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Analytical evaluation of drug *Cocos nucifera* Linn. Shell

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ABSTRACT

Introduction: Standardization of drugs is a crucial step in both experimental and clinical trials. It helps to ensure that the drug is consistent in terms of its composition, quality, and potency, which is essential for ensuring its safety and efficacy in treating the intended condition. In the case of Ayurvedic medicine, the texts describe a detailed process for examining and standardizing drugs, which involves identifying the source, selecting the appropriate plant part, processing and preparing the drug, and testing its efficacy through various methods. Regarding *Cocos nucifera* Linn shell, it is true that this plant part is used in various culinary and medicinal applications[1]. The shell of the coconut fruit has been reported to possess various pharmacological properties, including antimicrobial[2] and helps in curing eczema[3].

Objective: To determine the Preliminary Pharmacognostical and phytochemical analysis of *Cocos nucifera* Linn shell.

Materials and method: Collection of *Cocos nucifera* Linn shell was done from natural habitat of Udupi district and analytical studies were carried out according to the standard protocols.

Result and Discussion: Microscopic characteristics of coconut shell revealed to have vessels and sclerids, tracheids, isolated phloem fibres, parenchymatous ground tissue, vessels which are pitted, vessels which are broadly pitted, bundle of sclerenchymatous fibres and starch grains. Loss on drying showed 6.48%, Total ash weight is 2.43%, acid insoluble ash is 0.29%, water soluble ash constituted to about1.58%, Water soluble portion of shell is 7.31%, Alcohol soluble extractive is 5.81% along with physicochemical parameters and HPTLC for coconut shell *kashaya* of was tested.

Conclusion: The analytical study performed and recorded will be helpful for further researches in clinical practice.

Keywords: Standardization, *Narikela*, Pharmacognosy, Phytochemical analysis.

Introduction:

Ayurveda places great emphasis on *Dravya Pareeksha*, which involves the examination of drugs based on certain parameters such as their organoleptic properties, physical characteristics, and chemical composition. This is important in ensuring that the correct parts of the plant are used and that the drugs are of high quality and purity. Similarly, in modern science, the standardization of crude drugs is also essential to ensure their safety and efficacy. This is typically achieved through the use of various qualitative and quantitative standards, including macroscopic and microscopic examination, pharmacopeial standards, and chromatography parameters such as high-performance thin- layer chromatography (HPTLC) and gas chromatography (GC). Through these methods, one will able to identify and quantify the active constituents present in the crude drug, and to ensure that they are within the acceptable range of concentrations for therapeutic use. This helps to ensure the safety and efficacy of the drug and to prevent any potential adverse effects.

The drug Coconut, has got multiple utilities, mainly for its nutritional and medicinal values. Every part of coconut is used for one or the other medicinal purpose for which it has been named as *'Kalpavrikshsa'* and it also has got significant religious and cultural significance in India. Coconut, which is known as *Narikela*[4] in Sanskrit and botanically identified as *Cocos nucifera* Linn[5]., belongs to the family Arecaceae[6]. It is widely distributed in tropical regions and coastal areas, including Southern India, Ceylon (Sri Lanka), Malabar, Coromandel Coasts, and the islands of the Indian Archipelago[7]. It is a straight unbranched stately palm usually up to 25m in height with a cylindrical annulated stem bearing a crown of large leaves; leaves pinnate 2-5m long, leaflets equidistant, narrow and tapering; inflorescence spadix with a hard oblong longitudinally splitting spathe enclosing many yellow or orange male flowers and few female flowers; fruits trigonously obovoid or sub globose green or yellowish fibrous drupes; seed one, oval or spherical with a hard endocarp and oily white endosperm and sweet milky or watery fluid in the large cavity[8].

Materials and methods:

Drug source

Collection of dried *Cocos nucifera* Linn shell was from natural habitat of Udupi district and made into fine powder and submitted to Department of Pharmaceutical Chemistry and Pharmacognosy, SDM Centre for Research and Allied sciences, Udupi.

Methods[9]:

Powder microscopy:

A pinch of powdered drug was taken on a glass slide and added with a drop of glycerin-water.

Physico-chemical standards:

Powder of the sample tested for physico-chemical standards like loss on drying, total ash, acid insoluble ash, water soluble ash, alcohol soluble extractive value, water soluble extractive value as per standard guidelines. Refractive index, Specific gravity, Viscosity, Total solids (%), pH was checked for kashaya of *Cocos nucifera* shell.

