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# REVIEW ON DEVELOPMENT OF FORMULATIONS OF *COCUS NUCIFERA L.* SHELL EXTRACT

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**ABSTRACT:**

The term "**medicinal plant**" include various types of plants used in herbalism ("herbology" or "herbal medicine"). It is the use of plants for medicinal purposes, and the study of such uses.The word "**herb**"has been derived from the Latin word, *"herba"* and an old French word *"herbe"*. Now a days, herb refers to any part of the plant like fruit, seed, stem, bark, flower, leaf, stigma or a root, as well as a non-woody plant. Herbal formulation shall mean a dosage form consisting of one or more herbs or processed herb(s) in specified quantities to provide specific nutritional, cosmetic benefits, and/d other benefits meant for use to diagnose treat, mitigate diseases of human beings or animals and/or to alter the structure or physiology of human beings or animals.

Herbal preparations are obtained by subjecting herbal substances treatments such as extraction, distillation, expression, fractionation, purification, concentration or fermentation. These include comminuted or powdered herbal substances, tinctures, extracts, essential oils, expressed juices and processed exudates.

**KEYWORDS:**

Formulations, shell extract, preparation

INTRODUCTION:

**1.1 Plant overview**

The coconut tree (Cocos nucifera) is a member of the palm tree family (Arecaceae) and the only living species of the genus Cocos. The term "coconut" (or the archaic "cocoanut") can refer to the whole coconut palm, the seed, or the fruit, which botanically is a drupe, not a nut. The name comes from the old Portuguese word coco, meaning "head" or "skull", after the three indentations on the coconut shell that resemble facial features. They are ubiquitous in coastal tropical regions and are a cultural icon of the tropics.

The coconut tree provides food, fuel, cosmetics, folk medicine and building materials, among many other uses. The inner flesh of the mature seed, as well as the coconut milk extracted from it, form a regular part ofthe diets of many people in the tropics and subtropics. Coconuts are distinct from other fruits because their endosperm contains a large quantity of clear liquid, called coconut water or coconut juice. Mature, ripe coconuts can be used as edible seeds, or processed for oil and plant milk from the flesh, charcoal from the hard shell, and coir from the fibrous husk. Dried coconut flesh is called copra, and the oil and milk derived from it are commonly used in cooking – frying in particular

– as well as in soaps and cosmetics. Sweet coconut sap can be made into drinks or fermented into palmwine or coconut vinegar. The hard shells, fibrous husks and long pinnate leaves can be used as material to make a variety of products for furnishing and decoration.

The coconut has cultural and religious significance in certain societies, particularly in the Western Pacific Austronesian cultures where it features in the mythologies, songs, and oral traditions. It also had ceremonial importance in pre-colonial animistic religions. It has also acquired religious significance in South Asian cultures, where it is used in Hindu rituals. It forms the basis of wedding and worship rituals in Hinduism. It also plays a central role in the Coconut Religion of Vietnam. The falling nature of their mature fruit has

led to preoccupation with death by coconut.

Coconuts were first domesticated by the Austronesian peoples in Island Southeast Asia and were spread during the Neolithic via their seaborne migrations as far east as the Pacific Islands, and as far west as Madagascar and the Comoros. They played a critical role in the long sea voyages of Austronesians by providing a portable source of food and water, as well as providing building materials for Austronesian outrigger boats. Coconuts were also later spread in historic times along the coasts of the Indian and Atlantic Oceans by South Asian, Arab, and European sailors. Coconut populations today can still be divided into two based on these separate introductions - the Pacific coconuts and Indo-Atlantic coconuts, respectively.

### *1.1.1 Taxonomical details*

Coconut (Cocos nucifera L.; Arecaceae) (Figure 1) is a beautiful palm and essential multipurpose perennial crop of the tropics which attains a height of 60 to 90 feet. It is widely grown in Southern India and Ceylon. It is abundantly found in Eastern Bengal, particularly along the seashore, in the Malabar and Coromandal Coasts, and on the Indian Archipelago's islands.

This plant is life- maintaining species in fragile coastal and island ecosystems. Indonesia, Philippines, India, and Sri Lanka are the most important coconut-generating countries. Coconut belongs to the monotypic genus Cocos, beneathneath the subtribe Butiinae and tribe Cocoeae, subfamily Arecoideae (Table 1).

