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Feasibility Study for Developing a Manufacturing Industry for Activated Carbon and Bio Oil from Coconut Shell

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Abstract: *The production process consists of a pyrolysis stage and an activation stage. A downdraft gasifier was utilized as the pyrolysis reactor in order to maximize the energy efficiency of the process, and a separate cyclone and condenser were added to capture and purify the valuable byproducts of the pyrolysis reaction. A An extensive heat exchanger network is implemented to capture and recycle the heat and water produced by the activation reaction, in order to minimize the plant's thermal and water footprint. With a profit of 8% per month, the production unit is expected to have recovered the whole investment at the end of 4 to 5 years. Due to the expected high product demand and anticipated profits, construction of the plant is strongly recommended*
Keywords: *Pyrolysis, Activated Carbon, Bio-oil, Coconut Shell, recovery, investment, profit.etc.*

I. Introduction

The Coconut oil (also known as Pyrolysis oil) is extracted from coconuts and consists of over 80% saturated fat. It is typically used in cosmetics as well as in baking and cooking. Traditional aqueous coconut processing involves grating coconut into small pieces, adding water, squeezing the mixture by hand, leaving the resulting emulsion to stand, and then scooping off the oil-rich cream. The cream is then boiled to produce oil. The intermediate-moisture content aims to speed up the process by introducing a bridge-press to extract oil directly from partially-dried coconut gratings. Experimental programmes were undertaken by collaborators in Tanzania, Côte d'Ivoire, Ghana, and Sri Lanka and confirmed the basic concept that at 12% moisture content, between 10% and 20% of the available oil can be extracted from coconut kernel using an inexpensive manual low pressure system.

Activated carbon is one of the most important micro porous adsorbents due to its tremendous adsorptive capacity, an affinity for variety of dissolved organics and ability to be custom-tailored to suit specific application. Various materials are used to produce activated carbon and some of the most commonly used are agriculture wastes such as coconut shell, palm shell, saw dust, walnut shell, rice husk and almond shell. The major uses of activated carbon are in waste water treatment, water purification, gas purification, desulphurization and mercury removal.

Here we are extracting Activated Carbon and bio oil using coconut shell. And also then establish a manufacturing industry in Vidarbha region. So we must take into consideration that,

- How many Industries are currently working on this field in Vidarbha region?
- What is the minimum amount of Activated carbon and bio oil should be manufactured so that industry will be in profit?
- How much quantity of raw material will be required?
- Which steps to be followed for production of Activated Carbon and Bio oil?
- How much quantity of land, man, machine will be required?
- How it should be sold and how the price should be calculated?
- How advertisement of product should be done? So that more and more people will be aware about it.
- What are the specifications of the Activated carbon and Bio oil should be?

These are the important points which are to be taken into consideration before establishing an industry. Also as we are establishing an industry so the main objective of it should be customer satisfaction and profit to be earn.

II. Market Survey

The major requirement of activated carbon is found for water purification application.The type of activated carbon used for water purification applications in Municipal Corporations and Municipal Councils and also Rite Water Solutions Pvt. Ltd. (Water purification Industry) is powdered activated carbon (PAC). The price for powdered activated carbon at 97% purity is Rs.35 per kilogram.

Along with the activated carbon, the plant sells bio-oils. Since the bio-oils are in their crude state, they are sold at Rs.20 per kg. Bio-oils can be used as a fuel source or can be further used as furnace oil. Construction of this plant is highly recommended.

III. Process Description

This plant produces activated carbon from raw coconut shells in a process consisting of two major steps, each of which takes place in a separate section of the production plant. In the first section, a pyrolysis process converts the raw coconut shells to char. In the second section, a physical activation process converts the char to activated carbon.

The following reactions occur in reactor between the carbon, CO2, and moisture from the shells to produce the syngas and some of the water.

$$3H_2(g) + CO\ (g) \leftrightarrow CH_4\ (g) + H_2O(g) \qquad (1)$$

$$H_2O(g) + CO\ (g) \leftrightarrow CO_2\ (g) + H_2\ (g) \qquad (2)$$

$$C\ (s) + 2H_2(g) \leftrightarrow CH_4\ (g) \qquad (3)$$

$$C\ (s) + CO_2(g) \leftrightarrow 2CO\ (g) \ (4)$$

$$C\ (s) + H_2O(g) \leftrightarrow CO\ (g) + H_2\ (g) \ (5)$$

During the two and a half hour process, the unreacted carbon, bio-oil vapors, steam, and syngas in stream 10 flow through a cyclone, S-101, which separates the unreacted carbon solids from the gases. A vessel, V-101 collects the unreacted carbon solids in stream 11.