Phytochemical study:

Coconut shell kashaya was tested for the presence of secondary metabolites like, alkaloid, steroid, carbohydrate, tannin, flavonoids, saponins, terpenoids, coumarins, phenols, carboxylic acid, amino acid, resin and quinone.

HPTLC:

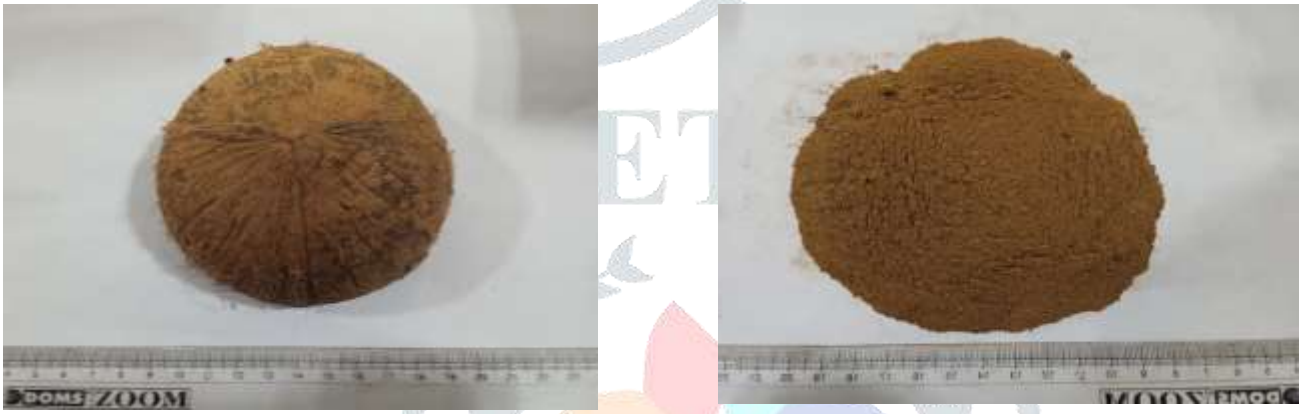
1gm of sample of kashaya of coconut shell was fractionated with n- Butanol in separating funnel, kept overnight and separated butanol fraction. n-Butanol fraction was further dried and dissolved in 5ml of methanol. 4, 8 and 12µl of each of the above extract was applied on a pre-coated silica gel F254 on aluminium plates to a band width of 7 mm using Linomat 5 TLC applicator. Plate was developed in Toluene: Ethyl acetate: Formic acid: Methanol (3.0: 3.0: 0.8: 0.2). The developed plates were visualized in short UV, long UV and then derivatised with Anisaldehyde sulphuric acid reagent subsequently scanned under UV 254nm, 366nm and 620nm (after derivatisation). Rf, colour of the spots, densitometric scan and 3-D chromatograms were recorded.

Result

Macroscopy:

The coconut shell, known as the endocarp, is the innermost layer of the coconut fruit wall. It has a prolate, spheroidal shape and features three micropyles (germination pores) located at one end. The micropyles are positioned between ridges that run along the shell's longitudinal axis. The brown-coloured coconut shell has a rough texture and is covered with fibres. It does not have any distinct or peculiar odour.

Figure 1: a. Coconut shell, b. Powder of Coconut shell



(a) **(b)**

Powder microscopy:

Important microscopic characteristics of coconut shell are vessels and sclerids, tracheids, isolated phloem fibres, parenchymatous ground tissue, vessels which are pitted, vessels which are broadly pitted, bundle of sclerenchymatous fibres and starch grains.

