Original Article

# Evaluation of antimicrobial activity of coconut husk extract

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## Abstract

The coconut plant *Cocos nucifera* (family Arecaceae) is considered as an important fruit crop in tropical countries. It is commonly available plant with wide variety of applications in food, drinks, fibres, building materials and various chemicals finding their way into a huge range of modern day products. Being highly nutritious coconuts have also been studied for medicinal qualities. As preliminary investigation of use of coconut husk, the antimicrobial activity can be evaluated. In present study antimicrobial activity of coconut husk is evaluated. It was observed that the antimicrobial activity of husk extract increased with increasing concentration and was found to be more effective against gram-negative than gram-positive organism. The extract was observed to be more effective against *Pneumonia vulgaris*. Presence of tannins and other phenolic compounds may responsible for antimicrobial activity.

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## 1. Introduction

Medicinal plants represent a rich source of antimicrobials and many other drugs. The potential of higher plants as source for new drugs is still largely unexplored. Published studies in medical journals show that coconut in one form or another may provide a wide range of health benefits.

*Cocos nucifera* (family Arecaceae) commonly known as coconut, is considered as an important fruit crop in tropical countries. It is a versatile plant with a variety of uses. Every part of it is useful to mankind for several purposes including food, drinks, fibres, building materials and chemicals finding their way into a huge range of modern day products. The coconut provides a source of meat, milk, oil, fibres, vitamins and minerals provides many health benefits beyond its nutritional content.

Coconut is unique in terms of their fruit morphology. Fibrous coconut fruit is not only edible but also popular for its multipurpose use. Besides being highly nutritious, coconuts have also been studied for medicinal qualities for heart, liver and kidney disorders. In fact, the coconut has recently been reported to reduce the viral load of HIV.

Modern medical science is now confirming the medicinal qualities which are used for the treatment of heart, liver and kidney disorders. Based on the knowledge of the traditional herbs used for the treatment for local application, coconut husk can be use as a topical antimicrobial. As preliminary investigation of the use of coconut husk, the antimicrobial activity can be evaluated. [1-3]

## 2. Materials and Methods

**Collection of plant material:**
Mature (7–8 months) coconuts were collected from the local market, Navi Mumbai. Outer husk of the fruit was decorticated, washed and cut into small pieces.

**Extraction:**
About 150 g of the cut husk was extracted using 250 ml of solvent ethanol at $40^0$ C and water : ethanol (1:1) at $50^0$ C, using soxhlet extractor. The extract was concentrated on water bath. Residue obtained was transferred into glass vial and stored at temperature 4°C.

**Phytochemical screening of the extract:**
Obtained extract was evaluated for various phyto-constituents by various phyto-chemical qualitative tests [4-7].

**Antimicrobial activity:**

**Bacterial strains:**

Micro-organisms used in this study includes reference strains used for laboratory experimental purpose namely *Escherichia coli, Staphylococcus aureus, Bacillus subtilis, Shigella sonarie, Pneumonia vulgaris, Salmonella typhi.* Stock cultures were maintained at $4^0$C.

Active culture inoculums for experiments were prepared by transferring a loopful of cells from the stock cultures to test tubes containing nutrient broth and incubated for 24 h at $37^0$ C.

**Antimicrobial susceptibility test:**

Disc diffusion method was used to screen the antimicrobial activity of obtained alcoholic and hydro-alcoholic extract. The plates were prepared by pouring 15 ml of molten sterile nutrient agar media into sterile petri plates. The plates were allowed to solidify for 5 min. Culture inoculum suspensions were spread uniformly on to prepared petri plates using sterile spreader and allowed to dry for 5 min. Solutions of various concentrations of both alcoholic and hydro-alcoholic extract were prepared (1, 2, 5, 10, 20 mg/ml). Paper discs of 6 mm diameter were cut and sterilized. Prepared sterile paper discs were saturated with both extract solution of prepared concentrations and dried. Saturated discs were then placed on the surface of agar medium of petri plate and allowed to diffuse for 5 min. Prepared plates were kept for incubation at 37 $^0$C for 24 h. Streptomycin discs were used as standard. Post-incubation inhibition zones around the extract disc were measured with a transparent ruler in mm. A positive and negative control was kept for the study [8-11].

