Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 05, Issue: 06 (NOV-DEC, 2025)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Value Addition in Coconut

*Dr. P. Pedda Nagi Reddy
Assistant Professor, Department of Horticulture, ANGRAU-S V Agricultural College, Tirupati, Acharya N G Ranga Agricultural University
*Corresponding Author's email: p.peddanagireddy@angrau.ac.in

Coconut The principal value-added edible coconut products are coconut oil, desiccated coconut, virgin coconut oil, coconut chips, tender coconut, coconut inflorescence sap, and coconut sugar. Several by-products are generated while processing these value-added products, which have immense health benefits and offer scope for further value addition. These by-products are obtained from mature coconut, tender coconut, coconut inflorescence, etc., which could be of edible and non-edible nature. The different by-products and their commercial utilities are presented below.

By-products derived from mature coconut: In the coconut processing chain, virgin coconut oil (VCO), is one of the major value added products, and a number of by-products such as husk, shell, testa, nut water, coconut milk residue, and VCO cake are obtained. During VCO processing, 500 nuts yield about 200 kg of husk, 67 kg of shell, 50 L of nut water, 3.3 kg of testa, 25 kg of milk residue and 5 kg of VCO cake. The husk has immense utilities in coir industries, in the preparation of potting mixtures. Shell charcoal, activated carbon, and shell flour are the commercial products obtained from the shell. Mature coconut water is commercially utilized for the preparation of vinegar, the production of nata de coco and soft drinks or squash. Coconut testa is enriched with phenolic compounds and appreciable antioxidant activity and hence used as an ingredient in highfibre digestive biscuits. Milk residue and VCO cake are the two co-products, presently underutilized or discarded as waste. In addition to VCO, husk, shell, water, and testa are the common by-products obtained during the processing of other major value added products such as desiccated coconut, coconut milk, etc.

Coconut milk residue (CMR): It is the leftover residue following coconut milk extraction, the process involved in producing coconut milk or virgin coconut oil (VCO). The per cent recovery of CMR ranges from 38.5 to 55.6%. CMR at 2.9% moisture level contains 46.5% dietary fibre, 5.3% protein, and 49.2% crude fat. It has four folds more fibre than oat bran, a couple of times higher than wheat bran, and is calorie-free. It is loaded with nutrients and free from gluten and phytic acid. It is also a source of polyphenolics with immense antioxidant activity. As a source of dietary fibre, it can improve bowel movement and protect against coronary heart diseases, colon cancer and diabetes.

Low fat desiccated coconut flour: CMR is marketed as low-fat desiccated coconut flour having a moisture percentage of 3-5%. It can be used as fillers, bulking agents and as a substitute for wheat flour, rice flour and potato flour and incorporated into baked and extruded food products. Flour made out of CMR is incorporated (10-15%) into various products including biscuits, cake, ladoo, etc.

Extrudates: CMR flour could be utilized for the preparation of extruded snacks. CMR-based cereal snack was formulated at the ICAR-CPCRI. It was found that 20% milk residue was optimum for preparing extruded snacks using broken rice, maize and pearl millet in a twin screw extruder. The product had good acceptability with a maximum shelf life of 6 months

when packed in laminated pouches. The product was commercialized as Kalpa Krunch. It is a healthy, nutritious, and ready-to-eat snack for people of all age groups since it is rich in dietary fibre, protein, minerals and antioxidant properties.

Pasta: CMR was utilized as a partial substitute for wheat in preparing fibre-enriched pasta. Studies conducted at CPCRI suggest that 10% of the durum wheat semolina could be replaced with CMR. Incorporation of CMR along with durum wheat semolina positively influenced the cooking, colour, textural attributes, and overall sensory acceptability of pasta. However, the firmness of the pasta gets reduced with an increased concentration of CMR beyond 10%. CMR fortified pasta can provide more than 50% of the recommended dietary allowance of fibre besides enriching the protein content of pasta.

Biscuits: CMR can be incorporated into wheat flour for the preparation of biscuits and cookies, and to enhance the crunchiness of these products. ICAR-CPCRI has developed biscuits from CMR and jackfruit seeds. The optimized combination comprise 50% wheat flour, 20% CMR, and 30% jackfruit seed flour along with coconut sugar. Kishi Vigyan Kendra, ICAR-CPCRI, Kasaragod also developed a CMR-based biscuit along with wheat flour, butter, and sugar.