**Fig.1** Coconut palm tree

**Table 1 Taxonomic Details**

| | |
|---|---|
| **Domain** | **Eukaryota** |
| **Kingdom** | Plantae |
| **Phylum** | Spermatophyta |
| **Subphylum** | Angiospermae |
| **Class** | Monocotyledonae |
| **Order** | Arecales |
| **Family** | Arecaceae |
| **Genus** | Cocos |
| **Species** | Cocos nucifera |

### *1.1.2 Therapeutically important parts*

Flowers, root, fruit, oil and ash are the therapeutically important parts of plant. The fruit containsshell;juice and kernel are also useful therapeutically.

**Table 2 Regional names**

| Language | Regional Names |
|---|---|
| **Sanskrit** | Tranaraj Deerghavraksha Sadaphala: Rasayana-taru Narikela |
| **English** | Cocoanut- Palm. |
| **Hindi** | Nariyal |
| **Bengali** | Narikel. |
| **Marathi** | Naral |
| **Gujrati** | Naliar. |
| **Telugu** | Tenkayichettu, Thenkayamanu; Kobbitichettu; |
| **Tamil** | Tengu; Tanba |
| **Malyalam** | Ten. Can. TenginamaraKon.Narla-maddo |
| **French** | Cocotier |
| **German** | Achte kokospalme |

### *1.1.3 Phytochemistry of plant*

Phytochemical studies of the coconut fiber (mesocarp) ethanolic extract revealed that the presence of phenols, tannins, leucoanthocyanidins, flavonoids, triterpenes, steroids and alkaloids, while a butanol extract recovered triterpenes, saponins, and condensed tannins. Notably, compounds like flavonoids having antioxidant action are widely distributed in edible vegetables, fruits, and many herbs. C. nucifera fiber are rich in polyphenols, compounds such as catechins, epicatechins, tannins, and flavonoids. The constituents of the liquid albumen were identified as vitamin B, nicotinic acid (B3, 0.64 mg/mL), pantothenic acid (B5, 0.52 mg/mL), biotin (0.02 mg/mL), riboflavin (B2, o0.01 ng/mL), folic acid (0.003 mg/mL), with trace quantities of vitamins B1, B6, and C, pyridoxine, thiamine, folic acid, amino acids, L-arginine, plant hormones (auxin, 1,3-diphenylurea, cytokinin), enzymes (acid phosphatase, catalase, dehydrogenase, diastase, peroxidase, RNA polymerases), and growth-promoting factors. Furthermore, oil extracted from the solid albumen is primarily lauric acid and alpha tocopherol. Root phenolic compounds were identified as flavonoids and saponins. Other compounds identified in leaf epicuticular wax were lupeol methylether, skimmiwallin, [3b-methoxy-25-ethyl- 9,19-cyclolanost-24(241)-ene], and isoskimmiwallin [3b- methoxy-24-ethyl-9,19-cyclolanost-25 (251)-ene]

### *1.1.4 Pharmacological significance of plant*

Several studies have been conducted to identify the active molecules in coconut and their possible pharmacological and biological activities. Various extracts, fractions, and isolated compounds from different parts of the coconut fruit were tested, showing different activities, including antihypertensive; analgesia; vasodilation; protection of kidney, heart, and liver functions; protection against ulcers; and anti-inflammatory, anti-oxidant, antiosteoporosis, antidiabetes, antineoplastic, bactericidal, antihelminthic, antimalarial, leishmanicidal, antifungal, and antiviral activities.

### *1.1.5 Traditional uses*

All parts of the fruit of the coconut tree can be used. Both the green coconut water and solid albumen ripe fruits are used industrially and in home cooking in many ways. Additionally, several parts of the fruit and plant have been used by people in different countries for the treatment of various pathological condition. In Brazil, extract from the husk fiber of C. nucifera is used to treat diarrhea. In Papua New Guinea, the leaves and roots ofyoung plants are chewed as treatment for diarrhea and stomachaches. In Fiji, coconut oil is used to prevent hair loss and coconut water is used to treat renal disease. In Ghana, people use coconut milk to treat diarrhea. In Guatemala, the husk fiber extract is used as an antipyretic, to reduce renal inflammation, and as a topic ointment for dermatitis, abscesses, and injuries. In Haiti, a decoction of the dry pericarp is used for oral treatment of amenorrhea, and the oil is applied as an ointment to burns; an aqueous extract from the husk fiberis also used for oral asthma treatment. In India, infusions made with the coconut inflorescence are used for the oral treatment of menstrual cycle disorders.