## 3. Result and Discussion

**Phyto-chemical screening:**

Obtained alcoholic and hydro-alcoholic extracts were evaluated for various phyto-constituents by performing different phyto-chemical qualitative tests and TLC. Extract showed positive test for glycosides, phenolic compounds and tannins. Presence of glycoside was confirmed by TLC. Results obtained for preliminary phyto-chemical analysis of alcoholic and hydro-alcoholic extract is shown in Table 1 and TLC analysis of both the extract is shown in Table 2.

**Antimicrobial activity:**

Antimicrobial activity of both extract was evaluated against selected bacterial strains by *in vitro*

**Table 1. Preliminary phyto-chemical analysis of alcoholic and hydro-alcoholic extract**

| Phyto-constituent | Alcoholic | Hydro-alcoholic |
|---|---|---|
| **Steroids** | - | - |
| **Saponis** | - | - |
| **Cadiac glycosides** | + | - |
| **Anthraquonone glycosides** | - | + |
| **Cyanogenic glycosides** | - | - |
| **Alkaloids** | - | - |
| **Tannins and phenolic compounds** | + | + |

**Table 2. TLC analysis of alcoholic and hydro-alcoholic extract**

| Solvent system | Detecting agent | Observation | Inference | Alcoholic | Hydro alcoholic |
|---|---|---|---|---|---|
| **Ethyl acetate : Methanol: Water (17.5: 13.5:10)** | KOH | Red / yellow | Anthraquonone/ Anthrone | - | + |
| | Vanilline-Sulfuric acid | Red/yellow/ brown/ blue green | Bitter principle | - | - |
| | Dragenderoff reagent | Orange red | Alkaloids | - | - |
| | U. V. | Blue | Saponins | - | - |
| **Toluene : Ethyl acetate (93:7)** | $NH_3$ / KOH | Light blue brown | Coumarin | - | - |
| | Acetic acid/ HCL | Blue / brown | Valproate | - | - |

**Table 3. Zone of inhibition for alcoholic and hydro-alcoholic extract against various concentrations**

| Micro organism | Zone of inhibition (mm) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Alcoholic extract (mg/ml) | | | | | | Hydro-alcoholic extract (mg/ml) | | | | | |
| | 1 | 2 | 5 | 10 | 20 | Standard Streptomycin | 1 | 2 | 5 | 10 | 20 | Standard Streptomycin |
| ***Escherichia coli*** | - | - | - | - | - | 13 | - | - | - | - | - | 13 |
| ***Staphylococcus aureus*** | - | 5 | 5 | 5 | 7 | 11 | - | 5 | 6 | 8 | 8 | 11 |
| ***Bacillus subtilis*** | - | - | - | 5 | 6 | 11 | - | - | 5 | 5 | 7 | 11 |
| ***Shigella sonarie*** | - | - | - | - | - | 11 | - | - | - | - | - | 11 |
| ***Pneumonia vulgaris*** | - | 5 | 8 | 8 | 12 | 12 | - | 5 | 6 | 10 | 12 | 12 |
| ***Salmonella typhi,*** | - | - | - | - | - | **10** | - | - | - | - | - | 10 |

agar disc diffusion method. Table 3 represents zone of inhibition for alcoholic and hydro-alcoholic extract against various concentrations.

Different concentrations of both the extracts were evaluated for antimicrobial activity and compared with standard streptomycin (100 µg/disc). Presence of phyto-constituents namely glycosides, phenols and tannins are responsible for the antimicrobial activity [12-14].