Figure 2: Powder microscopy of powder of dried coconut shell

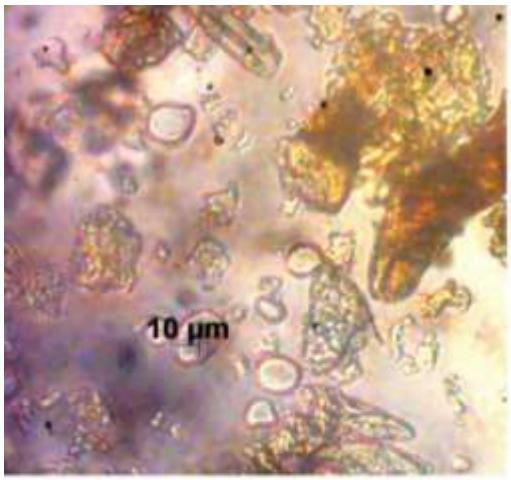


Fig 2.1 Masses of Starch grains

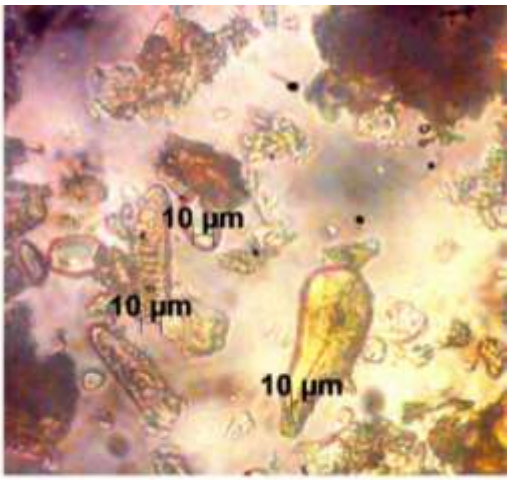


Fig 2.2 Vessels and sclereids

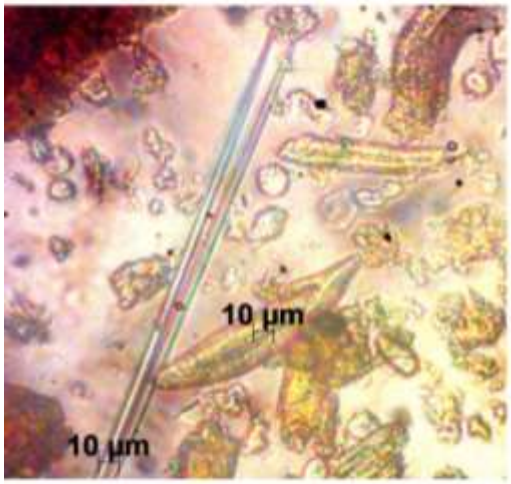


Fig 2.3 Tracheids

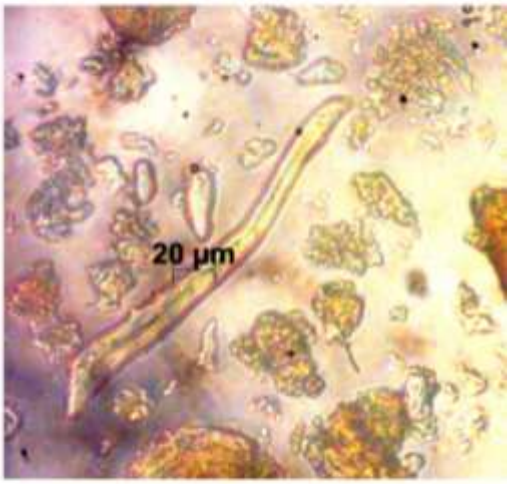


Fig 2.4 sclereids

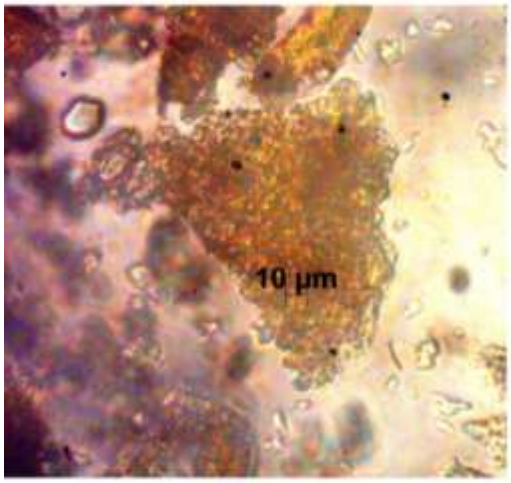


Fig 2.5 Parenchyma cells

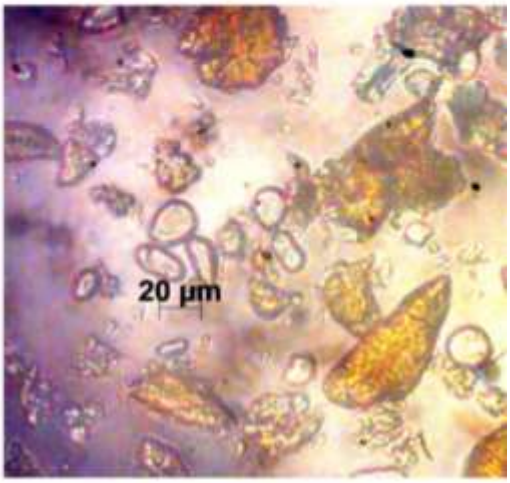


Fig 2.6 Starch grains

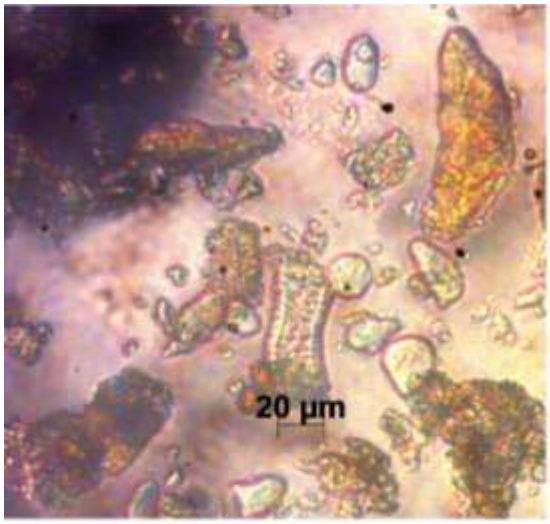


Fig 2.7 Pitted vessel

Fig 2.8 Tracheids

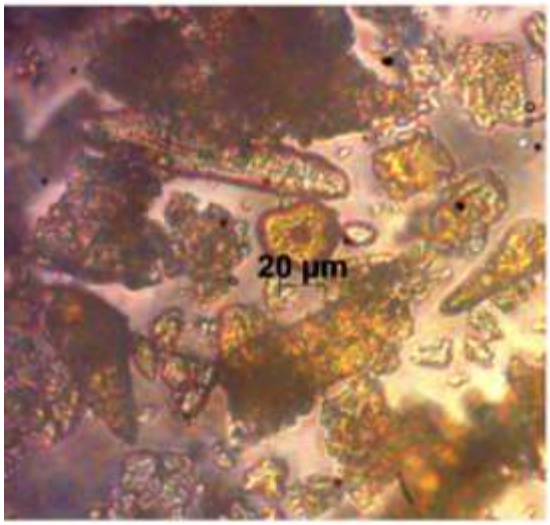


Fig 2.9 Stone cells

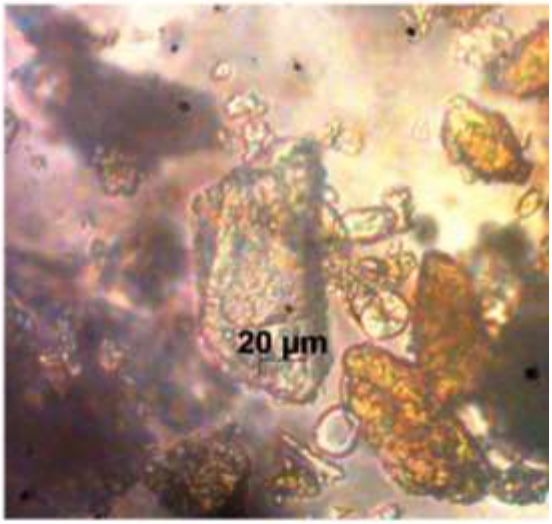


Fig 2.10 Sclereids

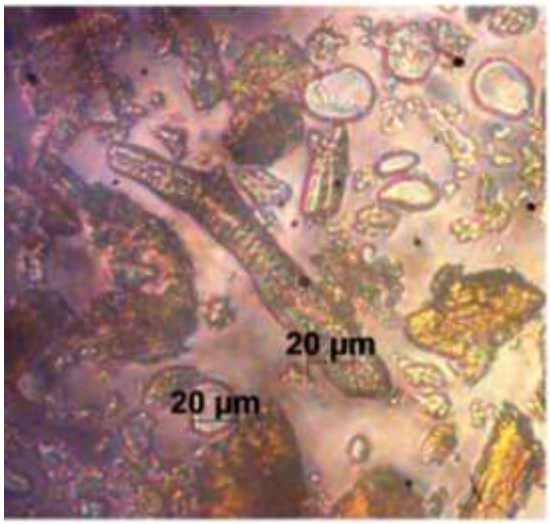


