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Husk of Cocus nucifera Linn. Extraction and phytochemical investigations

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ABSTRACT
Minerals, plants, and animals have traditionally been the principal suppliers of medications, and humans have employed them for therapeutic purpose throughout history. Cocos nucifera, commonly called as the ''coconut tree'', is one of the most naturally widespread fruit plants on Earth. Coconut fruit is very delicious and full of nutrients, while the rest of the fruit, coconut shell, and coconut husk also have some medicinal and phytochemical constituents. Millions of tons of coconut husk are wasted each year, which is one of the worst environmental problems. Husk of coconut can be a source of raw materials in the food and pharmaceutical industries. This husk has, if investigated properly, can be found to possess several phytochemicals that have medicinal value. Therefore, the objectives of the present study were the extraction of phytochemical constituents from coconut husk and their characterization. Extraction process was carried out using three different solvents, like, methanol, acetone, and ethyl acetate by maceration process. These extracts were screened for the presence of flavanoids, tannins, steroids, alkaloids, polyphenols, terpenoids, and saponin. After preliminary screening, further investigation of the extract was carried out by UV-visible and Fourier transform infrared to support the obtained data. The FTIR spectrum confirmed the presence of functional groups such as alcohol, alkanes, alkynes, carbonyl ketones, alkenes, esters, phenols.

KEYWORDS: Coconut husk, extraction, characterization, phytochemical screening, UV-Visible spectroscopy, FTIR.

I. INTRODUCTION

The coconut, or Cocos nucifera Linn, is a member of the Arecaceae (Palmae) family, which comprises 217 genera and 2,500 species. Coconut is grown for both nutritional and therapeutic purposes. It is also known as the "fruit of life". The scientific classification of Cocos nucifera L. is given in table1. Coconut water, coconut husk, copra, coconut oil, raw kernel, coconut cake, and coconut milk are just a few of the various goods that C. nucifera created.[1] The plant is an arborescent monocotyledonous tree of around 25 m height with a dense canopy. The root of the coconut tree is fasciculated, the stem is an unbranched type and the pinnate leaves are feather-shaped, having a petiole, rachis and leaflets. [2, 3] It is a special source of various natural ingredients that are used in the preparation of pharmaceuticals and commercial goods that are efficient against fungi, bacteria, viruses, parasites, and dermatophytes, and act as antioxidant. The many actions of phytochemicals help the body fight disease and health issues in a variety of ways [4].

Figure 1: Image of Dried Coconut husk.

According to reports, plants are a great source of secondary metabolites, including tannins, flavanoids, and alkaloids that can be utilized to make modern medicines to fight against microbial attack [5]. Coconut husk represents the entire fibrous material. Figure 1 shows the image of dried coconut husk enveloping the fruit, constituting both

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the inner endocarp (liquid and solid food part) and the outer mesocarp (fibrous part). Age of husk is an important factor for the selection of good quality fiber. Husks from near ripe to ripe nuts are reported to give the best fibers. Its constituents include cellulose, hemicelluloses, and extractives such as pectin and tannins. These constituents make coir dust a useful adsorbent or natural ion exchanger because of the hydroxyl and carboxyl groups present in its composition [6]. Extract from the husk fiber of C. nucifera is used to treat diarrhea, in high body temperature, to reduce renal inflammation, and as a topic ointment for dermatitis, abscesses, and injuries. In oral asthma treatment, an aqueous extraction from coconut has also been used [7, 8]. Hence, in this study the extract of coconut husk is subjected to phytochemical investigation to analyze the chemical constituents in it. Ultraviolet-visible (UV-Vis) spectroscopic analysis of extracts was performed and Fourier transform infrared spectroscopic (FTIR) analysis of the methanolic extract was also carried out to confirm the presence of distinct functionalities. The aim of current work is to collect coconut husk and identify some promising phytochemicals. Every year, imports of phytochemicals, which are necessary raw materials for the food and pharmaceutical industries, are made. We can save a huge amount of foreign currency if we can produce phytochemicals using coconut husk. Every year, a million tonnes of green coconut husk are thrown by people all over the world [9]. As a result, it is increasingly affecting environmental pollution issues. But this case will be changed if we plan to establish a related sector where plant waste will be processed to obtain significant phytochemicals [10].

Table 1: Scientific classification of cocos nucifera L.