CMR and VCO cake infused dark chocolates: Kalpa 'bean to bite' dark chocolate developed and released by ICAR-CPCRI comprises 45% cocoa nibs, 30% coconut sugar, and 25% cocoa butter. CMR and VCO cakes partially substituted the expensive ingredient of chocolate, cocoa butter, as a source of fat which doesn't melt at ambient temperature besides enriching the nutrient content.

CMR-based sweets/ladoo: The recipe for the preparation of CMR-based ladoo includes, 25% CMR, 32% sucrose, 12% desiccated coconut, and 7% refined wheat flour, 12% shortening (vegetable fat), 9% water, and 3% cashew nuts. The mixture was heated until it reached the consistency essential for shaping into a ladoo.

In addition to these value-added food products, wet CMR can be mixed with other agricultural farm wastes and animal manure, with or without the addition of microbial inoculums, to produce organic fertilizers. Mature coconut water: Mature coconut water has been considered a waste, especially in coconut processing plants. The liquid causes environmental pollution and is also a waste of valuable food. The most economical and practical way to enhance the value of coconut water are preparing vinegar, using it as a growth medium for yeasts, xanthan gum production, for the culture of various lactic acid bacteria or in nata de coco production. In addition, it can be marketed as a natural soft drink or non carbonated beverage following appropriate preservation and packaging strategies. Alternatively, mature nut water could be converted into concentrates (800 g from 10 L) for use in food industries. For instance, mature coconut water-based dessert (jelly), commands a huge demand in the domestic market.

Coconut water-based vinegar: It is the product of the alcoholic and acetic fermentation of sugar-enriched coconut water. After filtration, matured coconut water with an initial sugar content of 1-3% is concentrated in a boiling process to 15% by fortifying it with sugar. The pasteurized mixture is then cooled and inoculated with active, Saccharomyces cerevisiae (1.5 g/L). After alcoholic fermentation (22–27 °C) for about 3-6 days, the clear liquid is syphoned off and inoculated with mother vinegar or a starter culture containing acetic acid bacteria and the acetified vinegar is then aged before bottling. Vinegar is used as a preservative and as a flavouring agent in the food processing sector.

Mature coconut water-based squash: Squash is an unfermented beverage generally made from fruit pulp or juice (at least 25%) and is diluted before serving. The standardized coconut water based formulation consists of coconut water, sucrose, citric acid, and a combination of lemon and ginger with or without preservatives. The prepared coconut water squash can be served as a 1:3 dilution in water.

Coconut water jelly: Mature coconut water could be converted into a semisolid by increasing the total soluble solids to 8-10°Brix with sucrose, followed by the addition of a gelling agent such as agar agar, pectin, or gelatin at a 1% concentration.

Coconut testa: Coconut testa, a brown skin covering of a coconut endosperm, is a rich source of phenolics. It constitutes 2-7% of the whole coconut. Coconut testa has multiple phenolic acid and flavonoids with potent antioxidant activity. A direct solvent and ultrasonication assisted extraction yielded biocolourant from coconut testa. The colourant was infused in coconut water based jelly.

VCO cake: It is the residue obtained during the preparation of VCO in hot process. The brown-coloured VCO cake is rich in protein, fat, crude fibre, and dietary fibre. It can be utilized for protein enrichment in snacks and VCO cake incorporated extruded snack was prepared with a biochemical composition of 11.14% protein, 5.07% fat, 2.3% ash, and 74.19% carbohydrate using maize and broken rice (2:1). Because of its high protein content and sweet taste, it can be utilized in preparation of confectionary products such as cakes, muffins, etc. VCO cake can be used to replace 40–50% of the refined wheat flour used in confectionaries. Refined wheat flour (26 g/100 g) was replaced with 40% VCO cake flour, sugar (26 g/100 g), egg (21 g/100 g), full fat milk (13 g/100 g), shortening (12 g/100 g), sodium bicarbonate (1.1 g/100 g), and salt (0.1 g/100 g) were used in the development of a muffin formulation.

Coconut haustorium: It is a spongy tissue found inside the germinated coconuts, which is rich source of nutrients including fibres, minerals and antioxidants. Haustorium is discarded while the mature nuts are processed for coconut oil extraction. It has two distinct portions, the outer oil-rich yellow portion and inner carbohydrate-rich white portion. Completely dried haustorium (270 g from 400 g of fresh haustorium) can be mixed with cereals and marketed as health supplement. In addition, haustorium powder (20%) can be incorporated to make extrudates along with corn (30%) and rice (50%).

