

# Evaluation of Physico-Chemical Parameters and Anti-Microbial Studies of *Delonix regia* and *Piliostigma thonningii* Seed Oil

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**Abstract:-** *Delonix regia* leaves, roots, and seeds have been extensively used in the treatment of many diseases and ailments but only the immature seeds have been found edible because the mature seeds are reportedly toxic due to their anti-nutrient composition. The aim and objectives of this study are to check for the physicochemical parameters and antimicrobial activities of *Delonix regia* and *Piliostigma* seed oils. The seed samples of this study were collected from The Polytechnic, Ibadan, Oyo State, Nigeria and were carefully cleaned and were removed from the pods, thereafter, they were held with distilled-deionized water and thendried for seven days.

The Physicochemical characteristics of *Delonix regia* and *Piliostigma thonningii* oils were determined using standard methods. The parameter that were analyzed are saponification value, iodine value (VI), free fatty acid value, acid value and peroxide value (Table 1&2).

Inoculum of *Piliostigma. aeruginosa*, *K. oxytoca* and *E. coli* were prepared according to Kirby- methods. The specific gravity of *Delonix regia* oil was found to be 0.831 g/cm<sup>3</sup> and quite lower than that of *P. thonningii* Oil which was 0.942 g/cm<sup>3</sup> indicating that the oils from both seeds are less dense than water and also, peroxide values of 5.067±0.000 and 4.073±0.000, the saponification values were (122.428±1.805mgKOH/g) and (107.766±1.079 mgKOH/g) respectively. From this research finding, it is concluded that the seed oils of *Delonix. regia* and *Piliostigma. Thonningii* is of medicinally and industrially important. The oil could be used as a substitute for other oils or blended with other vegetable oils and hence the uses of these oils in industries should be encouraged.

**Keywords:-** Seed oils, Parameters, Physicochemical, Anti-microbial, Activities.

## I. INTRODUCTION

*Delonix regia* is a legume and belongs to the family Caesalpinaceae. It is a beautiful, semi deciduous tree known as flame of forest in Nigeria and grows to heights of about 18 meters. It can be easily propagated from seeds but take a long time to germinate. The fruits are long pods, which dangle from the branches and are green and flaccid when young and later

turn dark brown and hard when matured. On ripening, the mature fruit splits open into two halves revealing the elongated hard seeds. *Delonix regia* leaves and seeds have been reported to possess anti-inflammatory, anti-microbial, anti-ulcer and antioxidant properties. (Iravani, R., 2011). Pharmacological, phytochemical and proximate investigation of *Delonix regia* showed that it contains bioactive compounds and essential minerals. *Delonix regia* leaves, roots, and seeds have been extensively used in the treatment of many diseases and ailments but only the immature seeds have been found edible because the mature seeds are reportedly toxic due to their anti-nutrient composition(Rana, et al., 2014).Different parts of this plant are used in traditional medicine. Its bark and flowers extracts have been reported to have broad spectrum antibacterial, antifungal and anti-inflammatory properties. Phytochemicals such as anthocyanin, carotenoids, flavonol, and phenolic acids have been reported from the flower extracts of *Delonix regia* it also consists of fatty acids such as maristic, palmitic, stearic, oleic and linoleic acids have been found in its seeds oil(Jayakumar, P., Tan TK (2006).*Piliostigma. thonningii* is a leguminous plant belonging to the family Caesalpinaceae. It is commonly known as Camel's foot, Monkey bread, Rhodesian bauhinia and locally called "abefe"; "Kalo" and "Okpoatu" in Yoruba, Hausa and Igbo respectively in Nigeria (Jimoh, F.O, 2005). Various parts of *Piliostigma thonningii* have been used traditionally for the treatment and management of various diseases in humans and animals (Djuma, 2013). The bark is used in the management of cough, stomach infections, malaria, leprosy, sore throat and various forms of inflammation. The roots and twigs are used in treating fever, dysentery, snake bites, hookworms and skin infections, while the leaves decoctions possess antibacterial, antimicrobial and antioxidant activities and used as laxatives for children and for dressing wounds. Phytochemical screening of the genus *Piliostigma* revealed the presence of flavonoids, polyphenols and essential oils(Olanrewaju M.T 2015).The applications of seed oils are generally determined by their physicochemical properties and chemical compositions. Thus the uses of seed oils containing antimicrobial and antioxidants agents can increase the self-life of industrial foods products and fight against various microbial infections in addition to preventing oxidative stress related diseases. The bark is used in the management of cough, stomach infections, malaria, leprosy, sore throat and various forms of inflammation (Christman, 2004). The roots and twigs are used in treating fever, dysentery, snake bites, hookworms and skin infections, while the leaves

decoctions possess antibacterial, antimicrobial and antioxidant activities and used as laxatives for children .

