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# Oil Quality Characteristics of *Cultivars Sinnensis* and *Citrullus Lanatus* Seed Oils

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## Abstract

Oil quality characteristics of *Cultivars sinnensis* and *Citrullus lanatus* seed oils were investigated using standard techniques. The physico-chemical analysis revealed the colour to be (yellow, reddish brown), specific gravity (0.92 ± 0.01, 0.94 ± 0.02), pH (3.88, 5.21), acid values (82.00 ± 2, 93.18 ± 1 mg KOH/ g), iodine values (108.00 ± 3, 103.61 ± 2 mg iodine/ g), peroxide values (22.84 ± 1, 30.00± 1.5meq/ kg) and saponification values (192.00 ± 1, 208.50 ± 3 mg KOH/g) respectively. These properties indicate that the oils will be very useful industrially for the manufacture of products such as paints, liquid soaps and shampoos. The four most abundant fatty acids were; C18:2ω6 > C18:1ω9 > C16:0 > C18 : 0 in the two oils. Unsaturated fatty acids predominated in the sample with adequate amounts of essential fatty acids.

*Key words:* physico-chemical, *Cultivars sinnensis, Citrullus lanatus*, fatty acids.

## Introduction

In addition to carbohydrates and proteins, fats and oils are the third main class of food type needed in human diet[1]. The main sources of fats and oils are diary products and meat, although most food contains some fats, some of the richer vegetable sources of dietary fats and oils are nuts and seeds, soya beans, olive and peanuts[2]. The main function of fats and oils in body is as energy reserve and for insulation. However, the ultimate success of utilizing fats and oils as ingredients depends largely upon the beneficial qualities they impart to foods, which depends largely on their properties as well as their fatty acid composition[3]. Recently, emphasis is being made about the way and manner in which edible fruit seed and non – edible ones which sometimes constitute environmental problems could be gainfully utilized[4]. In line with this, effort is being made towards the possibility of harnessing, converting and recycling these wasted seeds from edible fruits and those regarded as weeds (non – edible

ones) which are sources of fats and oils into industrial and domestic use[5].

The extraction and commercialization of these oils will reasonably enhance the profit status of most fruit juice making industries and encouraging the sustenance of cultivation of the seedling species of fruits. The present study is aimed at investigating the physico – chemical properties and fatty acids composition of sweet orange (*Cultivars sinnensis*) and water melon (*Citrullus lanatus*) seed oils found in Benue State of Nigeria. Such information will expand the scope of knowledge on the utilization and nutritional qualities of these seeds and more also the possibility of harnessing, converting and recycling these waste seeds for food and industrial use. In ethnomedicine, the leaves, stem, root, bark and oil from C. *sinnensis* is used in the treatment of fever,cold, typhoid fever, stomach ache, jaundice, sore-throat and as carminative, antipyretic and anti-helmintic[6]. Orange juice in addition to its vitamin values can be used to stop bleeding in women immediately after delivery as well in the removal of blockage in the urethra where there is urine retention in case of enlarge prostate cancer in men[7].

## Materials and Methods

*Collection and treatment of sample :*

Fresh *Cultivars sinnensis* were harvested during the month of December, 2012 from Aliade, Benue State, Nigeria and *Citrullus lanatus* was gotten from Makurdi, Benue State. The seeds were removed and opened manually. The seeds were sun - dried and dehulled. The dehulled seeds were milled using the laboratory Kenwood grain blender and stored in plastic container from where samples were taken for analysis.

*Extraction of oils :*

Approximately 1.0 kg of each seed sample was extracted by soxhlet using petroleum ether as solvent for 3 hours. The solvent was removed by simple distillation and the residual oils oven dried at 60°C for 1 hour according to Nwokonkwo[8]. The oils were allowed to cool in a dessicator before weighing and sealed in air tight containers for physico-chemical and G/C analysis.

*Physico –chemical properties determination:*

The physico – chemical determination of *Cultivars simensis* and *Citrullus lanatus* oils for specific gravity, acid value, iodine value, peroxide value, saponification and unsaponifiable matters were carried out according to the methods of AOAC [9]

*Fatty acid analysis :*

The fatty acid methyl ester (FAMES) as prepared by Aremu *et. al.*[10] was injected into Hewlett Packard (HP) 6890 GC powered with HP Chemstation Rev. AO 9.01 (1206) software, equipped with flame ionization detector (FID) at Multi Environmental Consultants LTD laboratory, Lagos. The column was packed with HP innowax (cross – linked P.E.S); 30.0m column length; 0.32 nm I.D; 0.50 μm film thickness. The column initial temperature was 60°C for 3 mins, later increased at the rate of 8°C/ min to 140°C, and maintained at this temperature of 140°C for 5 minutes and then increased to 250°C at 10°C/ min and

maintained constant for 10 minutes. Injector and detector temperatures were 230°C and 275°C respectively. The carrier gas, nitrogen was maintained at 30.0 psi, while hydrogen pressure was at 22 psi and compressor air pressure was also maintained at 28 psi. FAMES peaks were identified by comparison of their retention time with those of a standard mixture obtained from Sigma Chemical Company.

