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Efficient use of Coconut and its by Products

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ABSTRACT

Coconut palm provides several benefits to the human kind, and has been used since civilization. Accordingly, coconut shell can be easily collected in places where coconut meat is traditionally used in food processing. Among the various purposes for coconuts, 35% are used as copra, 2% for manufacturing of value added products, 11% for tender uses and 2% for seed purpose. The coconut fruit yields 40 % coconut husks containing 30 % fiber, with dust making up the rest. The chemical composition of coconut husks consists of cellulose, lignin, pyroligneous acid, gas, charcoal, tar, tannin, and potassium. Conversely, Coconut shell is an agricultural waste and is available in plentiful quantities throughout tropical countries worldwide. Nonetheless, the economic well-being of a farmer depends not only on the quantity of food produced but also on the effective product and byproduct utilization as well as the importance assigned to on-farm integration and waste utilization. This research work evaluated the efficient use of coconut and its by-products. It concluded that effective utilisation of products/byproducts obtained from coconut-based agro-ecosystem remains imperative especially for rural farmers. The increasing need to promote effective utilisation of farm-derived produce for value addition has been recognised due to the emergence of newer technologies and rising public awareness on the importance of waste utilisation. Hence, in a coconut-based agro-ecosystem, effective utilisation of product/by-product is important.

Keywords: Coconut, Utilisation, By-products, Agricultural waste, Efficient.

INTRODUCTION

Coconut palm provides several benefits to the human kind. In India coconuts have been used since civilization. India consumes 50% of annual production for their culinary and religious purpose, 35% used as copra, 2% for manufacturing of value added products, 11% for tender uses and 2% for seed purpose.[1] The coconut fruit yields 40 % coconut husks containing 30 % fiber, with dust making up the rest. The chemical composition of coconut husks consists of cellulose, lignin, pyroligneous acid, gas, charcoal, tar, tannin, and potassium. Coconut dust has high lignin and cellulose content. The materials contained in the casing of coco dusts and coconut fibers are resistant to bacteria and fungi.

Coconut Shell

Coconut shell is an agricultural waste and is available in plentiful quantities throughout tropical countries worldwide. In many countries, coconut shell is subjected to open burning which contributes significantly to CO2 and methane emissions. Coconut shell is widely used for making charcoal. The traditional pit method of production has a charcoal yield of 25–30% of the dry weight of shells used. The charcoal produced by this method is of variable quality, and often contaminated with extraneous matter and soil. The smoke evolved from pit method is not only a nuisance but also a health hazard. The coconut shell has a high calorific value of 20.8MJ/kg and can be used to produce steam, energy-rich gases, bio-oil, biochar etc. It is to be noted that coconut shell and coconut husk are solid fuels and have the peculiarities and problems inherent in this kind of fuel. Coconut shell is more suitable for pyrolysis process as it contain lower ash content, high volatile matter content and available at a cheap cost. The higher fixed carbon content leads to the production to a high-quality solid residue which can be used as activated carbon in wastewater treatment. Coconut shell can be easily collected in places where coconut meat is traditionally used in food processing.

Coconut Husk

Coconut husk has high amount of lignin and cellulose, and that is why it has a high calorific value of 18.62MJ/kg. [2] The chemical composition of coconut husks consists of cellulose, lignin, pyroligneous acid, gas, charcoal, tar, tannin, and potassium. The predominant use of coconut husks is in direct combustion in order to make charcoal, otherwise husks are simply thrown away. Coconut husk can be transformed into a value-added fuel source which can replace wood and other traditional fuel sources. In terms of the availability and costs of coconut husks, they have good potential for use in power plants.

COIR

Coconut husk is a unique raw material for the extraction of coir fibre which is extracted from monocarp of 1"-1 ¾ thick coconut husk. Coir is one of the important natural, golden colour, hard fibres extracted from the husk or fibrous mass (mesocare) covering the coconut.[1] It is of great commercial interest and falls under the category of industrial hard fibres such as hemp, abucca, henequen etc. Coir has certain unique qualities, such as resistance to spoilage due to moisture and dampness. Coir fibre posses remarkable, durability to withstand physical strength and hence it is a renewable resource for manufacturing various floor covering and other coir products. In India coir fibre is extracted from coconut husk after retting in saline water and also by deploying mechanical method using fibre extracting machines. The white fibre sector has become stagnant over last few years, whereas the export requirement is mainly of white fibre products.[3] On the other hand, Coir pith commonly known as coconut peat is the by-product of coir industry, which was hitherto considered as a waste material. Coir pith is converted into briquettes for the purpose of easy transportation. [2] It is easily composed to be used as an organic manure and soil ameliorant.

