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RESEARCH ARTICLE

EXTRACTION AND EVALUATION OF PHYTOCHEMICALS FROM GREEN COCONUT (*COCOS NUCIFERA*) SHELL

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ABSTRACT

Phytochemicals from green coconut (Cocos nucifera) shell can be a source of raw materials in food and pharmaceuticals industries. Every year, million tons of green coconut shells are being wasted and one of the major concerns of the environments. The objectives of the present study were detection of phytochemicals content from green coconut shell. The Green coconut shell was collected from the local area of Sobhanbagh near Daffodil International University, Bangladesh. Phytochemicals were extracted using four different solvents i.e. methanol, ethanol, acetone and 0.9% NaCl solution. Flavonoids, carbohydrates, reducing sugar, saponins, tannins, anthraquinones, steroids, alkaloids, glycosides, phytosterols, phenols, were extracted and observed by change in color using available methods described in several literatures. We tried to find out some valuable phytochemical of green coconut shell which might be used in food industry as food additives after the commercial purification.

KEYWORDS

Green coconut shell, Extraction of phytochemicals, Solvent preparation.

1. INTRODUCTION

The multipurpose applications that have recently become of great interest on plant derived substances. Medicinal plants and other plants are the richest bioactive ancient system of pharmaceuticals, medicine, food supplements and other synthetic drugs. Based on a study, natural products and its integral parts have been using an ancient traditional medicine system [1-2].

Following the World Health Organizations (WHO), introduction of a medicinal plant is referred to a plant of which one or more parts, elements are used for diagnostic purposes. Leaves, roots, rhizomes, stems, and barks of plants therefore contain different chemical components. Study showed these bioactive compounds of plants nonnutritive parts are often mentioned as phytochemicals [3-5].

According to research, plant parts contain antioxidants are, fiber, polyphenols carotenoids, flavonoid, conjugated vitamin B, C, E, calcium, selenium, chlorophyll, alipharin, sulphidescatechin, lignins, uric acid, indoles, thiocyanatesand protease inhibitors and are used as food and pharmaceutical additives [6]. The use of phytochemical compound as food additives require that this is not toxic substance which prefers recommended level of use. World Health Organization (WHO) and the Food and Agricultural Organization of United Nation (FAO) work with jointly as an expert committee in food additives (JECFA). This committee regulates the standards, guidelines, safety of foods and code of practice on use of food additives. Specific role of chemical characteristics of vitamin, mineral, amino acids, and other phytochemicals which can be used to improve nutritional food staff profile. The common practice of bakery products snacks, fruit juice, canned vegetables and milk include in food formulations of balance during processing. The fortification of food additives uses for producing quality food [7-9]. Plant and fruit phytochemicals are the great source of sweetening agent of food. Based on a study, many of these sweetening agents are not directly sugar, but protein [10]. There are several kinds of phytochemicals like Monellin, Thaumatin, Brazzein, Pentadin, Miraculin, and Mabilin are plant substance which have sweetening properties. Many phytochemicals also used as coloring substance in the time of food processing. They adjust correct food coloration during processing and storage. Anthrocyaanins, betalains, chlorophylls and carotenoids are the coloring substance [11].

Phytochemical are used in many food industries as food components or food additives and physico-chemical determination how they are handling in industry. For example, if a phytochemical has an antioxidant activity and could be used of potential avoid of undesirable oxidation of food products (fat of protein). The use of phytochemicals in food industry is monitoring by competent regulation body such as BSTI, BCSIR. These green coconut shell waste materials could be processed and isolated phytochemical compound which are actually related for production and processing of food products.

1.1 Green coconut *(Cocos nucifera)*

Cocos nucifera L., the coconut or green coconut, which has been described as the "tree of life". Each part of the coconut tree is valuable. Study showed coconut is derived to have its origin in the indo-malayan region. The coconut palm is monoecious [12]. A scholar said green coconut is a member of magnoliophyta division, and the Palma family that grows

abundantly in all over the Bangladesh and it is called "Dab" in Bangla [13]. Coconut palm tree and all the parts of these trees have good beneficial aspects. Food scientists' have been unconcious of the potential benefits of coconuts. Antibacterial, antimicrobial, antiprotozoal and anti-cancer effects of coconut have been recognized by the researchers in recent times [14]. The researchers have explored the beneficial effects of coconut consumption, reported that high cholesterol or heart disease mortality and morbidity have been decreased by eating coconut [15].

