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Proximate analysis of *Hibiscus mutabilis* seeds *obtained* from Samaru, Kaduna State

Sani Uba, Isreal Kehinde. Omoniyi, Abubakar Sani, Mikail Abdul Hameed.
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Abstract: Hibiscus mutabilis seed has been reported to be rich in oil and other proximate contents that can be a good feedstock for biodiesel production and other technologies. Consequently, seeds were analysed for their proximate composition while the extracted oil was used for biodiesel synthesis. The proximate contents included moisture contents (11.46± 0.08%), ash content of (6.52 ± 0.2%), crude fat (8.41 ± 0.53%), protein (16.86 ± 0.28%), fiber (30.16 ± 0.26%) and carbohydrate (26.59 ± 0.39%). The evaluated results suggest that the plant seed may be useful for the production of paints, cosmetics and vegetable oils The results also suggested that Hibiscus mutabilis *seed possesses some properties that were suitable for biodiesel production.*

Keywords: *Hibiscus mutabilis seed. Analysis, evaluation, and useful applications*

Sani Uba
Department of Chemistry, Ahmadu Bello University, Zaria
Kaduna State, Nigeria
Email: saniuba10@yahoo.com
Orcid id: 0000-0001-9595-6897

Isreal K. Omoniyi
Department of Chemistry, Ahmadu Bello University, Zaria
Kaduna State, Nigeria
Email: israelflourish@yahoo.com

Sani Abubakar*
Department of Pure and Industrial Chemistry, Umaru Musa Yaradua University, Katsina, Katsina State, Nigeria.
Email: abubakar.sani@umyu.edu.ng
Orcid id: 0000-0002-5296-9564

Mikail Abdul Hameed.
Department of Chemistry, Ahmadu Bello University, Zaria
Kaduna State, Nigeria
Email: mikailhameed@yahoo.com
Orcid id: 0000-0002-2625-6616

1.0 Introduction

There is an increasing trend of the worldwide demand for oils and fats from vegetable origins in the food and cosmetics industries, as they are excellent sources of antioxidants and dietary energy as well as a good raw material for industrial products including biofuels (Ramadan *et al.*, 2015). Plants provide edible oils which have applications both in food and industries. As Enemor *et al*. (2021) noted, they can also serve as a source of oleochemicals. Babatunde and Umoru, (2022) variously concluded that vegetable oils have made important contributions to diets in many countries; serving as a good source of protein, lipids and fatty acids for human nutrition including the repair of worn-out tissues, new cells formation as well as a useful source of energy.

Hibiscus mutabilis (Malvaceae) are shrubs that bloom in peach col
or and are endemic to China and Africa. An ornamental shrub with a huge, bushy growth

Corresponding Author: Mikail Abdul Hameed, , Email: emikailhameed@yahoo.com

habit. Cordate, suborbicular leaves with 5-7 lobed or angled lobed or angled leaves that are lightly pubescent. Flowers are big, axillary, and solitary, with a 7.5-10 cm wide, spreading corolla in white or pink. *Hibiscus mutabilis* seeds, which have yet to be commercialized, are a source of vegetable oil. *Hibiscus mutabilis* seed oil has a significant level of phenolic compounds and tocopherols. Lectin can also be found in the seeds of *Hibiscus mutabilis*. Humans' immune systems are gradually disrupted by HIV, the RNA virus that causes AIDS. Since a recent study found that DHA in high DHA-concentrated fish oil improved certain aspects of immune function in middle-aged obese adults (Geum et al., 2021), DHA-enriched goat milk stabilized by *Hibiscus mutabilis* seed oil could be used as an immune stimulator for HIV treatment.

This study investigated the proximate analysis of *Hibiscus mutabilis* seeds. Proximate properties were determined using a traditional approach. All test parameters evaluated met requirements. As a result, *Hibiscus mutabilis* is an economically viable, environmentally acceptable, and non-edible feedstock for the generation of high-quality oil.

2.0 Materials and Method

2.1 Sample collection and preparation

Seeds *of Hibiscus mutabilis* were brought from *Samaru market in Zaria within Kaduna metropolis, Nigeria.* The research was carried out at Ahmadu Bello University, Zaria Sabon Gari Local Government Area of Kaduna State, Nigeria. *The seeds were peeled to obtain the kernels, which were air-dried and pulverized to a fine powdered form and stored in an airtight plastic container.*

2.2 *Proximate analysis of oil*

Various proximate analyses were conducted to evaluate the quality of each of the oilseeds. The seed proximate analysis was determined following a standardized association of analytical chemist's procedures. Moisture content, Ash content, Protein content, Lipid content, Fibre content, and carbohydrate contents were determined using standard methods as follows.