**Results and Discussion**

The results of some of the physico-chemical properties of *Cultivars sinnensis* and *Citrullus lanatus* are presented on Table 1 and 2. The colour of the oil was yellow and reddish brown respectively indicating the presence of carotenoids which are soluble in oils. Carotenoids are highly unsaturated hydrocarbons and when oils are hydrogenated, hydrogenation of the pigments also occurs with a reduction in color. A pH of 3.88 and 5.21 which showed a relatively high acidity. The specific gravity was 0.92 and 0.94 respectively, indicating that the oil is less dense than water and compared with cashew nut oils of 0.964[10].

Table 1 Some physico – chemical properties of *Cultivars sinnensis* seed oil

| Property | Result |
|---|---|
| Colour | Yellow |
| pH | 3.88 |
| Specific gravity (SG) | 0.92 ± 0.01 |
| Acid value (mg KOH/ g) | 8.20 ± 0.2 |
| Iodine value (mg iodine/ g) | 103.61 ± 1 |
| Peroxide value (mEq/ kg) | 12.80 ± .01 |
| Saponification value (mg KOH/ g) | 192 ± 4 |

Table 2. Some physico – chemical properties of *Citrullus lanatus* seed oil

| Property | Result |
|---|---|
| Color | Reddish brown |
| pH | 5.21 |
| Specific gravity (SG) | 0.94 ± 0.02 |
| Acid value (mg KOH/ g) | 9.31 ± 0. 1 |
| Iodine value (mg iodine/ g) | 108 ± 2 |
| Peroxide value (Meq/ kg) | 13.00 ± 1.5 |
| Saponification value (mg KOH/ g) | 208.50 ± 2 |

Meq = milliequivalent

The acid values were 82.00 and 93.18 mgKOH/g, which are higher when compared with 68.88 mgKOH/g for sponge luffa (*Luffa cylindrica*)[11] and 11.5 mgKOH/g for *Plukenetia corophora*[12]. Acid value is used as an indicator for edibility of an oil and suitability for use in the paints and soap industries[13]. The high acid value obtained for *Cultivars sinnensis* and *Citrullus lanatus* seed oils showed that the oils may not be too suitable for use as an edible oil, but however, be useful for production of paints, liquid soaps and shampoos[14].

The iodine values of 108.00 and 103.61 mg iodine/g respectively obtained for *Cultivars sinnensis* and *Citrullus lanatus* were higher than the values reported for *Citrullus vulgaris*[14]. The values however, placed cultivars *sinnensis* and *Citrullus lanatus* seeds oils in position in between the non-drying and semi-drying oils. By implication, the oils can easily be converted into semi-drying oil for use in the production of paints and vanish, while it may be used as non-drying oil in the lubricant industry. The value also shows high level of unsaturation and high susceptibility to oxidative rancidity[15]. Peroxide values of 22.0

Table 3 Relative fatty acid content (%) of *Cultivars sinnensis* seed oil

| Fatty acid | Concentration (%) |
|---|---|
| Caprylic acid (C8:0) | <0.01 |
| Capric acid (C10:0) | <0.01 |
| Lauric acid (C12:0) | <0.01 |
| Myristic acid (C14:0) | < 0.01 |
| Palmitic (C16:0) | 11.50 |
| Palmitoleic (C16:0) | 2.26 |
| Stearic (C18:0) | 6.95 |
| Oleic (C18:1ω9) | 34.77 |
| Linoleic (C18:2ω6) | 38.00 |
| Linolenic (C18:3ω3) | 3.75 |
| Arachidic (C20:0) | 0.57 |
| Behenic (C22:0) | 0.57 |
| Erucic (C22:1) | 0.88 |
| Lignoceric (C24:0) | 0.74 |
| Saturated fatty acids (SFA) | 22.63 |
| Monounsaturated fatty acids (MUFA) | 35.62 |
| Polyunsaturated fatty acids (PUFA) | 41.75 |
| ω6/ω3 | 10.13 |
| Oleic/ linolenic fatty acids (O/L) ratio | 0.92 |