Approximately 50% of active metabolites are present in coconut as of the chain of saturated fatty acids. Based on a previous study, green or young coconut is free from fat, low calories, vitamins, minerals, sodium, potassium, phosphorus, chloride and magnesium found in coconut water [16-18]. Coconut shell is one of the wastes and environment concern in Bangladesh as well as in Coconut producing countries. Several agricultural wastes such as coconut shell have studied as bio sorbents for water treatments and also have benefits of various types of trees e.g. coir, shell, fibre etc. From 1980, the total world coconut production was increased 35 to 40 million tones [19]. According to source of world coconut statistical yearbook- 1998, 10 million tons of copra/coconut were produced in Philippines, Indonesia, and India which was 70% of the total production [20].

According to BBS 2009-2010 the total coconut production in Bangladesh was 389094 metric tons. Weights of coconut shells are around 1.5 – 2 kg. A huge amount of coconut shells is being thrown out to the environment, which has spoiled soil and water sources. However, the use of coconut byproducts has been source of materials for common people as well as processing industry. According to a researcher, coco-diesel, coir, glues, and charcoal are main byproducts come from waste green coconut shell [21].

If it is possible to isolate potential number of phytochemicals, Bangladesh needed not to import certain raw materials for food and pharmaceuticals industries. Concerning this in mind, our objectives of the studies are

(1) Detection of Phytochemicals present in green coconut shell.

(2) Find out economic viability of establishing allied food/pharmaceutical raw material industries in Bangladesh.

2. MATERIALS AND METHODS

2.1 Collection of plant materials and preparation of sample

Four types of solvent such as aqueous (water 0.9% NaCl) solution, 70% Methanol, 70% Ethanol, and 70% Acetone were used for the detection of different result. The green coconut shells were collected from the local area of Dhaka city and Sobhanbag near the Daffodil International University. Sample preparation is a complex stage of a successful analytical method. There is important common guideline protocol for all types of sample preparation must be taken for better preparing samples for analysis.

2.2 Preparation procedure

The collected sample was washed properly and keeps it room temperature for some time for drying. The samples were cut into small pieces and blended by electronic blender and then pestle and grinded by mortar for fine particles. The grinded sample was soaked with prepared 70% methanol, ethanol, acetone and 0.9% NaCl aqueous solvents. The extracts of samples were prepared 25 mg in 75 ml of solvents in conical flask for the 1: 3 ratios. The aluminum foil paper was used to seal the conical flask and marked by permanent marker for identifying. Four types of extracts were kept at 72hours or 3 days at room temperature. After 72 hours all the extracts were sieved with thin cloths and taken into separate conical flask and sealed by aluminum foil paper.

2.3 Screening of phytochemical compound

Based on recent study, to identify the phytochemical derivatives in the methanol, ethanol, acetone and NaCl aqueous solution extract were performed for standard phytochemical screening [22-25]. Phytochemical examination was bringing out for all the extracts as per standard analytical methods.

2.3.1 Identification of flavonoids

Magnesium ribbon and 2-3 drops of concentrated HCL were added to 2ml of extracts in a test tube, pink or red color indicates the presence of flavonoids [26].

2.3.2 Identification of carbohydrates

Molish test: 2 ml of Molish's reagent and 2ml of extracts were boiled and then few drops of sulfuric acid were added. A radish ring indicates the existence of carbohydrate.

2.3.3 Identification of reducing sugar

5 ml of extracts was added with 5ml of boiling Fehling solution for 2-5min. A brick red precipitate shows the presence of reducing sugar.

2.3.4 Identification of tannin

2 ml of extracts was taken into a small test tube and added few drops of 0.1% or 1m ferric chloride solution. A blue black or greenish black coloration indicate the presence of tannin.