Fig 2.11 Trachea/Tracheids

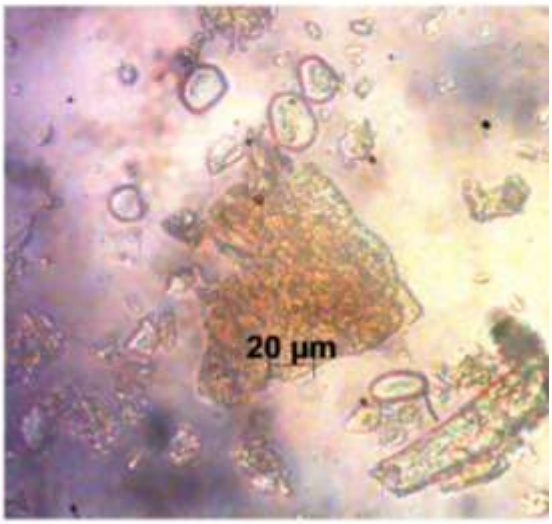


Fig 2.12 Parenchyma

Table 1. Results of standardization parameters of dried coconut shell powder

Parameter	Results n= 3%w/w (Avg±SD)
Loss on drying	6.48±0.00
Total Ash	2.43±0.20
Acid Insoluble Ash	0.29±0.01
Water soluble Ash	1.58±0.01
Alcohol soluble extractive value	5.81±0.02
Water soluble extractive value	7.31±0.01

Table 2. Physico-chemical parameters of *kashaya* of coconut shell

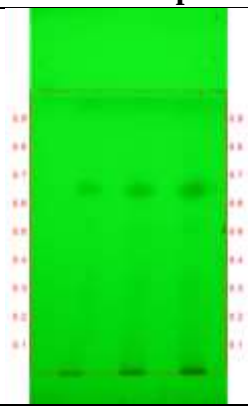
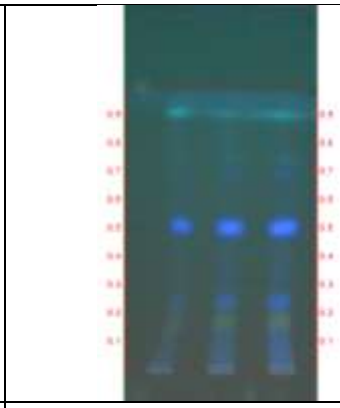
Parameters	Results n=3
	Kashaya of coconut shell
Refractive index	1.3315
Specific gravity	0.9742
Viscosity	1.1541
Total solids (%)	98.32
pH	6.0