Table 4 Relative fatty acid content (%) of *Citrullus lanatus* seed oil

| Fatty acid | Concentration (%) |
|---|---|
| Caprylic acid (C8:0) | <0.01 |
| Capric acid (C10:0) | <0.01 |
| Lauric acid (C12:0) | <0.01 |
| Myristic acid (C14:0) | < 0.01 |
| Palmitic (C16:0) | 17.71 |
| Palmitoleic (C16:0) | 1.49 |
| Stearic (C18:0) | 10.93 |
| Oleic (C18:1ω9) | 24.77 |
| Linoleic (C18:2ω6) | 38.04 |
| Linolenic (C18:3ω3) | 4.10 |
| Arachidic (C20:0) | 0.36 |
| Behenic (C22:0) | 0.65 |
| Erucic (C22:1) | 1.05 |
| Lignoceric (C24:0) | 0.88 |
| Saturated fatty acids (SFA) | 32.06 |
| Monounsaturated fatty acids (MUFA) | 25.82P |
| Polyunsaturated fatty acids (PUFA) | 42.14 |
| ω6/ω3 | 9.3 |
| Oleic/ linolenic fatty acids (O/L) ratio | 0.65 |

and 300 mEq kg were obtained for the seed oils respectively. Peroxide value is an indicator of deterioration of oils[16]. The WHO/ FAO[17] stipulated a permissible maximum peroxide level of not more than 10 milliequivalent of peroxide oxygen/ kg of the oils. Therefore, since the oils in the present study have peroxide value above 10, it may not be too suitable for consumption.

The saponification values obtained for C. *sinnensis* and C. *lanatus* seeds oils (192 and 208 mg KOH/ g) are higher when compared with the 106.6 mg KOH/g for *Persea gratesina*[16]. However, there are some vegetable oils with higher saponification value such as coconut oil (225 mg KOH/ g), palm kernel oil (247 mg KOH/g), butter fat (225 mgKOH/ g), Luffa cylindrica[10,11]. It has been reported by Pearson[18] that oils with high saponification values contain high proportion of lower fatty acids. Therefore, the value

obtained for the two oils indicate that the oils contained high fatty acids.

Table (3) and (4) shows the relative fatty acids composition of *Cultivars sinnensis*; 11.5% palmitic acid (C16:0), 6.95% stearic acid (C18:0), as major unsaturated fatty acids and 34.77% oleic acid (C18:1), 38.00% linoleic acid (C18:1) and 3.75% linoleic (C18:3) as major unsaturated fatty acids. Also, for *Citrullus lanatus*; 17.71% palmitic (C16:0), 10.93% stearic (C18:0) as major saturated fatty acids and 24.77 oleic acid (18:1), 38.04 linoleic and 4.10% linoleic (18.3) as major unsaturated fatty acids. Generally, the oils have higher percentage of unsaturated fatty acids; approximately 79.77% unsaturated (i.e. 38.02% for mono saturated and 41.75% for polysaturated) and 69.45% unsaturated (*i.e.* 27.31% monosaturated and 42.14% polysaturated fatty acids) for the two seed oils respectively. The highest concentration of fatty acids was linoleic acid (38.00 and 38.04 % respectively), these values compare favorably with result of *Cultivars sinnensis* (33.48%) obtained in Abakaliki[8], but lower than for Hausa melon flour and corn oil (55.7%)[19-20] and also lower than that for luffa cylindrical oil (32%)[11]. It has been established that relative to carbohydrates, the saturated fatty acids elevate serum cholesterol while the polyunsaturated fatty acids (PUFA) lowers serum cholesterol[21-22]. Linoleic and linolenic (PUFA) are the most important unsaturated essential fatty acids required for growth, physiological functions and body maintenance. These seed oils will participate well in these functions.

Omega 6 and 3 (ω6 and ω3) which are referred to as essential fatty acids have critical roles in membrane structure and as precursors or eicosanoids which are potent and highly reactive compounds[22]. The seed oils contain enough fatty acids as shown in Tables (3) and (4) (C18ω6 38%, C18ω3 3.75% and C18ω6 38.48%, C18É3 4.1% respectively). Moreover, the ω6/ ω3 ratio, which the WHO/FAO[17] recommends should not be higher than 10 in the diet, only *cultivar sinnensis* is Slightly above that value by 0.13.

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