2.3.5 Identification of saponins

Foam test: 2 ml of extracts was taken with 5 ml of distilled water in a test tube. If foam persist for ten minutes which indicate the presence of saponins [27].

2.3.6 Identification of anthraquinones

2 ml of extracts with added 2 ml of ammonium hydroxide solution. A bright pink coloration indicates the presence of anthraquinones.

2.3.7 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.

2.3.8 Identification of Alkaloides

Wagner test: 2 ml of extracts treated with 2-3 drops of wogner's reagent. Formation of brown or radish precipitate indicate the presence of Alkaloides.

2.3.9 Identification of Glycosides

Modified Bronstrager's test: Extracts were taken with some 0.1% or 1m ferric chloride solution and immerse in boiling water for 5 minutes. Then the mixture was cooled and adds same volume of benzene. Then the benzene layer was separated into another test tube and added few drops of ammonia solution. A rose-pink color in the ammoniacal layer indicate the presence of anthranol glycosides.

2.3.10 Identification of phytosterol

Libermanburchard's test: 2 ml extracts were taken with 5 ml of chloroform and filtrates. Then the filtrates solution was treated with few drops of concentrated sulfuric acid with shaken and allowed to stand. A golden yellow appearance indicates the presence of phytosterol.

2.3.11 Identification of Phenols

Ferric chloride test: 2 ml of extracts were treated with 3-4 drops of 0.1%or 1m ferric chloride solution. A bluish black color indicates the presence of Phenols.

2.3.12 Identification of Terpenoides

To 2ml of extract were treated with 2ml of chloroform, then added 3ml of or few drops of sulfuric acid. Radish brown coloration in the inter face indicates the presence of Terpenoides [28].

3. RESULTS AND DISCUSSION

The present study carried out on the *Cocos nucifera* shells, waste materials revealed the presence of medicinal and active phytocompounds. The active phytocompounds were qualitatively analyzed from the four types of extracts such as methanolic, ethanolic, acetone and the aqueous NaCl solution individually and the result was presented in Table 1. In this screening process we were detected different types of phytochemicals,

which has shown their activity in different solution.

Table 1: The analysis of phytochemicals in the various extracts of *Cocos nucifera* shell

Phytochemical	Methanol Extract	Ethanol Extract	Acetone Extract	Aqueous Extract
Flavonoids	+	+	+	-
Carbohydrates	+	+	+	+
Reducing Sugar	+	+	+	+
Tannins	+	+	+	+
Saponins	+	+	+	-
Anthraquinones	-	-	-	-
steroids	-	-	-	-
Alkaloids	+	+	+	+
Glycosides	+	+	-	+
Phytosterols	-	-	+	+
Phenols	+	+	+	+
Terpenoids	+	+	+	+

+ = presence; **-** = absence

In table 1 there has been shown the analysis result of phytochemicals of green coconut shell from four different types of solvents methanolic, ethanolic, acetone and aqueous solution. The extracts also show their absence and presence by color change activity. Flavonoids is shown their activity of presence all the solution except aqueous solution. Carbohydrates are shown their activity all the type of solutions. Reducing sugar and tannin are shows their activity of presence in all the solution type on the other hand saponins are actives in 3 types of solution except aqueous solution. Anthraquinones and steroids are totally absent in four types of solutions. Alkaloids, phenols, and terpenoids are shown their presence by color change activity in all the solutions. Glycosides are absence only acetonic solution and plytosterols are presence in the acetone and aqueous solutions.