***Toxicity***

Several studies have investigated the toxicological properties of C. nucifera. One paper verified the effect of ethyl acetate extract of C. nucifera fiber on physiological parameters and on topical inflammation induced by xylene in animal models. Regarding the physiological parameters and macroscopic aspects of the lymphoid organs in this study, neither mortality nor any symptom of toxicity was observed in the animals

**1.2 Herbal formulations**

Herbal formulation shall mean a dosage form consisting of one or more herbs or processed herb(s) in specified quantities to provide specific nutritional, cosmetic benefits, and/d other benefits meant for use to diagnose treat, mitigate diseases of human beings or animals and/or to alter the structure or physiology of human beings or animals.

Herbal preparations are obtained by subjecting herbal substances treatments such as extraction, distillation, expression, fractionation, purification, concentration or fermentation. These include comminuted or powdered herbal substances, tinctures, extracts, essential ils, expressed juices and processed exudates.

**2 LITERATURE REVIEW**

*Analgesic activity*

Crude husk-fiber extract and two aqueous extract fractions of molecular weights less than and greater than 1 kDa were studied for their analgesic activity by acetic acid-induced abdominal writhing, tail- flick, and hot plate tests in mice. All three extracts induced peripheral and central ant nociceptive activity. Oral administration of the crude extract (50, 100, or 150 mg/kg) significantly inhibited writhing by 24%, 34%, and 52.4%, respectively, when compared with a control group. Fractions F1 and F2 reduced total writhing at 10 and 50 mg/kg. In the tail-flick test, oral pre-treatment with crude extract (100 and 150 mg/kg), F1 (10 and 50 mg/kg),or F2 (10 and 50 mg/kg) produced effects better or similar to morphine (5 mg/kg) until 80 min. However, with the exception of F1 (50 mg/kg, 60 min after administration), neither crude extract (150 mg/kg) nor F2 (50 mg/kg) significantly increased the latency of mice response to thermal stimulation in the hot-plate test. The mechanism of action of the extracts were also evaluated using the opioid antagonist naloxone (5 mg/kg), which inhibited the ant nociceptive effect of the crude extract, F1, and F2, indicating a probable action on opioid receptors. In another study, an ethanol extract of the husk fiber (40, 60, or 80 mg/kg) showed significant analgesic properties, as indicated by a reduction in the number of writhes and stretches induced in mice by 1.2% acetic acid (41). The results were similar to those in animals that received aspirin (68 mg/kg), paracetamol (68 mg/kg), or morphine sulfate (1.15 mg/kg). Furthermore, administration of the ethanol extract along with morphine or pethidine not only produced analgesia in mice but also potentiated the analgesic effect of these two drugs. These studies were performed using coconut husk fiber extracts, suggesting that this part of the plant is a highly potent analgesic. Cocos nucifera may enable the production of new low-cost medicines for several ailments and may provide a very inexpensive source of new analgesic drugs. Further investigations are warranted. Further bioassay-guided fractionation and isolation of specific molecules are highly recommended so that the chemical moiety responsible for the activity can be identified and its mechanism of action established.

*Anti-inflammatory activity*

Aqueous crude extracts of husk fiber of C. nucifera are used to treat arthritis and other inflammatory ills in Northeastern Brazil‟s traditional medicine. A study using animal models of inflammation (formalin test and subcutaneous air pouch model) showed that aqueous crude extracts of C. nucifera var. typica (50, or 100mg/kg) significantly inhibited (Po0.05) the time that animals spent licking their formalin-injected paws and reduced inflammation induced by subcutaneous carrageenan injection by reducing cell migration, extravasation of protein, and TNF-a production. Husk fiber extracts were also tested on rat paw edema induced by carrageenan, histamine, and serotonin. Animals were pre-treated by oral administration of crude extract (50,100 or 150 mg/kg), F1 or F2 (1, 10, or 50 mg/kg), promethazine (30 mg/kg), or methysergide (5 mg/kg). The crude extract significantly (Po0.05) reduced histamine (at 150 mg/kg) and serotonin-induced rat paw edema (at 100 and 150 mg/kg). Even when mice were treated with 1 mg/kg of F1, a significant inhibitory effect was observed in histamine and serotonin-induced edema. However, F2 did not inhibit the edema induced by any pro- inflammatory agent. Animal tests revealed significant activity supporting the use of these husk fiber extracts in traditional medicine. The chemical constituents responsible for their activity should be isolated, identified, and researched to establish safety doses.

