



LAXMINARAYAN INSTITUTE OF TECHNOLOGY
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Brief Project Report on

“Synthesis of Activated Carbon from Bamboo and its Industrial Applications”

Financed By:



**MAHARASHTRA BAMBOO DEVELOPMENT BOARD,
NAGPUR.**

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Report on Project

“Synthesis of Activated Carbon from Bamboo and its Industrial Applications”

As described in the title, a consultancy project was sponsored by Maharashtra Bamboo Development Board, Nagpur. The objective of the project was to prepare **Activated Carbon** or **Activated Charcoal** from various species of Bamboo and improve its surface area to make it suitable for various industrial applications viz. **adsorption, absorption and filtration**. Bamboo was selected for carbonization owing to its following advantages:

- The yield of carbon/ charcoal from the bamboo is higher.
- Carbonization is more rapid.
- Charcoal can be made from species that cannot be processed by traditional methods.
- Industrial Chemicals like **Vinegar and Tar** and heat energy can be recovered from the smoke given off during Carbonization.
- By recovering by-products from the smoke there is less pollution of the environment.
- Bamboo is a fast-growing grass and it can prove to be a sustainable source of carbon.

The project was divided in two parts as follows:

- 1) Development of three to four products prototypes and/ or process utilizing the prepared bamboo carbon on commercial basis.
- 2) Designing and installing a carbonization furnace at commercial scale.

The complete idea behind the project was to develop employment and livelihood ideas for rural people on small scale.

Product Analysis:

In all about 35 different species of Bamboo were carbonized and studied in the laboratory for their carbonization efficiency and various other important properties. **Iodine number** of the carbon thus synthesized was determined. **Iodine number gives an idea about the surface area of the carbon.**

Higher the Iodine number value, better is the quality of carbon. General value of Iodine number for Activated carbon is 500. Best of the results are as shown under:

Sr. No.	SPECIES NAME	Iodine number	Moisture Content	Initial Weight	Final Weight	Calorific Value (Cal)	%Con version	Ash Content %
1	Manvel	934.97	-	-	-	4109	-	-
2	Pseudoxthenanthra Stocksii	951.84	19.017	200	100	4986.37	50	8.22
3	Bambussa Tulda	915.05	4.0816	200	120	5096.57	60	7.89
4	Tuldavarstriata	1105.091*	4.1869	200	135	5567.64	67.5	7.65
5	Bambusa Balcooa	933.36	4.758	500	230	5015.87	46	9.56
6	Dendrocalamus Membrana Cells	1087.6*	5.0578	500	218	4163.12	43.6	6.532
7	Dendrocalamus Hamiltonii	1095*	17.5801	500	211	4033.65	42.2	3.47
8	Phyllostachys Aurea	915	11.974	500	201	5139.78	40.2	2.62

*Results for Iodine Number are obtained on Thermal activation. Hence it can be stated that the carbonized material on appropriate thermal activation gives almost twice the value of original Iodine Number obtained when carbonized. After thermal activation, Manvel gave iodine number of 934.97.

ONE best advantage with Bamboo was observed that, it does not require any chemical treatment for activation and the process was set in such a manner that only thermal activation during carbonization gave better surface area of carbon prepare from bamboo.

PRODUCT PROTOTYPE DEVELOPMENT:

Following is the short description of the product prototypes developed from the Bamboo Carbon:

1) Air Filter:



As shown in the image simple prototype was prepared from plastics basket containing a layer of Bamboo Activated Carbon of about 1 inch. The air analysis as shown in second image shows pure air from the purifier.

2) Water Filter:



Water filter as shown in the image consists of pre and post carbon filter and the filter was able to purify the water, reducing its TDS from above 500 to 350 ppm. The TDS was found to fall in drinking water range as per the set standards. Inspired from the success of the water filter prototypes, a total of FIVE filters are installed at different locations of MBDB and LIT and a large Filtration plant is also installed at MBDB.

3) Smokeless Briquettes



Carbon Briquettes of the size of a Biscuit were prepared from the bamboo Carbon. As shown in the second image the briquette burnt continuously without any smoke and the small briquette was able to raise the temperature of the cup to 320 °C.

4) Pouches (For Odor & Moisture Removal)



As shown in the image small pouches from bamboo carbon were made. These pouches are capable of removing odor and moisture from the container in which they are kept.

Designing, Fabrication and Installation of a Commercial Carbonization Kiln

Installation of a commercial carbonization kiln was the primary objective of the project. Inspired from the laboratory results a commercial kiln (furnace) with feeding capacity upto 3 Tonnes Bamboo was designed and fabricated for carbonization process.

Highlights of the kiln are as under:

- Kiln works without electricity.
- It proves to be a zero/ minimum discharge technology as there is minimum pollution during its running.
- Carbonization of bamboo in the kiln also yields food grade **Vinegar** which will be separated and **Tar** which will be processed for high temperature resistant paint.
- Gases produced during the carbonization are recycled in the kiln itself for accomplishing the carbonisation process.



Future Developments in the Project:

Owing to the positive and promising results obtained from the study, the project was further extended in the following direction:

- **Bleaching of edible oil** using the Bamboo Carbon to replace bleaching earth and other toxic chemicals.
- Conversion of Bamboo Carbon into **Graphite/ Graphene**.
- Manufacturing of pencil body (from Bamboo Dust and Binder) and its lead (from Graphitization of Bamboo Carbon). (Project already in pipeline with **CAMLIN, Ltd.**)
- Installation of another Commercial Carbonization Furnace in **Forest Region of TADOBA** and Private entrepreneur **Mr. Vinay Salve**.