The bio-oil vapors, steam, and syngas in stream 12 pass through a blower, C-102, and exit as stream 13, which enters a heat exchanger, E-101, and leaves as stream 14 at 620 °C. The energy from stream 13 is used to heat the CO2 in stream 4. A condenser, E-102, uses ocean water to cool and condense the bio-oil vapors and steam in stream 14 to 95 °C. The liquids and syngas in stream 15 enter a gravity separator, S-102, which separates the gases from the liquids. Bio-oil and water in stream 16 are collected in a vessel, V-102. A compressor, C-103 a/b, compresses the syngas in stream 17 to 4 bar and 331 °C. A vessel, V-103 a/b, collects the syngas in stream 18. When the pressure of V-103 a/b reaches 76 bar, a second identical vessel collects the remaining syngas.

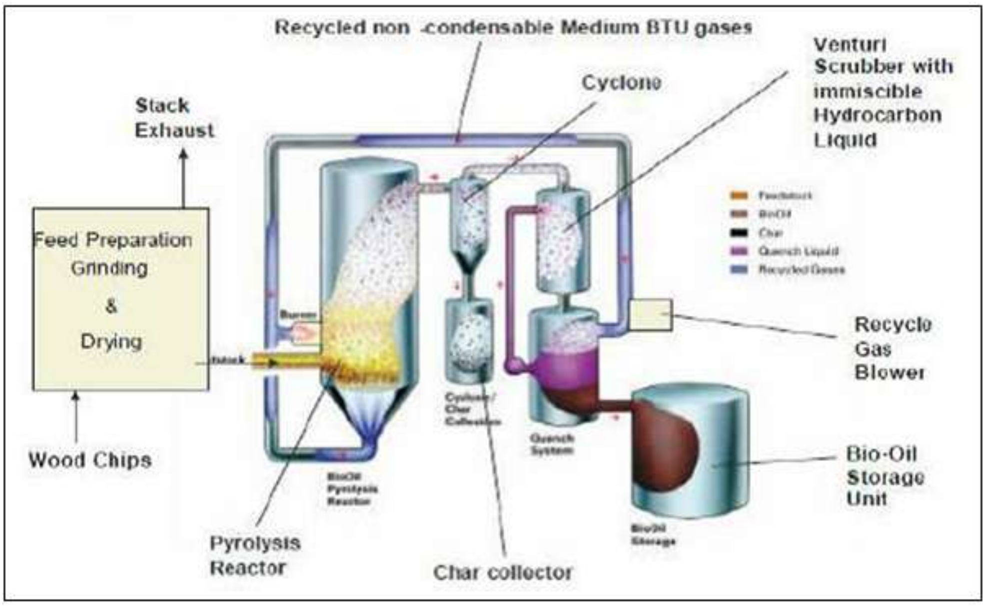

Fig.7.1 Carbonization method

IV. Project Requirement

Required Raw Material:-

1. Coconut Shells: 1,080 tonnes of shells/month

Product Out Come:-

1. Activated Carbon: 170 tonnes of Activated Carbon/month
2. Bio-oil: 200 tonnes of Bio-oil/month

Requirements:-

1. Electricity: 1,500MW of Electricity/month
2. Process Water: 20000 m^3 of Process Water/month
3. Fuel: Furnace Oil 200 lit.

V. Conclusion

There are two ways by which we can calculate the profit per month, as

1. We can utilize whole profit of per month for recovering the investment so at the end of year so at the end of fifth years we can recover our whole investment.
2. We must require fund for running the industry at the end of every month so we can save 40% from calculated profit per month as a saving for running an industry and the remaining can be utilized for recovering the investment done.

From the above study we can conclude that the development of manufacturing unit is possible Here, we have considered all the taxes and each and every parameter essential in the project assessment, so from that we can say that it is feasible to develop a manufacturing unit in vidharbha region**.**

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