➤ *Aim, scope and justification of this studies.*

The aim of this study is to check for the physicochemical parameters and antimicrobial activities of *Delonix regia* and *Piliostigma thonningii* seed oil. The scope is to find out the presence of physico-chemical and anti-microbial activities of *Delonix regia* and *Piliostigma* seed oil from The Polytechnic, Ibadan Oyo State, Nigeria and Justification is that they have been many research works and concentration on the phytochemical analysis of *Delonix regia* and *Piliostigma* seeds with little attention on the physicochemical parameters of the seed oil. This research concentrated more on physicochemical parameters and antimicrobial activities of *Delonix regia* and *Piliostigma* seed oil.

## II. MATERIALS AND METHODS

The seed samples of this study were collected from Senior Staff Quarters of The Polytechnic, Ibadan, Oyo State, Nigeria.

➤ *Seed Samples Pre-treatment*

Mature pods of *Delonix regia* and *Piliostigma thonningii* were collected from a tree within the premises of The Polytechnic, Ibadan (6.89°N, 3.02°E) between February and March, 2021. The collected plant seeds were cleaned thoroughly, the seeds were removed from the pods, and held with distilled-deionized water and then shade dried for seven days. The dried seeds were then pulverized using a blender, sieved and kept in an airtight container for further analysis.

➤ *The extraction of oil*

The extraction were done using American Oil Chemist's Society (AOCS; 2103) Methods.

## III. DISCUSSION

The parameters that were analysed are saponification value, iodine value (VI), free fatty acid value, acid value and peroxide value, colour, odour, initial weight and after, viscosity, pH and specific gravity.

Parameters.	1	2	3	Mean	SD	Mean±SD
Density (g/mL)	0.688	0.688	0.688	0.688	0.000	0.688±0.000
Specific Gravity	0.831	0.831	0.832	0.831	0.001	0.831±0.001
Refractive index	1.445	1.445	1.445	1.445	0.000	1.445±0.000
% Acid Value	0.940	0.940	0.940	0.940	0.000	0.940±0.000
Viscosity (mm <sup>2</sup> /s)	48.50	48.50	48.50	48.50	0.000	48.50±0.000
pH	6.88	6.88	6.88	6.88	0.000	6.88±0.000
Colour	Amber					
Odour	Sweet-smelling					
Iodine Value (g/100g)	50.678	50.678	50.678	50.678	0.000	50.678±0.000
Saponification Value (mg KOH/g oil)	120.344	123.44	123.5	122.428	1.805	122.428±1.805
Peroxide Value (meq/Kg)	5.067	5.067	5.067	5.067	0.000	5.067±0.000
% Free Fatty Acid	0.987	0.987	0.987	0.987	0.000	0.987±0.000

Table 1: Physico-chemical analysis of *Delonix regia* oil.

Parameters.	1	2	3	Mean	SD	Mean±SD
Density (g/mL)	0.721	0.721	0.721	0.721	0.000	0.721±0.000
Specific Gravity	0.942	0.942	0.942	0.942	0.000	0.942±0.000
Refractive index	1.445	1.445	1.445	1.445	0.000	1.445±0.000
% Acid Value	1.027	1.027	1.027	1.027	0.000	1.027±0.000
pH	6.02	6.02	6.02	6.02	0.000	6.02±0.000
Viscosity (mm <sup>2</sup> /s)	43.75	43.75	43.75	43.75	0.000	43.75±0.000
Odour	Repulsive					
Colour	Green					
Iodine Value (g/100g)	63.278	63.278	63.478	63.345	0.115	63.345±0.115
Sap Value (mg KOH/g oil)	108.444	108.333	106.522	107.766	1.079	107.766±1.079
Peroxide Value (meq/Kg)	4.073	4.073	4.073	4.073	0.000	4.073±0.000
% Free Fatty Acid	1.289	1.287	1.287	1.288	0.001	1.288±0.001

Table 2: Physico-chemical parameters of *Piliostigma thonningii* seed oil.