Kingdom	plantae
Order	arecales
Family	Arecaceae
Subfamily	Arecoidae
Tribe	Cocoseae
Genus	Cocos.L
Species	C.Nucifera
Binomial Name	Cocos nucifera .L

II. MATERIAL AND METHODS

MATERIALS

The coconut husk was obtained from the local market. Methanol, ethyl acetate, acetic acid, hydrochloric acid was purchased from (MOLYCHEM lab Mumbai) Acetone and Chloroform were obtained from (Thermo Fisher Scientific Lab Mumbai) Sulfuric acid was purchased from Research-lab fine chem. Industries, Mumbai. Ferric chloride was purchased from OZONE International Mumbai.

METHODS

EXTRACTION USING DIFFERENT SOLVENT

The extraction was carried out by a maceration process. The husk was finely chopped and dried to approximately 10% of its original water content. The dried husk was ground into powder using mortar and pestle and extraction was carried out using methanol, ethyl acetate and acetone, individually. For extraction, 250 g of husk powder was mixed with 500 ml of solvent and extraction was carried out for seven consecutive days. The extracts were filtered, and then kept on a rotary evaporator until the dried pellets were obtained. The pellets were subjected to chemical analysis for their bioactive compounds and were also individually dissolved in sterile solvent for further analysis. [11]

PHYTOCHEMICAL INVESTIGATION

IDENTIFICATION OF FLAVANOIDS

H_2SO_4 test: Three types of extracts were treated with a few drops of H_2SO_4 and the formation of an orange color indicated the presence of flavanoids. [11]

IDENTIFICATION OF TANNIN

2 ml of extracts were taken into small test tubes and to it added a few drops of 0.1% or 1ml ferric chloride solution. A blue, black or greenish black coloration indicates the presence of tannin. [11]

IDENTIFICATION OF STEROIDS

2 ml of extract with 2 ml of chloroform, 2 ml of acetic acid and 1ml of concentrated sulfuric acid was taken in a test tube. A blue-green color indicates the presence of steroids [11].

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IDENTIFICATION OF ALKALOIDS

Sample of weight 0.2g was boiled with 5ml of 2% HCl in a steam bath. The mixture was filtered and taken in 4 test tubes to it 1 ml portion of the filtrate was added and was treated with 2 drops of Dragendorff's reagent which produced red coloration that indicates the presence of alkaloids [11]

IDENTIFICATION OF ANTHROQUINONE

Borntrager's test was used to identify presence of anthroquinone. About 0.2g of the extract was boiled with 10% HCl for a few minutes in a water bath. It was filtered and allowed to cool. An equal volume of $CHCl_3$ was added to the filtrate. A few drops of 10% NH_3 were added to the mixture and heated. A formation of pink color indicates the presence of anthroquinone. [11]

IDENTIFICATION OF TERPENOIDS

2ml of extract was treated with 2ml of chloroform, and then to it added few drops of sulfuric acid. Radish brown coloration in the interface indicates the presence of Terpenoids. [11]

IDENTIFICATION OF SAPONINS -FOAM TEST

About 2 ml of extract was taken, and to it added 5 ml of distilled water in test tubes. Persistance of foam for ten minutes indicates the presence of saponins. [11]

UV – VISIBLE SPECTRAL ANALYSIS

For UV-VIS Spectrophotometric evaluation, the methanolic extract of coconut husk was scanned with a (Shimadzu UV1800) UV-Visible double beam Spectrophotometer at wavelengths ranging from 200 to 800 nm, and the distinct peaks and their absorption values were recorded [12]

FOURIER TRANSFORMS INFRARED ANALYSIS (FTIR)

The FTIR spectrum was recorded using the Perkin Elmer FTIR system. A thin coating of the compound was distributed which was placed on the face of a highly polished KBr salt plate. A second KBr plate was placed on top to spread the compound evenly. Wave numbers between 400 and 4000 cm^{-1} were used to record the FT-IR spectra. [12]

III. RESULT AND DISCUSSION

PHYTOCHEMICAL INVESTIGATIONS

The results of the qualitative analysis of the active phytocompounds from each of the three types of extracts, methanol, acetone, and ethyl acetate, are shown in Table 2.

Table 2: The evaluation of phytochemicals in cocos nucifera shell extracts

Phytochemicals	Methanol extract	Acetone extract	Ethyl acetate extract
Flavanoids	+	+	+
Tannins	+	+	+
Steroid	–	+	–
Alkaloids	+	+	+
Anthroquinone	+	-	+
Terpenoids	+	+	+
Saponin	+	+	+

+ = Presence; - = absent.

