



APPROPRIATE TECHNOLOGIES FOR VALUE ADDITION IN COCONUT

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INTRODUCTION

Coconut palm (*Cocos nucifera* L.) is a versatile crop, which provides all required amenities for human life. It also provides a variety of raw materials for production of array of products of commercial importance. India is the third largest producer of coconut with a production of 12160 million nuts from an area of 1.9 million hectares. The crop contributes about Rs 7000 crores annually to the GDP and earns valuable foreign exchange to tune of Rs. 350 crores by export. It is estimated that about 10 million people in the country depend on coconut farming and industry, directly or indirectly.

Small and marginal holdings, unorganised marketing systems, poor value addition and by-product utilisation are the major challenges faced by the Indian coconut industry. Of late, the stability of coconut-based economy of the major coconut producing countries especially India, has been threatened by the changes associated with trade liberalisation brought out by globalisation. Moreover, coconut-processing sector is currently confined to the traditional products. The coconut industry today mainly survives on coconut oil, which experiences wide and erratic price fluctuations from time to time. An array of coconut food products exported by Philippines and Vietnam are available in international market. India could exploit the potential for value addition by applying appropriate technologies.

VALUE ADDED EDIBLE PRODUCTS

Desiccated Coconut:

It is the white kernel of the coconut, comminuted and desiccated to a moisture content of less than 3 percent. In India, only small units of production are available. The major unit operations in desiccated coconut industry are seasoning, shelling, peeling of testa, washing, and disintegration of the white kernel and then drying. Other than the unit operations like disintegration of the white kernel and drying, all unit operations are done manually. The machineries used for disintegration and drying are of

very old type, which require further modification for higher efficiency. Continuous type fluidized bed dryer of higher capacity are being used in the large scale industries in other countries. There is good export potential for desiccated coconut.

Medium / low fat Desiccated Coconut:

After extraction of the milk, the residual coconut cake is rich in protein. It can be dried just like desiccated powder and sold as medium / low fat desiccated coconut powder, which may find application in bakery and formulations of low calorie foods. Because of the low content of fat and higher percentages of protein, sugars and minerals, the product possesses better water holding thickening properties.

Sweet Coconut Chips:

This is prepared by osmotic dehydration of coconut slices. A technology for the production of sweet coconut chips has been developed at CPCRI. Dehusking, deshelling, paring, cutting into slices, keeping in sugar syrup and drying are the unit operations to prepare sweet coconut chips. Sweet Coconut Chips is crispy and can be packaged and marketed in laminated aluminium pouches, which will have shelf life of 6 months. It could also be used just like fresh kernel after rehydration of the chips in hot water.

Tender Coconut-based Products:

Tender nuts are valued both for sweet water, as a refreshing drink, and for its gelatinous kernel. The use of tender coconut water is recommended in cases of gastroenteritis and as a useful substitute to saline glucose in intravenous infusion.

Tendernut can be stored for one week without losing the quality by minimal processing wherein the husk is trimmed without damaging the shell. Then this tendernut is dipped in a solution of 5% KMS and 0.5% citric acid for three minutes. Further it is drained and stored under refrigerated condition at about 5C. The nut may be stored by covering with ventilated polypropylene sheet for better keeping quality.



i. Snow- ball Tender Coconut:

The soft tender kernel or solid endosperm of tender coconut with water inside intact is called snowball tender coconut (SBTN). The kernel of the tender coconut is sometimes eaten or else thrown away, as it is difficult to remove it from the shell. A technology for making snow ball tender nut (SBTN) has been developed at CPCRI. Coconuts of 7 to 8 months maturity are generally used to prepare SBTN. A machine has been developed to remove the shell without opening the kernel. The machine makes a groove on the shell and a flexible spatula specially designed is used to scoop out the kernel from the shell. This white ball contains tender coconut water, which can be consumed by just inserting a straw through the kernel.

Snowball tender nut is nutritive and is a drink and a snack. Since the product can be individually packaged and refrigerated under hygienic conditions, the shelf-life of this product is prolonged and therefore this ready-to-serve product is found to become popular.

ii. Coconut Candies:

A low cost technology was developed at CPCRI for preparation of coconut candies. Eight month old coconut is used to make candy preserve. The kernel is scooped out and cut into cubes. Sugar of suitable concentration is added to make different types of candies. Crystallised candy made with tender coconut kernel can be consumed as a snack.

iii. Packed Tender Coconut Water:

A technology has been developed by Defence Food Research Laboratory, Mysore to extend the shelf life of the tender coconut water packed in flexible pouches and aluminium beverage containers. The optimum age of the tender coconuts for processing is around seven months as tender coconut water attains its optimum level of quality in respect of flavour, taste and yield at this period. The product is well acceptable and can be stored up to a period of three months under ambient condition and about six months under refrigerated condition.

iv. Beverages from Coconut water:

Beverages from both tender coconut water and matured coconut water can be prepared in combination with acidulants, lemon and pineapple juices. When carbonated and stored in both retort pouches as well as in glass bottles the product was found to retain its quality for a period up to

60 days. At present carbonated beverages containing no natural fruit or pulp, dominate the industry. Natural beverages are virtually absent and there is enormous scope for the same. These cost effective technologies can be taken up as a cottage industry with minimum investments.

Coconut toddy and its Products:

Toddy is obtained from the inflorescence before the flowers fully develop. Sweet toddy is the unfermented fresh juice obtained by tapping. It is a sweet, refreshing and healthy drink. Toddy on fermentation becomes an alcoholic drink. Arrack can be produced from the fermented toddy. A processing technology was developed by Kerala Agricultural University for bottling of toddy (*neera*) as a soft drink. Coconut farming can be made highly remunerative if a few trees in a farm are exclusively used for toddy tapping.