Extract	<i>E. coli</i>	<i>P. aeruginosa</i>	<i>K. oxytoca</i>
<i>Delonix regia</i> oil	0.00 mm	13.0 mm	8.00 mm
<i>Piliostigma thonningii</i> oil	0.00 mm	9.0mm	10.5 mm

Table 3: Anti-microbial test of *Delonix regia* Oil and *Piliostigma thonningii* Oil

From the results, there are variation in the value of the determined parameters of the extracted oils. The density value of *Delonix regia* seed oil was 0.688 kg/m<sup>3</sup> which is a bit lower than that of *Piliostigma thonningii* 0.721. The specific gravity of *Delonix regia* oil was found to be 0.831 g/cm<sup>3</sup> and quite lower to *Piliostigma thonningii* oil 0.942 g/cm<sup>3</sup>, this indicated that both oils are less dense than water and seem to indicate that no heavy elements are present in them.

The Peroxide values of 5.067±0.000 and 4.073±0.000 were obtained for *Delonix regia* and *Piliostigma thonningii* oil respectively, the oil of *Delonix regia* had higher peroxide value than *Piliostigma* seed; Peroxide value is an indication of deterioration of oils, oil with higher peroxide value is more unsaturated than those with lower peroxide value, more unsaturated oil is known to absorb more oxygen and develop higher peroxide value, oil with higher peroxide value is prone to rancidity. The WHO/FAO stipulated a permitted maximum peroxide level of oil not more than 10M equivalent of peroxide oxygen/Kg of the oil, the values gotten are within the permitted peroxide level and make it non-toxic. The saponification values were (122.428±1.805mgKOH/g) and (107.766±1.079 mgKOH/g) respectively, it is therefore observed that the saponification value of *Delonix regia* is higher than *Piliostigma thonningii* oil, although, the values obtained for *Delonix regia* and *Piliostigma thonningii* oils are lower than those of the common oils such as neem seed oil (213mgKOH/g) and coconut oil (253mgKOH/g), however, values obtained were higher than those obtained for pawpaw seed oil (24.13mgKOH/g), sweet orange seed oils (106.30mgKOH/g) and beeswax (93 mgKOH/g) all of which are commonly used in soap making. This indicates that *Delonix regia* and *Piliostigma thonningii* oil could be also used in soap making since their saponification values fall within the range. The iodine values obtained for *Delonix regia* and *Piliostigma thonningii* oil were 50.678±0.000 and 63.345±0.115 mg/iodine/100g, their is significant difference in these values, *Piliostigma thonningii* is higher than *Delonix regia* oil, which shows that the oils could be classified as non-drying which makes them suitable because their values is within the said range. Acid values of 0.940±0.000 and 1.027±0.000 mg/KOH/g were obtained for *Delonix regia* oil and *Piliostigma thonningii* oil respectively, their is no significant difference in the acid values obtained, the acid values obtained is lower, compared to that of olive oil 17mgKOH/g as discussed by Abdulhamid, A.; Sani, (2014) and that of shea oil 14.77± 0.065 reported by Wara *et al.* The free fatty acid values obtained for *Delonix regia* and *Piliostigma thonningii* oil were 0.987±0.000 and 1.288±0.001 mgKOH/g The free fatty acid concentrations of the oils were low which was consistent with the low acid value observed.

#### ➤ The Anti-microbial value *Delonix regia* Oil and *Piliostigma thonningii* Oil

The preliminary antimicrobial screening of *Delonix regia* oil and *Piliostigma thonningii* Oil against three different gram-negative bacterial strains namely: *E. coli*, *P. aeruginosa* and *K. oxytoca* (Table 3), revealed that *Delonix regia* oil showed significant activity against *P. aeruginosa* with no effects against *E. coli* and *K. oxytoca* while *Piliostigma thonningii* Oil exhibited significant antimicrobial activity against *E. coli* and *K. oxytoca* but zero activity against *P. aeruginosa*.

## IV. CONCLUSION

The results obtained from physicochemical analysis of *Delonix regia* and *Piliostigma thonningii* seed oils are saponification value, acid value, pH, colour, odour, viscosity, free fatty acid and Iodine values that fell within the range of those acceptable as having good potential for production of soap, paints, perfumes and varnishes.

The results of antimicrobial and antioxidant indicated that the oils from *Delonix regia* and *Piliostigma thonningii* can be used in food and pharmaceutical industries to inhibit the growth of certain bacterial and food deterioration because of strong resistivity to the growth of such organism. The fatty acids compositions of *Piliostigma thonningii* oil is quite higher than that of *Delonix regia* and this is directly coincide with the fatty acid values as evaluated in physicochemical analysis.

## RECOMMENDATION

From this research finding, it is recommended that the seed oils of *Delonix regia* and *Piliostigma thonningii* is medicinally and industrially important. The oils are eatable and could be used as a substitute for other common oils like groundnut and soybean oil, or blended with other vegetable oils and hence the uses of these oils in industries should be encouraged.

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