During this screening procedure, various phytochemical kinds that have demonstrated their action in various solutions were found. The activity of the extracts' colour change demonstrates both their presence and absence. All the extracts were tested positive for flavanoids as test tubes shown in

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Figure 2 [A], confirming their presence in coconut husk. Flavanoids are types of phytochemicals that have a variety of uses in the food and pharmaceutical sectors today. Compounds called flavanoids are a subclass of polyphenols. Thus, the husk extract can have the potential to reduce osteoporosis, heart disease, and cancer. Also, it can be used in soft drink beverages. Similarly, tannins exhibit their existence in all types of the prepared extracts because of the black coloration observed in all test tubes which are shown in Figure 2 [B]. Steroids phytochemical was found to be present in acetonic extract as shown in figure 2[C]. Alkaloids were also found to be present in all the three extract as can be seen from figure 2[D], where red coloration was seen in all the test tubes. Anthroquinone phytochemicals can also be extracted in all the extracts as shown in figure 2[E] where pink coloration formed in all the test tubes. Figure 2[F] shows reddish brown coloration in all test tubes and this observation indicated the presence of terpenoids in all types of extracts. Saponin phytochemicals can be identified by foam test and the foam was formed on top of solution in all test tubes as can be seen in figure 2[G] thus it can be confirmed that saponin was present in all types of extracts.

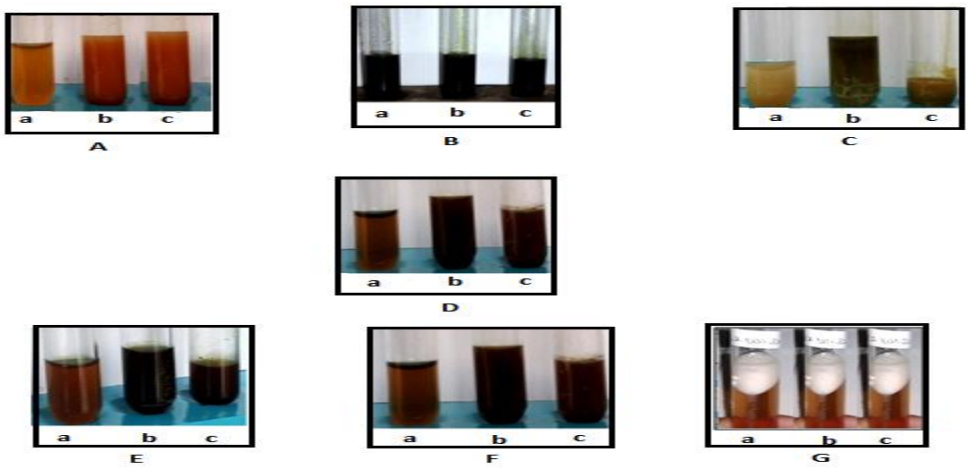

Figure 2: (A) Test for flavanoids, (B) Test for tannin, (C) Test for steroids, (D) Test for Alkaloids, (E) Test for Anthroquinone, (F) Test for Terpenoids, (G) Test for Saponin. (a, b, c represents methanol, acetone, and ethyl acetate extracts respectively)

UV – VISIBLE SPECTRAL ANALYSIS

The UV-Visible fingerprint profile of the methanolic extract of coconut husk was chosen at 200nm to 800nm due to the sharpness of the peaks and proper baseline. The compounds were found to be separated at wavelengths of 232, 399, and 663nm, with absorbance of 3.997, 0.872, and 0.192, respectively as shown in Figure 9 and Table 3. Thus, UV-VIS spectroscopy investigation reveals the presence of phenols and flavanoids.

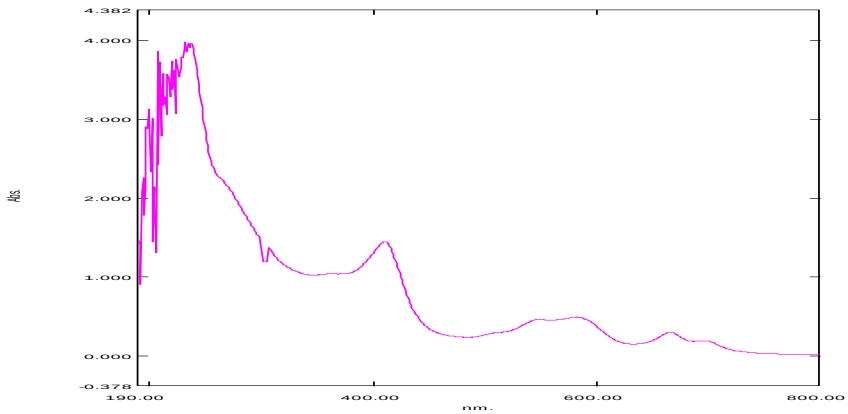

Figure 3: UV-Visible spectra of methanolic extract of coconut husk

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Table 3: UV-Visible spectrum of methanolic extract of coconut husk