2.2.1 Determination of moisture

Moisture content was estimated by the method of differences, which evaluates the moisture content of 5 g of the ground after drying in an oven for four hours at 105 ^{0}C The calculation was based on equation 1 (AOAC., 2003).

$$\text{Moisture} = \left(\frac{M_2 - M_3}{Mw_1}\right) \times 100 \quad (1)$$

The definition of symbols used in equation 1 is as follows, W_1 is the weight of the empty crucible while M_2 and M_3 are the volume of the crucible containing the sample, before and after drying respectively.

2.2.2 *Determination of ash content*

The loss in weight of 2 g of the grounded sample before and after ashing at 550 ˚C for 30 minutes were parameters that were relevant for the evaluation of the ash sample of the sample, based on equation 2. (AOAC.,2003).

$$\%\ \text{Ash} = \left(\frac{M_3 - M_1}{M_2 - M_1}\right) \times 100 \quad (2)$$

In equation 2, M_1 is the weight of the empty crucible while M_2 and M_3 are the volume of the crucible containing the sample, before and after drying respectively.

2.2.3 Determination of crude fibre

In the evaluation of the crude fibre content, 2.0 g of the sample, containing 100 cm3 ^{of} 3 M solution of H_2SO_4 $_{in}$ a round bottom flask was boiled for complete digestion to take place. The hot solution was filtered under suction and the insoluble matter was washed severally with hot water until it is acid-free. This was quantitatively transferred into the flask and 100 cm3 of (0.3M) sodium hydroxide solution was added and the mixture boiled again under reflux for 30 minutes, followed by immediate re-filtration. The insoluble residue was washed with boiling water until it was alkaline-free. It was dried to constant weight in the oven set at 100˚C, cooled in a desiccator, weighed (C_2)

and incinerated for 30 minutes (when cooled) in a muffle furnace operating at 550˚C. The residue was cooled in adesiccators and reweighed (C3) (AOAC., 2003).

$$\% \text{ Crude Fibre} = \frac{c_2 - c_3}{w} \times 100 \quad (3)$$

where W is the weight of the sample and the numerator, $C_2 - C_3$ is the weight loss due to ashing (incineration).

2.2.4 Determination of fat

100 cm^3 of petroleum ether (40-60 ˚C) was transferred into a clean dry 250 cm^3 round bottom flask fitted with a Soxhlet extraction unit. Some anti-bumping granules were then added. Fat-free extraction thimbles were weighed (W_1) and approximately 0.5 g of the sample was added and weighed (M_2). The thimble was fixed into the Soxhlet extraction unit with forceps and cold water $_{\text{circulation}}$ put on. The heating mantle will be switched on and the heating rate was adjusted at a temperature between 40-60˚C until the solvent refluxed at a steady rate. Extraction was carried out for 8 h and the heating mantle was switched off. The thimble was removed and dried to a constant weight in an oven at 70˚C and reweighed W3 (AOAC., 2003).

$$\% \text{ Fat} = \left(\frac{w_3 - w_1}{w_2 - w_1} \right) \times 100 \quad (4)$$

Equation 4 is satisfied by the following definition of terms, that is W_1 represents the weight of the empty crucible; w_2 is the volume of the crucible plus the Sample before oven drying while w_3 is the volume of the crucible plus the sample after oven drying;

2.2.5 Determination of protein

The protein content was determined by the Kjeldahl method as described by AOAC, (2003). About 0.5g of the ground sample was digested with 25 ml of concentrated sulphuric acid in the presence of Kjehltabs (digestion catalyst: CuSO4, Na2 SO4, SeO). The digest was neutralized with 50% sodium hydroxide solution and distilled into 2% screened Boric acid indicator then Titrated with 0.05N Hydrochloric acid (Filli, 2016). The % crude protein was calculated as shown:

$$\% \text{ Nitrogen} = \frac{v_1 \times v_o \times M \times 14 \times 100}{W \times 1000 \times 10} \times 100 \quad (6)$$

The description for the symbols in equation 6 above is V_0= volume of diluted digest, V_1= total volume of HCl used, M= concentration of HCl (0.1 M); 14 = atomic weight of nitrogen; 100 = total volume of digest and W = weight of the sample. The crude protein was calculated as:

% Crude Protein = 6.25 x % Nitrogen

2.2. Determination of total carbohydrates

Total carbohydrates will be calculated by difference rather than direct analysis according to the FAO method. All components other than carbohydrates (moisture, ash, crude protein, crude fat, and crude fibre) were individually determined, summed, and subtracted from 100 (total percentage of powder components) using the following formula:

Total carbohydrates = 100 – (moisture + ash + protein + fat + crude fibre) % (7)

(AOAC., 2003).

