Nata de coco - A unique value added product from coconut

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INTRODUCTION

Coconut is a versatile crop, providing all amenities for human life. It is rich in antioxidants, dietary fiber, fat, protein, vitamins and minerals. Traditionally coconut is mainly used for production of oil. Changes in life style and eating habits, worldwide distribution of food products, increasing awareness by consumers and attention by regulatory bodies drive the production and processing trends of coconut products. Due to these enormous scopes in value addition and product diversification, various value added products are been launched in the domestic as well as international market. Virgin coconut oil, spray dried coconut milk powder, coconut milk, coconut vinegar, grated coconut based sweets, coconut chips, desiccated coconut powder, etc. are some of the major value added products seen in the market. Since coconut water is rich in essential minerals and nutrients, there is always continuous demand for coconut water and its diversified value added products. Nata de coco is one of the value added product having immense market scope (Fig. 1).

Nata de coco

The name "nata de coco" comes from the Spanish language, meaning "cream (*nata*) of the (*de*) coconut (*coco*)". It is a traditional food of Philippines which was developed locally first in 1949. Over the years, its popularity spread to countries like Japan, China, Malaysia and India. It is one of the first reported commercial food applications of bacterial cellulose. Nata production in the Philippines is a labor-intensive cottage industry, employing a aseptic, static batch culture system. Despite these limitations, it has attained commercial success and flourished into an important commodity export earner in the Philippines. This demand was attributed primarily to its popularity and the probiotic effect derived from the regular consumption of this fibrous low calorie food. The increase in consumer demand has also led to the rapid proliferation of small and medium scale nata producers in many provinces in the Philippines.

NUTRITIONAL AND HEALTH BENEFITS OF NATA DE COCO

This delicacy is prepared by the fermentation of coconut water. It is widely used in desserts and confectioneries especially in ice creams and fruit cocktails. It is much appreciated for its high dietary fiber, low fat and zero cholesterol content. Because of the high fiber content, it helps to clean human intestines and prevent constipation. This product is safe for consumption as its constituents are mainly water and cellulose (fibre). It is low in calories and can be considered an ideal diet addition to people who are trying to manage their weight. Recently *Nata de coco* was used for the production of bacterial cellulose which has wide application in cosmetic industry for the production of bio-cellulose face masks, in medical diagnostics and synthetic bone replacements. Nata de coco is a translucent gelatinous product prepared from matured coconut water by the action of cellulose forming bacteria namely *Acetobacter aceti* subspecies *xylinium*. *Acetobacter xylinum* metabolizes glucose in coconut water that act as carbon source and converts it into extracellular cellulose as metabolites.

METHOD OF PREPARATION FROM COCONUT WATER

Nata de coco is prepared by mixing coconut water with sugar and acetic acid and inoculated with *A. xylinium* through a culture liquid commonly known as starter or mother liquor. The collected coconut water is strained using a muslin cloth. For every litre of coconut water, 100 g of refined sugar and 5 g of monobasic ammonium phosphate are added. The container is covered and the mixture is boiled followed by cooling. To this, 10 ml of glacial acetic acid and 150 ml of starter or mother liquor containing *A. xylinium* were added and filled in glass trays or wide mouthed jars covered with a muslin cloth which is kept for 2-3 weeks without any disturbance. After 20 days, a layer of gelatinous sheet forms on the surface of the fermented coconut water. The sheets are allowed to grow to a thickness of 1 cm and then cut into squares of 1 cm x 1 cm. The cubes are washed thoroughly and cured in sugar solution for 12 hours and if needed, necessary flavors are added to it. It has a maximum shelf life of 180 days. 100 litres of coconut water would yield about 20 kg of raw nata. There is very good demand for nata de coco in the countries like USA, Europe, UAE, Japan,

Taiwan, and Korea. It is commercially produced and marketed mainly by the Philippines, Indonesia and Malaysia. They used it as an enhancer for sweet fruit salads, fruit cocktails, ice creams and sherbets.

METHOD OF PREPARATION FROM COCONUT MILK/ FRESH KERNEL

Nata de coco can also be prepared from coconut milk. The process flow from coconut milk include, milk extraction (with two times water) of dehusked deshelled and grated coconut kernel, addition of sugar, glacial acetic acid and mother liquor of starter culture followed by distribution of this mixture into trays leading to fermentation for 10-12 days. At the final stage the pH of the product will be 3.5- 4. Once the fermentation is finished, it is harvested, cleaned, sliced into squares and packed.