Varying degree of antimicrobial activity was observed. Increase in antimicrobial activity was observed with increase concentration of extract. Extract was found to be more effective on gram negative than gram positive bacteria. Plant extract exhibits antimicrobial activity against *Staphylococcus aureus* and *Pneumonia vulgaris*. Extract is more active against P*neumonia vulgaris.* Extract was observed to be ineffective against *Escherichia coli and Shigella sonarie* in all prepared concentrations. In case of *Bacillus subtilis*, activity was observed at higher concentration.

## 4. Conclusion

The coconut plant *Cocos nucifera* is commonly available plant with wide variety of applications in foods, drinks, fibres, building materials and chemicals finding their way to a range of modern day products. In the current project antimicrobial activity of coconut husk is studied. It was observed that the antimicrobial activity of husk extract increased with increasing concentration and was found to be more effective on gram-negative than gram- positive organism. Extract is more active against *Pneumonia vulgaris*. Presence of tannins and phenolic compounds may responsible for antimicrobial activity.

## 5. Abbreviations and Symbols

h: Hours

min: Minute

mg: Milligram

µg: Microgram

mm: Millimetre

0C: Degree celsius

TLC: Thin layer chromatography


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## 8. Competing Interests

None declared.

## 9. References


1. Sharma PC, Yelne MB, Dennis TJ. Database on medicinal plants used in Ayurveda. vol. 4, New Delhi, Central Council for Research in Ayurveda & Siddha, 2002.
2. Chopra RN, Nayar SL, Chopra IC. Glossary of Indian Medicinal Plants. New Delhi, CSIR, 1986.
3. Nadkarni KM. Indian Materia Medica. Popular Prakashan, 1978.
4. Kokate KC. Text book of Pharmacognosy, Nirali prakashan Pune .2002
5. Boily Y, Vanpuyvelde L. Screening of medicinal plants of Rwanda (Central Africa) for antimicrobial activity. J Ethnopharmacol. 1986;16:1-13.
6. Britto ARMS, Antonio MA. Oral anti-inflammatory and anti-ulcerogenic activities of a hydroalcoholic extract and partitioned fractions of Turnera ulmifolia (Turneraceae). J Ethnopharmacol. 1998;61:215 -28.
7. Esquenazi D, Wagg MD, Miranda MM, Rodrigues HM, Tostes JB, Rozental S, et al. Antimicrobial and antiviral activities of polyphenolics from Cocos nucifera Linn. (Palmae) husk fibre extract. Research in Microbiology. 2002;153:647–52.
8. Zhu X, Zang H, Lo R. Phenolic compounds from the leaf extract of Artichoke (Cynara scolymus L.) and their antimicrobial activities. J of Agricultural and Food Chemistry. 2004;52:7272–8.
9. Scortichini M, Pia Rossi M. Preliminary in vitro evaluation of the antimicrobial activity of triterpenes and terpenoids towards Erwinia amylovora (Burrill). J Bacteriol 1991;71:109–12.
10. Tsuchiya H, Sato M, Miyazaki T, Fujiwara S, Tanigaki S, Ohyama M, et al. Compara-

tive study on the antibacterial activity of phytochemical flavanones against methicillin-resistant Staphylococcus aureus. J Ethnopharmacol 1996;50:27–34.

11. Haque MM, Rafiq, Sherajee S, Ahmed Q, Hasan, Mostofa M. Treatment of external wounds by using indigenous medicinal plants and patent drugs in guinea pigs. J Biol Sci. 2003;3:1126–33.
12. Dey G, Chakraborty M, Mitra A. C6–C3 and C6–C1 phenolic metabolites in Cocos nucifera. Journal of Plant Physiology. 2005;162:375–81.
13. Samy RP, Ignacimuthu S. Antibacterial activity of some folklore medicinal plants used by tribals in Western Ghats in India. J. Ethnopharmacol.2000;69: 63-71.
14. Girish KS, Machiah KD, Ushanandini S, Kumar H, Nagaraju KS, Govindappa M, Vedavathi, K. Kemparaju, Antimicrobial properties of a non-toxic glycoprotein (WSG) from The *Withania somnifera* (Ashwagandha). J. Basic Microbiol. 2006; 46: 365-74