3.0 Results and Discussion

As could be observed from Table 1, *Hibiscus mutabilis* seed showed moisture contents of 11.46± 0.08 %, ash, crude fat, protein, fibre and carbohydrate concentrations in the sample to be 6.52 ± 0.2, 8.41 ± 0.53 %, protein of 16.86 ± 0.28 %, 30.16 ± 0.26 26.59 ± 0.39% respectively.

On comparing these results with those of Food and Agricultural Organization (FAO) standards, it was found that the results indicate that the crushed seeds have relatively moderate moisture content to most seeds. A moisture level of 12 percent or less is preferred for food shelf stability (Mohammed *et al.* 2021). Higher moisture content is also an indication that the seeds are highly susceptible to microbial attack and therefore lessen their shelf lives. *Hibiscus mutabilis* has a very high value of moisture content of 11.46 %. The range calculated for the moisture is higher than the value of 5.12 in *jatropha curcas*, as reported by Nzikou *et al.*,

*(*2009). The ash content was measured as the mineral contents of the original food material (Effiong and udo, 2010). *Hibiscus mutabilis* have a high ash content of 6.52 %. These values are in the same range as the one reported by *Parkia biglosa* (6.71 %) reported by Aremu (2006). This is a clear indication that the seeds have more organic matter. However, it is recommended that ash content in seeds should fall in the range of 15.25 to be suitable for oil (Aremu *et al.,* 2006).

Crude fat contents of *Hibiscus mutabilis, were* found to be 8.41% . The fat contents obtained in this report were higher when compared with values reported by Kwenin *et al.,* (2011) for *Moringa oleifera* (1.33 %) and lower than 13.70 % reported for Adenanthera povoninia (Ogbuagu *et al.,* 2011). The low lipid contents of these seeds can make them useful as a diet for obese patients.

The crude fiber value of *Hibiscus mutabilis,* seed oil was found to be 30.16. Fiber works by delivering roughages that help with digestion and nutrition absorption (Nwekwe *et al.,* 2016). The crude fiber content of *Hibiscus mutabilis,* is higher than 10.40 % and 8.00 % as reported by Kwenin *et al.,* (2011) for *Amaranth cruentus* and *Talinum triangular,* respectively.

The protein content of *Hibiscus mutabilis,* seed oil was found to be 16.86, which is within the range of 15-22 % reported for *Adenopus breviflorus* (Lakht-e-Zehra *et al.,* 2015). Functionally, proteins are important in food as they help in the growth and development of the body (Erukainure *et al.,* 2011). The high protein content observed for the studied seed indicates that it can be a good source of materials for the management of protein deficiency.

The carbohydrate content of *Hibiscus mutabilis* seed oil is 26.59%. These values were within the range of 39.05 % reported by Hassan and Umar, (2006) in their work on *Momordica balsamina*. However, this value was lower than the 75.00 % reported for *Corchorus tridens* by Asibey-Berko and Tayie, (1999).

Table 1: Proximate parameters for *Hibiscus mutabilis*

Parameter (%)	Content
Moisture	11.46 ± 0.08
Ash	6.52 ± 0.19
Fat	8.41 ± 0.23
Protein	16.86 ± 0.28
Fibre	30.16 ± 0.26
Carbohydrate	26.59 ± 0.39

** Values reported as mean ± standard deviation of triplicate analysis

4.0 Conclusion

Global production of oil seeds has increased during the last thirty years. Given that oil seeds are primarily grown for their oil and meal, this appears to be related to increased demand for oil seed commodities and by - products. In general, the important nutrients required by the human body are fats and oils, as well as proteins, carbohydrates, vitamins, and minerals. Fats and oils are high-calorie foods that contain 2.5 times as many calories as carbohydrates (per unit weight).

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