Cocos nucifera (green coconut) is very popular fruits across the country. There are no significant uses in Bangladesh for the green coconut shell. Therefore, green coconut shells are found in everywhere on roads to dustbin and ponds to river creates threats to the environments. Ours studies has detected some important phytochemicals from green coconut shell. These phytochemicals have a role in human health as well as have potential use in food and pharmaceuticals industries. Flavonoids, carbohydrates, reducing sugar, tannins, saponins, anthraquinones, steroids, alkaloids, glycosides, phytosterols, phenols, terpenoids, and amino acids were detected in this study. Anthraquinones and steroids were totally absent in every solvent system. Green coconut shell is a waste biproducts which are available in Bangladesh. Even food industry produces huge amount of these types of waste both solid and liquid after the production, processing and consumption of food. These waste materials increasing disposal and potential pollution problems and represent a loss of valuable biomass and nutrients in the environment. These byproducts and its pollution have hazard aspects in many ways. Food processing waste might have a potential for conversion into a value-added product. These type of waste like green coconut shell, waste are used for other purpose of isolation of phytochemicals compounds [29]. Phytochemicals are used in food industry as flavoring agents, antioxidant, coloring agents and nutraceuticals agents. Flavonoids and carbohydrates are two types of phytochemicals which have various using purpose [30,31].

Two types of phytochemicals which has a versatile use in the food and pharmaceutical industries nowadays that is flavonoids and carbohydrates. Flavonoids compound are the sub group of polyphenols. Nowadays, there are a vast range of adjunct rich in flavonoids from numerous plant extracts can be easily found. Some food and beverage industries are using flavonoids to target the healthy food products for consumers. Large worldwide producers of soft beverage drinks have been producing variation of their products involved with polyphenols. The fortification of these substances has been hindered by the chemical commodities of some polyphenols. Some natural extracts of contains polyphenols like grape, green, tea or cranberry extracts were added to a prepared cheese. Isoflavones are a subclass of the more universal properties of flavonoids [32]. It has been supposition that isoflavones are reducing the risk of cancer, heart disease and osteoporosis. Carbohydrates are one of the important components in foods and raw materials in an industry. Carbohydrates are added to food products to provide nutrients and improve the calories, texture and overall quality of food products.

Carbohydrates are also added to food products as stabilizer and dietary fiber. For example, locust bean and guar gum most exoteric ingredients which are used to stabilize emulsions and prohibit ice crystal growth in ice-cream. Other polysaccharide gels and gums have been widely used in bakery and dairy products as gelling agents for making dessert. Polysaccharides are also used for stabilizing emulsions, foams, and gels in many cosmetic products. Overall phytochemicals have a wide range of impacts on production of food and food products. Phytochemicals perform in food processing sectors as a coloring agent, antioxidant agents, stabilizer, foaming agents, gelling agents, antioxidant and antimicrobial activity to extend shelf life [33]. Screening of phytochemical from such kind of waste or byproducts which are available, and which produce huge amount of waste materials. Green coconut shell, waste can be recycled for the isolation of important phytochemicals which are actually used for production of food products. Every year our food industry imported huge amount of phytochemicals-based food additives from abroad. So, it can be establishing a waste byproducts processing industry in small scale, where the waste materials are processed and isolated phytochemicals for the further use of our food industry. As a result, we can save huge amount of foreign currencies and waste free environment. After isolating phytochemicals from waste materials grinded and pestle sample byproducts can be used as a fertilizer in the field.

4. CONCLUSION

Every plant has phytochemicals. Most of plant derived waste materials contain phytochemicals as well. We have qualitatively identified some potential phytochemicals from popular waste green coconut shell. All of the phytochemicals are the essential raw materials for food and pharmaceuticals industries and are being imported every year. If we can use green coconut shell for the production of phytochemicals we can save a significant amount of foreign currencies. Every year million tons of green coconut shell is thrown by people all over the world. As a result, it will become a major concern of environmental pollution affairs. But is this case if we make some plan to build up an allied industry where this type of waste plant materials will be processed and extracted such kind of phytochemicals which is very important for food and pharmaceuticals industry. Every year all over the world food and pharmaceuticals industry import million tons of such kind of phytochemical compound for their production. In Bangladesh every year huge amount of phytocompound is imported by food and pharmaceuticals industry. The present study we find out the presence of phytochemicals of waste material green coconut shell. The further study will be quantitative examination of this phytocompound as a result the actual quantity will be known. Our country can easily save their foreign currencies by buildup of purification plant of phytochemicals.

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