***Anti-bacterial, antifungal, and anti-viral activities***

Brushing the teeth with fibrous coconut husks is a common oral hygiene practice among rural people of South India. In this context, the antimicrobial properties of alcoholic extracts of the husk against common oral pathogens were analyzed by the agar well diffusion method. There was significant concentration-dependent antimicrobial activity, expressed as a zone of inhibition with respect to all tested organisms except Actinomyces species. However, the effect of the C. nucifera extract was less than that of chlorhexidine. Ethanolic (cold and hot percolation), dry-distilled, and aqueous extracts of coconut endocarp were compared with gentamicin and ciprofloxacin for their antibacterial activities against methicillin-resistant Staphylococcus aureus (MRSA), methicillin-sensitive S. aureus, Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumonia, Acinetobacter baumannii, Citrobacter freundii, Enterococcus, Streptococcus pyrogens, Bacillus subtilis, and Micrococcus luteus using the Kirby-Bauer disc diffusion method. The endocarp extracts showed strong antimicrobial activity against B. subtilis, P. aeruginosa, S. aureus, and M. luteus but had no effect on E. coli. The dry-distilled extract (1 mg/mL and 200 mg/mL) could inhibit the growth of B. subtilis and Aspergillus spp. but was inactive against R. oligosporus at all concentrations. The crude aqueous extract of husk fiber and five fractions obtained by thin layer chromatography (TLC) were also tested (10, 50, and 100 mg/kg) against E. coli, S. aureus, and MRSA via agar diffusion; they were active onlyagainst S. aureus and MRSA, with a minimum inhibitory concentration (MIC) of 1024 mg/mL for both. In another study, he

antimicrobial activity of mesocarp powder extracted with six common organic solvents was evaluated by the disk diffusion method. The pathogens E. coli and S. typhiwere used.

## 3. MATERIAL & METHODS

### 3.1 Collection of plant material

The fresh fruits of Cocos nucifera L. plant were collected from the region of Theur, Pune, Mahatashtrafor thepurpose of research.

### 3.2 Processing of plant material

The collected fruits were processed for purification and drying.

#### *3.2.1 Purification*

The fruits were purified by washing with distilled water. Then fruits were crushed to remove waterand shellswere separated from white coconut meat and heavy hairs.

#### *3.2.2 Drying*

The purified and separated shell of fruit was dried in sun for 15-16 days.

#### *3.2.3 Reduction of size of shell*

The dried shell of fruit was crushed by using mortal and pestle and converted into small pieces forfurtherextraction purpose.

### 3.3 Preparation of test extract of shell of *Cocos nucifera* L. fruit

Purified and dried pieces of shells of fruits were subjected for extraction by traditional method viz.“AnterDhoom Paddhati”.

### 3.4 Development of formulation

The extract thus prepared by “Anter Dhoom Paddhati” was used for the development of formulations.Theointment and gel formulations were prepared as per the below mentioned procedure.

#### 3.4.1 *Preparation of ointment*

For the development of ointment, soft paraffin was melted on water bath and then it was added in porcelain dish. Glyceryl Mono Stearate (GMS) was added gradually in melted soft paraffin. The accurately weighed quantity of methyl paraben (1%) was added in above mixture. Mixture was transferred to mortar in hot condition and then it was triturated vigorously with the help of pestle after addition of extract of *Cocos nucifera* L. A damp mass thus obtained was converted into semisolid mass by the addition of Hariol oil (10 ml).

The ingredients were used as per the formula mentioned below for the preparation of ointmentformulation,

**Table 3** Ingredients for ointment preparation

| Sr. No. | Requirements/Ingredients | Quantity Taken |
|---|---|---|
| 1 | Soft Paraffin | 5 g |
| 2 | Glyceryl Mono Stearate (GMS) | 4 g |
| 3 | Methyl Paraben | 1% |
| 4 | *Cocos nucifera* L. extract | 1 ml |
| 5 | Hariol 628 (Captex 326) | 10 ml |

### 3.4.2 *Preparation of gel*

The ingredients were used as per the formula mentioned below for the preparation of gel formulation,

**Table 4** Ingredients for gel preparation

| Sr. No. | Requirements/Ingredients | Quantity Taken |
|---|---|---|
| **1** | Tween 80 : Span 60 (1:1) | 4ml |
| **2** | Coconut Shell Oil | 0.5ml |
| **3** | Triethylamine | 0.1ml |

For the development of ointment, stock solution of Tween 80 and Span 60 (1:1) was prepared in first step. The *Cocos nucifera* L. extract (0.5 ml) was added in previously prepared stock solution in drop wise manner with vigorous stirring. The Triethylamine (0.1ml) was added to give the jelly consistencyto the mixture.