Table 3: Results of preliminary phytochemical screening of *kashaya* of coconut shell

Test	Inference
	Kashaya of coconut shell
Alkaloid	-
Steroid	+
Carbohydrate	+
Tannin	+
Flavanoids	-
Saponins	+
Tri terpenoid	-
Coumarins	-
Phenols	-
Carboxylic acid	-
Amino acids	-
Resin	+
Quinone	-

(+) – Present; (-) – Negative

Figure 3. HPTLC photo documentation of methanol extract of Dried Coconut shell kashaya

		
Short UV	**Long UV**	**Post derivatisation**

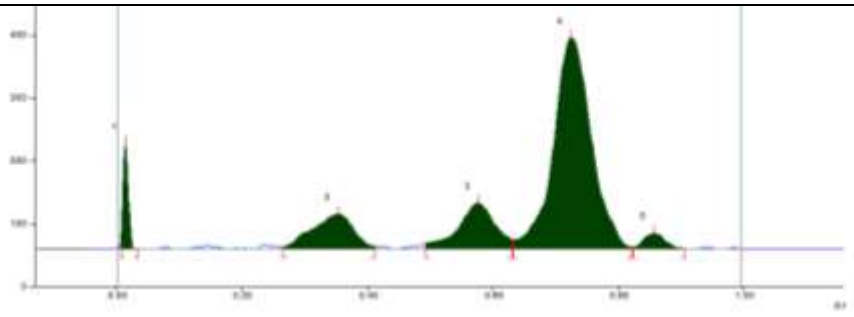
Track 1 - **Dried Coconut shell kashaya** – 4µl
Track 2 - **Dried Coconut shell kashaya** – 8µl
Track 3 - **Dried Coconut shell kashaya** – 12µl
Solvent system – Toluene: Ethyl acetate: Formic acid : Methanol (3.0: 3.0: 0.8: 0.2)