The manufacture of coconut jaggery from coconut sap holds promise as a viable commercial venture. Sweet toddy when boiled to 113°C to 120°C and allowed to cool solidifies. The solid mass is known as coconut jaggery or Gur. Manufacture of coconut jaggery is a cottage industry in Lakshadweep.

Coconut Vinegar:

Coconut water can be converted into vinegar. The matured coconut water consisting of about 3 per cent sugar content is concentrated to 10 per cent level by fortifying with sugar. The fortified coconut water is then fermented by inoculating with yeast, *Sacharomyces cerevisiae*. After alcoholic fermentation for about 4 to 5 days, the clear liquid is siphoned off and inoculated with mother vinegar containing acetobacter bacteria. This acetified vinegar is then aged before bottling. Vinegar has extensive use as a preservative in the pickle industry and flavouring agent in food processing sector. Traditionally synthetic vinegar is produced and marketed. Natural vinegar enjoys export market in place of such synthetic vinegar. Coconut vinegar enjoys a wide market segment as a preservative in pickling industry and as a flavoring agent for food stuffs.

Products from Coconut Milk:

Coconut milk and milk products are prepared from fresh matured coconuts. In this process the white coconut kernel is ground into slurry from which coconut milk is separated by pressing. In continuous process, coconut milk is extracted in the screw press. The milk is then centrifuged and further processed to get milk concentrate, coconut cream, and milk powder.



Nata-de-Coco:

Nata-de-coco is formed by the action of a micro-organism *Acetobacter xylinum* in a culture medium of coconut water. The culture solution is prepared by mixing coconut water with sugar and acetic acid at a stipulated proportion, which is inoculated with *Acetobacter xylinum* through a culture liquid. It is filled in glass jars covered with thin cloth and kept for 2-3 weeks without any disturbance. During this period a white or cream colored jelly like substance forms and floats on the top of the culture medium. It is harvested, cut into pieces and washed in pure water to remove all acid. It is then immersed in flavoured sugar syrup for 12 hours and packed in glass bottles. The product has great export potential in Japan, Taiwan and Korea for use as a dessert and as an ingredient in ice cream and fruit cocktails.

Virgin Coconut Oil:

Coconut oil obtained from coconut milk is called virgin coconut oil (VCO). Traditional and modern methods are available for the manufacture of virgin coconut oil. In the traditional method, the milk extracted from grated coconut kernel is boiled to get oil. Of late, the traditional method has been partially mechanized using a bridge press and mechanical grater. The modern method of extracting oil from fresh coconut kernel is known as *wet processing*. In this process, the coconut kernel is made into a viscous slurry from which coconut milk is separated by pressing the slurry. The milk is sieved and concentrated. The cream is stirred vigorously to get virgin coconut oil by a process called phase inversion. The virgin coconut oil is considered superior for use as hair oil and baby oil because of its pleasing aroma and purity. Maturity of coconut greatly effects the yield of coconut milk. Mature brown - husked nuts of 12 months maturity with no protruding sprouts produce higher yield of milk.

Virgin coconut oil can also be prepared by fermentation of coconut milk. Freshly harvested coconuts are used (within 24 hours of harvest) for this purpose. The fresh coconut meat is shredded (**wet milled**), and then **cold-pressed** to get coconut milk. The milk is then fermented for 28-36 hours, and the oil is then separated and filtered from the cream. The oil recovery is about 20 to 23 % of the volume of coconut milk. (The residue left over is thick coconut cream, which could be heated to extract coconut oil, and the recovery of oil is around 80 % by volume). The virgin coconut oil is colourless and has a

natural sweet taste. It is clear and free from turbidity and rancidity.

Non - Edible Products

Coir pith constitutes as much as 70 per cent of the husk and is now a waste product of the coir industry. Accumulation of this waste in industrial yards causes environmental pollution and fire hazard. Coir pith after inoculation with *Pleurotus sajor-caju* and treatment with urea shows a definite reduction in the cellulose and lignin contents on incubation for 26 days at room temperature. A technology has been developed at Tamil Nadu Agricultural University using Basidiomycetous fungus, *Pleurotus sajor, Caju*, which is capable of detoxifying phenolics of coir pith and producing bio-polymerizing enzymes. To compost one tonne of coir pith five spawn bottles (one spawn bottle contains 350 g of *Pleurotus* fungus culture raised on sorghum or pearl millet grain) and five kg of urea are required. After 30 days of decomposition, coir pith turns into a black mass of compost with an increase in the total nitrogen and other nutrients while the C:N ratio is narrowed from 112:1 to 24:1. Thus, it is feasible to use the inoculated pith as manure in agricultural farm

Coconut shell, the endocarp of coconut, is another important commercial product. The major use is as a fuel. To a lesser extent, it is used as a raw material for the manufacture of hookah shells, various domestic utensils, curious, fancy items etc. The commercial utilization of coconut shell for the production of shell charcoal, activated carbon, shell flour etc is now gaining importance in the producing countries with an expanding market demand.

Coconut wood can also be used for timber purposes using suitable preservatives. CCA, CCB, CNSL and creosote with bunker oil are good preservatives for coconut wood.

CONCLUSION:

The development strategy for coconut needs a new orientation with a thrust on product diversification, value added product development, quality improvement, and marketing and export promotion. Focusing attention on non-traditional products can strengthen coconut-processing sector. Viable technologies are presently available for the production of diversified products from coconut. Consumer awareness campaign is the need of the hour and integrated coconut based processing industries needs to be encouraged by implementing specific developmental schemes.