Coconut cabbage (Heart of palm): Palm cabbage, or heart of palm, is an underutilized, nutritious edible product of palm trees. Palm cabbages are relatively rich in protein and contain 17 amino acids. They are low in fat and sugar and are an excellent source of dietary fibre, moderate source of calcium and high concentration of vitamins and minerals. Fresh hearts of palm are good source of ‘heart healthy diet’ because of very low fat, no cholesterol, and low sodium contents. It is sometimes referred to as the ‘millionaire’s salad’ and is also used in vegetarian spreads. It is minimally processed into readyto-use salads. Application of minimal processing using pre-treatments such as blanching and sugar solution, the shelf life of palm cabbage could be enhanced.

Vinegar from coconut inflorescence sap: Coconut inflorescence sap is a healthy drink and the sap extracted from the CPCRI technology is known as Kalparasa®. Bottled ready-to-drink sap, coconut syrup, honey, jaggery and coconut sugar are the value added products from sap. The partially fermented sap is also marketed as ‘toddy’ Fermented sap is processed into natural vinegar loaded with nutrients and phytochemicals in addition to acetic acid content.

Byproducts from coconut shell and husk

Charcoal: The most important produce derived from coconut shell is charcoal. Charcoal is an indispensable industrial commodity, especially in metallurgy and as an adsorbent. Development of the chemical industries and legislative measures aimed at preserving the environment has markedly increased the application of charcoal in the purification of industrial waste. In the barbecue fuel market, charcoal has little competition, and in almost all other applications, charcoal could be substituted by coal, coke, petroleum coke or lignite.

Coconut shell charcoal is one of the best fuels for cooking because of its pleasant smell. The yield of shell charcoal is about 30% of the weight of the shells, and it is generally reckoned that about 17,000-24,000 whole shells make one metric tonne of charcoal. Shell charcoal is made by burning clean, fully dried and matured coconut shells in a limited oxygen supply. The drum and pit methods are the most widespread among the different methods of producing coconut shell charcoal.

Activated carbon: Activated carbon is a carbonaceous, highly porous adsorptive medium that has a complex structure composed primarily of carbon atoms. Coconut shells are mainly used for manufacturing of activated carbon. Activated carbon plays a very important role in solvent recovery processes, water and effluent treatment and in treatment of flue gas before discharge into the atmosphere. The intrinsic pore network in the lattice structure of activated carbon allows the removal of impurities from gaseous and liquid media through adsorption. This is the key to the performance of activated carbon.

Chemical activation or high temperature steam activation mechanisms are used in the production of activated carbon. In the activation process, shell charcoal is fed continuously into a retort. The normal activation process involves the use of steam at selected temperature for the selective oxidation of material, resulting in production of carbon with pores of molecular dimension. Approximately, three tonnes of shell charcoal is needed to produce one tonne of activated carbon. Retorts designed to produce activated carbon usually operate in one of the three ways-vertically, horizontally, or by means of a series of hearths.

Shell flour: The coconut shells are available from all coconut-producing states in India, namely Kerala, Tamil Nadu, Karnataka and Andhra Pradesh which contribute more than 90% of the production in the country. A second important product derived from the shell is shell flour. It is prepared by grinding clean coconut shells to a fine powder, the particle size depending on the end use. The shell powder is a by-product of coconut oil industries and individual households. The powder has various uses as a filler in synthetic resin glues, filler and extender in phenolic moulding powders, a burning medium in mosquito repellent coils, mastic adhesives, resin casting, bituminous products, etc. Coconut shell powder finds its applications in manufacturing mosquito coils as a burning medium.

Coconut husk biochar: Coconut husk is one of the important by-products of coconut tree and coconutbased activities. Husk is the outer fibre (35%) of the nut, followed by the hard protective shell (12%). Except the husk obtained during de-husking at household level, the entire husk, including the unorganized marketing sector, reaches the coir industry, where it fetches a market value. In the coir industries, fibre is extracted from coconut husk. The thickness of the husk of an ordinary nut varies from 2.5-3.0 cm in thin-husked nuts to 4.0-5.0 cm for thick husked ones.

Coconut husk, especially tender husk, is a bio-waste which accumulates on the road sides. ICAR-CPCRI has standardized a protocol for the preparation of coconut husk biochar which could be utilized for crop production without any concern of environmental pollution. It is the carbon-rich product obtained by the thermal decomposition of organic material under a limited supply of oxygen. Biochar production systems are generally classified as either pyrolysis or gasification systems. Two types of prototypes that utilize pyrolysis and gasification systems were fabricated. The technical performance of the pyrolysis method was much inferior to that of the gasification method.