Table 4: R_f values of sample of Dried Coconut shell kashaya

Short UV	Long UV	Post derivatisation
-	0.17 (F. yellow)	-
-	0.24 (F. blue)	-
0.31 (Green)	-	-
-	-	0.34 (Purple)
-	0.50 (F. blue)	-
0.52 (Green)	-	0.53 (Purple)
-	-	0.59 (Purple)
0.64 (Green)	-	-
-	0.69 (F. blue)	0.69 (Purple)
-	-	-
-	0.74 (F. blue)	-
-	-	0.80 (Purple)
-	0.90 (F. blue)	0.90 (Purple)

*F – Fluorescent; L –Light; D – Dark

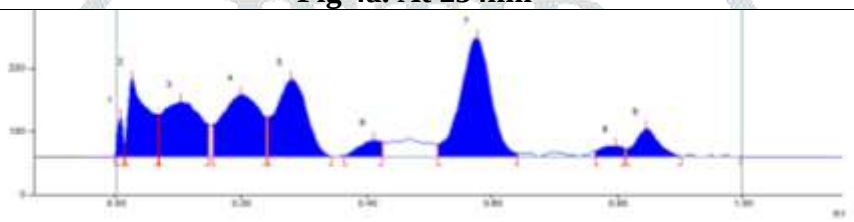
Figure 4. Densitometric scan of Dried Coconut shell kashaya



Track 3, ID: Dried coconut shell decoction

Peak	Start Position	Start Height	Max Position	Max Height	Max %	End Position	End Height	Area	Area %
1	0.01 Rf	9.8 AU	0.01 Rf	165.8 AU	25.44 %	0.04 Rf	0.0 AU	1027.3 AU	4.71 %
2	0.27 Rf	2.2 AU	0.35 Rf	55.0 AU	8.44 %	0.41 Rf	3.8 AU	2612.2 AU	11.97 %
3	0.49 Rf	7.9 AU	0.58 Rf	72.0 AU	11.05 %	0.63 Rf	14.1 AU	3036.0 AU	13.92 %
4	0.63 Rf	14.1 AU	0.73 Rf	334.5 AU	51.34 %	0.82 Rf	2.6 AU	14535.0 AU	66.63 %
5	0.82 Rf	2.6 AU	0.86 Rf	24.3 AU	3.73 %	0.91 Rf	0.1 AU	604.1 AU	2.77 %

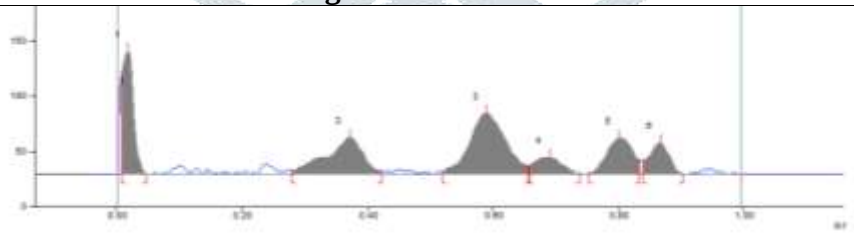
Fig 4a. At 254nm



Track 3, ID: Dried coconut shell decoction

Peak	Start Position	Start Height	Max Position	Max Height	Max %	End Position	End Height	Area	Area %
1	0.00 Rf	0.0 AU	0.01 Rf	61.7 AU	8.11 %	0.01 Rf	14.7 AU	345.5 AU	1.45 %
2	0.02 Rf	16.8 AU	0.03 Rf	123.0 AU	16.17 %	0.07 Rf	65.9 AU	2688.2 AU	11.32 %
3	0.07 Rf	66.2 AU	0.10 Rf	86.1 AU	11.32 %	0.15 Rf	50.4 AU	3693.6 AU	15.55 %
4	0.16 Rf	50.1 AU	0.20 Rf	97.5 AU	12.81 %	0.24 Rf	62.3 AU	4171.0 AU	17.56 %
5	0.24 Rf	62.7 AU	0.28 Rf	121.1 AU	15.91 %	0.35 Rf	0.4 AU	4250.1 AU	17.90 %
6	0.36 Rf	1.1 AU	0.41 Rf	25.4 AU	3.34 %	0.43 Rf	22.7 AU	627.8 AU	2.64 %
7	0.51 Rf	18.8 AU	0.58 Rf	186.7 AU	24.54 %	0.64 Rf	4.6 AU	6427.5 AU	27.06 %
8	0.77 Rf	8.5 AU	0.80 Rf	16.1 AU	2.11 %	0.81 Rf	13.1 AU	418.7 AU	1.76 %
9	0.82 Rf	12.2 AU	0.85 Rf	43.3 AU	5.69 %	0.90 Rf	0.1 AU	1126.4 AU	4.74 %

