 2005). SV specifies the molecular weights of fatty acids in oil, which is inversely proportional to the average molecular weight or chain length of the fatty acids (Muhammad et al., 2011). It has been reported to be one among important determinants in soap making industrial processes (Warra, 2013). Studies have shown that high SVs in oils suggest that, such oils are suitable raw materials in soap making industries while low values indicates non-suitability of oils for soap industrial use (Warra, 2013; Chibor et al., 2017). Table 4 presents SVs of the oil obtained from *T. emetica oil* seeds in this study. The obtained SVs are in the range from 189.5 mgKOH/g to 191.4 mgKOH/g. These values are above the specification range of (175 mgKOH/g −187 mgKOH/g) recommended for oils by ASTM, (2002).

Despite the fact that, the obtained SVs are higher than standard values set by ASTM, but they are lower than other values obtained from similar plant species (*T. emetica* oil) for studies conducted in Ghana (195.4 mg KOH/g) and Mozambique (197.3 mg KOH/g) (Grundy and Campbell, 1993; Vermaak et al., 2011). The values from this study are lower than those from the most common oils such as palm oil (200 mg KOH/g), groundnut oil (193 mg KOH/g) and coconut oil (257 mg KOH/g) reported by Kyari, (2008), but are higher than those from castor seed oil (185.83 mg KOH/g) reported by Akpan et al., (2006). According to Vermaak et al., (2011), high SV is an indication of the dominance of fatty acids of low molecular weight. Since the present study has reported higher SVs, it is clear that, *T. emetica* seed oil from Dodoma, Tanzania accumulates high low molecular weight fatty acids. Due to the fact that, the composition of %FFAs and SV in oil is higher than recommended standards, this affects oil quality. Therefore, *T. emetica* seed oil obtained in this study requires slight refining in order to bring acidity content and SV to recommended standards for efficient utilization as good quality feed-stocks in soap making industries.

5. Conclusion

T. emetica seeds contain high oil yields than the most commercially grown seed oils such as rapeseed oil, linseed oil, palm kernel oil, mustard oil, sunflower oil, and cotton seed oil. The obtained high oil yields and their suitability for soap making could be used as a current alternative in the replacement of the most commercial edible oils used for soap manufacturing in Tanzania, once quality characteristics are corrected to suit required standard limits. The obtained high SV and high oil quantity (yields) guarantee suitability of oil in soap making applications. But the highest amount of AVs, %FFA and SV of oil from *T. emetica* seeds indicates that such oil is of slightly low quality to suite its efficiency in soap making. Also, the high AVs and %FFAs obtained in oils of the study plant

Table 4
SVs of *T. emetica* seed Oil from Dodoma, Tanzania.

S/N	Sample Type	SV (mgKOH/g)			Average SVs
		R_1	R_2	R_3	
1	Sample SV_1	192.9	191.5	189.7	191.4
2	Sample SV_2	196.0	194.5	187.6	192.7
3	Sample SV_3	188.0	182.8	197.8	189.5

SV = Saponification value, reported in 3 replicates (R1, R2 and R3) suggest that, it is highly unsaturated and can undergo oxidative degradation, which is expected to reduce oil quality. Since, the studied oil quality variables (AV, %FFA and SV) of the *T. emetica* seeds were higher than the maximum permissible limits, which indicates low oil quality, thus it is imperative to purify the oil in order to make it suitable for soap making industrial applications. Finally, the study concludes that, *T. emetica* seeds oil obtained in Dodoma, once purified, can be an excellent source of oil to suit soap making applications to the local community surrounding Dodoma region in Tanzania.

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