Nanometers	Absorption values	Compounds
232	3.997	Phenol and Flavonoids
399	0.872	
663	0.192	

FT-IR ANALYSIS

Fourier Transmission Infrared Spectroscopy is used to detect the functional group of bioactive components based on the peak value in the region of infrared light. The coconut husk extract was put through the FT-IR and the main functional group of the components was determined based on the peak ratio. The FTIR spectrum peak values containing functional groups of bioactive components were marked in Figure 3 and Table 3. FT-IR spectra of coconut husk revealed a peak at 3378.06, 2917.35, 2849.52, 1731.73, 1627.78, 1575.24, 1539.65, 1466.37, 1419.39, 1378.44, 1168.04, 1036.36, 720.26cm-1 this confirms the presence of Alcohols**,** Alkanes Aliphatic Compounds, Aldehydes, Ketone, Carboxylic Acids, Alkenes, Aromatics, Alkene Methylene Group, Phenols, Aliphatic Amines and Alkanes.

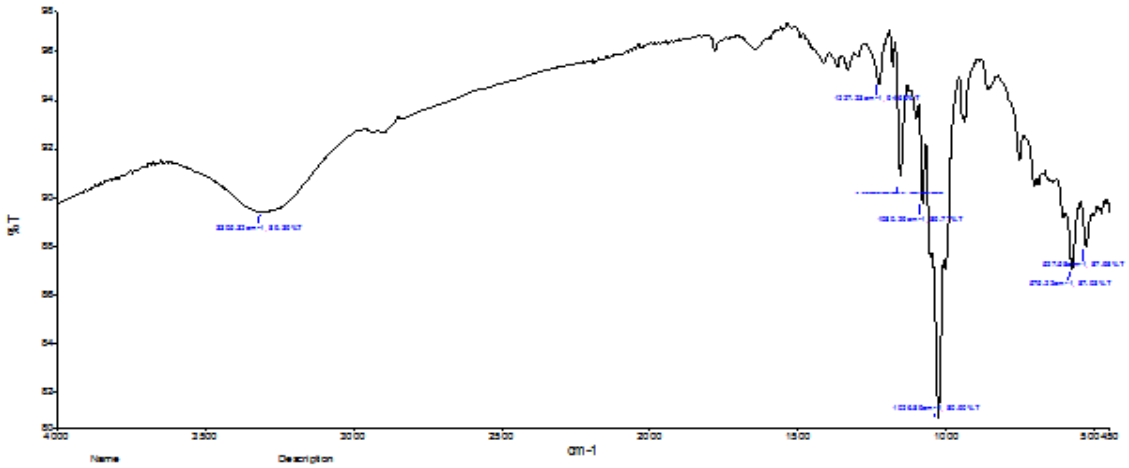

Figure 4: FTIR Spectra of methanolic extract of coconut husk

Table 4: FT-IR spectrum of methanolic extract of coconut husk

IR Peak	Coconut husk extract(cm^{-1})	Band assignments
1	3433.29	O-H stretching
2	2926.01	C-H stretching of volatile alkane
3	2376.30	C≡ C of alkynes
4	1739.79	C=O carbonyl band of ketones
5	1624.06	C=C of alkenes
6	1377.17	C-H strtching in alkanes or alkyl group
7	1109.07	C-O of esters, ether or phenol group

IV. CONCLUSION

Every plant has phytochemicals. Phytochemicals are also present in the majority of waste products created from plants. From discarded coconut shell, we have qualitatively identified some promising phytochemicals. Millions of tonnes of this type of phytochemical substance are imported annually by the global food and pharmaceutical industries for use in manufacturing. In the current work, we identify the existence of phytochemicals in coconut husk. The further study will be quantitative examination of these phytocompounds. As a result, the actual quantity will be known. Our nation may simply save foreign

currency by developing a phytochemical purifying facility.

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