Sources of *A xylinium*

A. xylinum is a common contaminant in the industrial production of vinegar by *A. aceti*. It can be isolated from rotting fruits vegetables and even from fermenting coconut water. During the preparation of nata de coco, *A. xylinum* uses the nutrients in the coconut water medium, forms a thick mass of cellulose which is visible as thin slimy, transparent layer on the surface of the medium. There are many strains of *A. xylinum* capable of producing cellulose in varying amounts and growing on a wide variety of substrates like glucose, sucrose, fructose, invert sugar, ethanol and glycerol. Cellulose production can be achieved in static as well as agitated cultures. *A. xylinum* can tolerate pH as low as 3.5. pH of 4.0- 5.0 is the most ideal for the development of cellulose.

Factors affecting the Processing of Nata de Coco

Chung and Shyu (1999) evaluated the effects of pH, common salt (NaCl) concentrations, and temperatures on the physical properties of salted nata, and found that addition of NaCl increased the hardness of nata but decreases the water holding capacity. Compared to keeping at 25°C, freezing at -20°C for 24 hrs gave a more elastic texture. Acidification or alkalization is necessary to prepare salted nata products without increasing their hardness.

Benefits for Regular Consumption of Nata de Coco

It is very good for digestive system especially for those who faces constipation problem. It helps to clean the intestine and prevent constipation. Many studies showed that regular consumption of nata de coco helps to protect against bowel cancer and has potential to prevent atherosclerosis and coronary thrombosis. In many Asian countries such as Japan, Taiwan, Indonesia and Singapore, nata de coco has become their daily dessert after meal. It is suitable for all age groups. In addition, fiber and cellulose present in it is good option for weight loss. Nata per 100 grams, contained 12 mg calcium, 5 mg iron, 2 mg phosphorus, traces of vitamin B1, proteins, and hase the additional benefit of zero fat. Aaprt from its activity against constipation and obesity, it is effective for hemorrhoids, appendicitis, colon cancer, diabetes, and coronary heart disease. It can be sweetened and used as dessert or can be mixed with ice fruit, custard, ice cream, or fruit cocktail.

Problems associated during the processing of nata de coco

The production of nata de coco is still done by inoculating *A. xylinum* directly into the culture medium of coconut water. Hence constant requirement of starter culture is essential. This method has the risk of the starter culture being contaminated due to improper handling.

Another important problem in traditional nata fermentation is the production inconsistency due to strain or genetic variability reflecting mixed microbial communities involved in this process. The dynamics of the bacterial population involved in Nata fermentation will be a crucial factor for determining traditional nata quality.

Regarding the quality, there are two terms viz, good and bad nata. 'Good nata' fermentation is one which will generate a thick (1.5-2 cm), homogenous cellulose gel with high transparency; while 'bad nata' fermentation will generate frothy, thin (frequently less than 0.5 cm), soft with white or opaque color Nata gel after 8 days of fermentation (Seumahu *et al.*, 2007)

It is necessary to identify a fermentation method to produce nata containing little or free of biomass. One solution for this is by immobilization of *A.r xylinum* for fermentation of nata de coco. Immobilization of cells is nothing but a method for confining or physically placing of microbial cells in a particular space in which the cells still have the catalytic activity and can be used continuously and repeatedly (Chibata, 1978). Recently a work has been done to immobilize *A. xylinum* for nata de coco fermentation (Nugroho and Aji, 2015).

Cost –Benefit Analysis (Courtesy: CDB)

Cost incurred:

(Capacity 100 litres per day)	
Land required	5 cents (cost variable)
Building (500 sq. ft.)	Rs.2.0 lakhs
Equipment/ glassware	Rs.0.5 lakhs

Benefit:

Annual sales turnover @ Rs.40 / kg	Rs.3.75 lakhs
Net profit	Rs.1 lakh per annum
Return on investment	40 per cent

CONCLUSION

The coconut water which is usually wasted out could be effectively utilized for the production of nata de coco, which could be further utilized in fruit punch, pudding and salads. This can be a profitable venture for the small scale industry and also for women endeavors. Even though the popularity of the product is gaining much importance in foreign countries, it is still in the infant stage in India, which is a leading producer of coconut. The product has sufficient potential for export to foreign countries also.

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