Fig 4b. At 366nm



Track 3, ID: Dried coconut shell decoction

Peak	Start Position	Start Height	Max Position	Max Height	Max %	End Position	End Height	Area	Area %
1	0.01 Rf	91.8 AU	0.02 Rf	110.9 AU	40.37 %	0.05 Rf	0.3 AU	1428.1 AU	19.85 %
2	0.28 Rf	2.9 AU	0.37 Rf	33.2 AU	12.10 %	0.42 Rf	2.8 AU	1392.6 AU	19.36 %
3	0.52 Rf	2.1 AU	0.59 Rf	54.9 AU	19.97 %	0.66 Rf	7.3 AU	2274.5 AU	31.62 %
4	0.66 Rf	7.4 AU	0.69 Rf	15.0 AU	5.45 %	0.74 Rf	0.5 AU	481.4 AU	6.69 %
5	0.75 Rf	0.8 AU	0.80 Rf	32.3 AU	11.76 %	0.84 Rf	12.9 AU	971.2 AU	13.50 %
6	0.84 Rf	12.8 AU	0.87 Rf	28.4 AU	10.35 %	0.90 Rf	0.1 AU	645.4 AU	8.97 %

Fig 4c. At 620nm (Post derivatisation with ASA)

Discussion

Loss on drying showed 6.48% which is indicative of the moisture present in the shell. Total is inclusive of organic and inorganic contents that contribute to the total ash weight which is 2.43%. acid insoluble ash is purely inorganic part of total ash which is salicaceous earthly matter, inorganic materials, which constitutes to about 0.29%. water soluble ash which is inorganic part of ash, and will be having therapeutic benefit constituting of 1.58%. Water soluble portion of shell is 7.31% which is pf therapeutic use. Alcohol soluble extractive is 5.81% it largely composes of polar and non-polar compounds. In phytochemical screening showed presence of steroids, carbohydrates, tannins, saponins and resins. Refractive index of the kashaya is 1.3315, which is the ability of liquid preparation to refract the monochromatic light, it is about container combability and phase separation. Specific gravity is 0.9742 which helps in dispensing the dose. Total solids are 98.32, the phytoconstituents which is present and add to the weight of kashaya. Ph is 6 which is towards neutral. HPTLC was carried out in a solvent system- Toluene: ethyl acetate: formic acid: methanol. Methanolic Coconut shell decoction was applied in 3 different concentrations 4,8, 12 µl in a solvent system- Toluene: ethyl acetate: formic acid: methanol (3.0: 3.0: 0.8: 0.2). after the plate was run in the solvent system, to a desired length, the plate was removed, dried and observed under UV Chamber under short UV, there were 3 bands present. Under long UV 6 bands were present. Following derivatised with Anisaldehyde sulphuric acid reagent 6 bands were identified. The plate was scanned in Linomat scanner 4, at 254 nm with deuterium lamp, 5 peaks illustrated among Rf .73(66.6%) was the major constituent. At 366 nm scanned under mercury lamp inflorescence mode, Rf point 0.58(27.87%) was the major constituents. Following with Anisaldehyde sulphuric acid reagent at 620 nm under white light tungsten shows Rf 0.59(31.61%) was the major peak.

Conclusion

Various parts of the coconut, such as leaves, roots, and flowers, have therapeutic uses. Coconut shells are utilized as fuel and in crafts. Folk practices include using coconut shells for hyperlipidaemia. If research confirms its efficacy, the shell could be employed in treating various medical conditions, necessitating further studies. These investigations aim to maximize the benefits of coconut shell as a potent drug in clinical practice.

Conflict of Interest

Nil

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