## 3.5 Evaluation of formulations

The developed formulations were evaluated for organoleptic and physico-chemical parameters viz. colour, odour, consistency, pH, irritancy, viscosity, moisture content (loss on drying), spreadability, washability.

## RESULTS AND DISCUSSION

The freshly collected fruits of *Cocos nucifera* L. plant were collected from the local region of Theur, Pune, Mahatashtra and it was further processed for purification and drying. The purification process was carried out toremove earthy and foreign matters. Then fruits were crushed to remove water and shells were separated from white coconut meat and heavy hairs. The desired part (coconut shell) was dried in sun for 15-16 days to remove the excessive water content. To isolate active phytoconstituents and to increase efficiency of extraction, the dried shells were crushed by using mortar and pestle and converted into small pieces. Purified and dried pieces of shells were subjected for extraction by traditional method viz. “Anter Dhoom Paddhati” mentioned in materials and methods. The extract thus prepared by “Anter Dhoom Paddhati” was used for the development of formulations (ointment and gelformulations) (Figure 2 & 3 respectively).

**Fig. 2 Ointment Formulation**

**Fig. 3 Gel Formulation**

The developed formulations were evaluated for organoleptic and physico-chemical parameters viz. colour, odour, consistency, pH, irritancy, viscosity, moisture content (loss on drying), spreadability, washability. The results of evaluation of formulations are as follows,

**Table 5 Evolutionary ParametersSr.No.**

| | Parameters | Significance | |
|---|---|---|---|
| | | **Ointment** | **Gel** |
| **1** | Color | Yellowish Brown | Yellowish Brown |
| **2** | Odor | Characteristic | Characteristic |
| **3** | Consistency | Smooth | Jelly |
| **4** | pH | 5.6±0.1 | 6.2±0.1 |
| **5** | Irritancy | Non Irritant | Non Irritant |
| **6** | Viscosity | Viscous | Less viscous |
| **7** | Moisture Content (Loss On Drying) | 27.78±0.88 | 30.08±0.94 |
| **8** | Spreadability | Easily Spreadable | Easily Spreadable |
| **9** | Washability | Good | Good |

**Formulation Label for Ointment:**


**Formulation Label for Gel:**

**Formulation Label for Gel:**

| INGREDIANTS | | INSTRUCTION |
|---|---|---|
| **Tween : Span (1:1)** | **4ml** | This is not for internal use. |
| **Oil Triethylamine** | **0.5ml0.1ml** | |

**SUMMARY AND CONCLUSION**

The formulations prepared from the extract of shell of *Cocos nucifera* L. by Anther Dhoom Paddhati viz. ointment and gel was found to possess better consistency, spreadability, washability. The colour, odour of formulations was found to be characteristics which will helps to increase palatability of formulation. The results of pH, viscosity, moisture content and irritancy shows that these formulations can be significantly use for topical application.

**FUTURE SCOPE**

The developed formulation can be explored further for the treatment of fungal diseases as per the traditional claim by tribal community as well as screening for the treatment of other skin disorders can be possible. There is need of characterization of active constituents present in the drug for better understanding of pharmacological actions of the extract.

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37. The 2019 Cosmetic Ingredient Review Expert Panel members are: Chair, Wilma F. Bergfeld, M.D., F.A.C.P.; Donald V. Belsito, M.D.; Curtis D. Klaassen, Ph.D.; Daniel C. Liebler, Ph.D.; James G. Marks, Jr., M.D., Ronald C. Shank, Ph.D.; Thomas J. Slaga, Ph.D.; and Paul W. Snyder, D.V.M., Ph.D. The CIR Executive Director is Bart Heldreth, Ph.D. This safety assessment was prepared by Alice Akinsulie, former Scientific Analyst/Writer, and Christina Burnett, Senior Scientific Analyst/Writer