Coconut Leaves

Coconut leaves are plaited and used for thatching houses and sheds in rural areas. It is also used for thatching 'honeymoon huts' in towns and cities. Plaited coconut leaves are also used for making baskets, headgears and for erection of temporary fences. [4] Plaiting of coconut leaves is a cottage industry in traditional coconut growing states of India. Midribs of leaves are used to make brooms of different types which are used for cleaning rough grounds and floors. Brooms of midribs of coconut leaves are made on a commercial scale in Tamilnadu and Karnataka.

Coconut By-Products

The various by products from coconut kernel (Meat) matured coconut includes:

i. Ball copra
ii. Cup copra (coconut flour)
iii. Coconut yoghurt / Ice cream
iv. Fresh coconut gratings
v. Dehydrated edible coconut meat
vi. Coconut oil / virgin coconut oil
vii. Desiccated coconut
viii. Partially de-fated coconut powder
ix. Rousted coconut paste
x. Coconut chips (sweetened chips) (sliced coconut)

The products from coconut milk comprise:

i. Sweetened coconut skim milk blend
ii. Coconut protein
iii. Low / high fat coconut jam
iv. Virgin coconut oil
v. Milk powder (dehydrated milk)
vi. Coconut milk / syrup
vii. Coconut spread / cheese
viii. Coconut honey / candy
ix. Coconut skim milk beverage

The tender coconut by-products are:

i. Fresh tender coconut water
ii. Tender nut coconut water & coconut meat shake and
iii. Canned or pouched tender coconut water

Utilization of Waste Coconut Water

A large number of coconut oil mills are operating in tropical countries like India.

They discharge considerable amount of waste coconut water (WCW) having very high values of Biochemical Oxygen Demand (BOD) to the extent of 29,000 mg·L-1 and Total Solids (TS) of 5.45 ± 0.35%. [5] The fermented coconut water is highly acidic with a pH of 4.03 ± 0.01. The south Indian states, especially Kerala has a large number of coconut oil mills and most of them discharge the WCW without proper treatment resulting in pollution of the environment. Due to the bad odour and pollution of water bodies, the general public has started complaining against the coconut oil mills. Hence many Local Self Government bodies and the State Pollution Control Boards have imposed stringent restrictions on these small scale agro based industrial units. Installation of conventional ETPs (Effluent Treatment Plants) is costly and they consume electric power for their operation. It is highly relevant to save these small scale agro industries by providing an affordable technology for pollution abatement, which is also capable of producing energy. Anaerobic digestion of organic wastes is a known technology. Anaerobic digestion is the degradation of complex organic matters in an oxygen free environment. The biological conversion of the organic matters occurs in the mixture of primary settled and biological sludge under anaerobic condition followed by hydrolysis, acidogenesis and methanogenesis to convert the complex compounds into simpler end products as methane (CH4) and carbon dioxide (CO2). This technology offers simultaneous production of energy in the form of biogas along with pollution control. The technical problems associated with conventional biogas plants in dealing with high volume low strength wastes like waste waters make them less popular for effluent treatment. They are slow in operation with long Hydraulic Retention Times (HRTs) in the order of 35 to 55 days, necessitating very large digester volumes. The requirement of large digesters consumes much space and makes their installation very costly. Hence people are tempted to adopt aerobic treatment systems in which energy is being consumed for aeration. Even though the anaerobic waste treatment is more environment friendly the aforesaid technical constraints are the bottlenecks in adoption of technology. Anaerobic digestion of high volume liquid wastes like WCW is technically and economically feasible only through high rate bioreactors, where we can reduce the HRTs to few days or even hours. The anaerobic bioreactors which can retain high level of biomass (microbial) population in the reactor, and remove higher percentages of organic matter is known as the "high-rate anaerobic bioreactor. Up-flow Anaerobic Hybrid Bio-reactors (digesters) are very good for treating low strength effluents with maximum gas production and less space required compared to conventional methods. It can produce gas of 8-14 Litres per kg of waste coconut water and also very suitable to reduce BOD level down to less than 1000 mgL-1.

CONCLUSION/RECOMMENDATION

The economic well-being of a farmer depends not only on the quantity of food produced but also on the effective product and byproduct utilization as well as the importance assigned to on-farm integration and waste utilization. Effective utilisation of products/byproducts obtained from coconut-based agro-ecosystem remains imperative especially for rural farmers. The increasing need to promote effective utilisation of farm-derived produce for value addition has been recognised due to the emergence of newer technologies and rising public awareness on the importance of waste utilisation. Hence, in a coconut-based agro-ecosystem, effective utilisation of product/by-product is important.

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