STUDY REPORT ON

"VETTING THE DESIGN AND GUIDELINES PREPARED FOR CHARCOAL UNITS LOCATED IN TAMILNADU BY TNPCB JOINT COMMITTE INCOMPLIANCE OF ORDERS OF HON'BLE NGT"

Prepared by

CENTRE FOR ENVIRONMENTAL STUDIES
DEPARTMENT OF CIVIL ENGINEERING
ANNA UNIVERSITY
CHENNAI - 600 025

FEBRUARY 2022

STUDY REPORT ON

"VETTING THE DESIGN AND GUIDELINES PREPARED FOR CHARCOAL UNITS LOCATED IN TAMILNADU BY TNPCB JOINT COMMITTE INCOMPLIANCE OF ORDERS OF HON'BLE NGT"

Prepared by

CENTRE FOR ENVIRONMENTAL STUDIES
DEPARTMENT OF CIVIL ENGINEERING
ANNA UNIVERSITY
CHENNAI - 600 025

FEBRUARY 2022

Table of Contents

List of Figures

REPORT ON VETTING OF THE "TNPCB COMMITTEE DESIGN AND GUIDELINES FOR CHARCOAL UNITS" BY CENTRE FOR ENVIRONMENTAL STUDIES, ANNA UNIVERSITY, CHENNAI -600025.

1.0 INTRODUCTION

Several coconut shell based charcoal manufacturing units are located in and around Kangeyam Taluk. They use the raw coconut shells after the removal of copra from the coconut oil manufacturing units in and around Kangeyam Taluk, Tiruppur District. Traditionally, the coconut shells are subjected to partial burning (pyrolysis) in the absence of air in open earthen pit and quenching with water to get charcoal which is the raw material for Activated Carbon Manufacturing units. Such activities are done in brick lined earthen pits of about 3 m diameter and 4.5 m depth, mostly below the ground level. The size and the number of pits depend on the permitted processing capacity of the plant which vary in the range of 10 to 100 t/day. A single pit can process about 45 tons of coconut shells in a day.

The cycle of operation of an open pit is about 72 hours. First, about 20% of the pit is filled with coconut shell and ignited with fire. This will emit smoke and as the fire getting aggravated, may be after an hour, again 20% of the pit will be filled with coconut shell. This process will be carried out at specific interval till the pits get filled. The smoke from the pit is taken through pipeline to the wet scrubber and sends out through a chimney. In order to cool the red hot shell charcoal at about 1000^{o}C, water is spayed from the top of the pit which leads to possibility of leaching into ground water pollution as the quench water is contaminated has of higher concentration of dissolved organics (COD) and suspended solids. This process of charcoal making has the potential for causing significant environmental impacts through air emissions during pyrolysis and ground water contamination due to disposal and seepage of quenched water.

Consequent to a public protest in October 2012 by the villagers of Veeranampalayam Panchayat, Tamilnadu Pollution Control Board (TNPCB) constituted a committee which inspected some of the units and directed the charcoal manufacturing units to install air pollution control systems and collect the quench water in impervious tanks and reuse for quenching. TNPCB had also taken the initiative to evolve certain guidelines such as common hood attached to a scrubber and a tall chimney to treat the smoke and

discharge into the atmosphere. Similarly, the water used for quenching and scrubber bleed off is collected in impervious tank and reused for quenching.

TNPCB had further recommended that all the processing chambers are to be above the ground level with visible pipelines of the quenched water beneath the processing chambers to the elevated tank for recycling. The quenched water shall be recycled for quenching after providing adequate treatment. The possibility of oxidizing carbon monoxide with other fumes arising in the initial stage of controlled in the dwarf chimney to be explored. Coconut shell charcoal fines to be collected and disposed in a scientific way without public complaints. The wet charcoal drying yards should be made impervious with dwarf walls. The finished products including the reject fine should be stored under proper roofing system.

The National Green Tribunal (NGT) constituted an expert committee in October, 2013 to assist the Tribunal in the adjudication of the matter seeking a permanent solution to the pollution from coconut shell charcoal manufacturing units. It was observed that all the units except one used partial underground pit carbonization and the pollution control measures, consisting of a dwarf chimney to burn off the volatile gas emissions are adopted by all the units with minor modifications and waste water collection pits to collect the quench water which is reused for quenching. Some units have installed an additional common gas scrubber followed by tall stack to control volatiles during the initial stages of carbonization. The two pollution sources from the coconut shell charcoal units are the emissions during the carbonisation process and the potential for ground water contamination by the residual quench water/scrubber effluent, if disposed on land. The quench water samples showed very high concentrations of organics as indicated by high values of COD volatile organics and phenolic compounds. Further, the fine carbon dust and fugitive emissions during charcoal handling process can cause nuisance.

The expert committee recommended that all the units which have installed the pollution control measures recommended by the TNPCB committee and have obtained the consent to operate from TNPCB may be allowed to operate. Those units which have not obtained the consent may be closed. No new units may be permitted till above round pyrolysis design is proved feasible. The feasibility of setting up charcoal unit above ground needs to be evaluated by setting up a demonstration unit and the technical, environmental and economic feasibility may be evaluated based on field data.

The units did not comply with the setting up chambers above ground level on the contention that it is unfit for heat retention necessary for the manufacture process and it would also be unsafe for humans to work nearby due to possibility of blast at high temperature. Due to the said reason a representation had been made to the TNPCB praying for an alternate method to be suggested. It was reported that the model charcoal units constructed above the ground level as directed by the TNPCB had caused explosion ad accident during its operations and there is apprehension that the construction of charcoal unit above the ground level may cause danger to the human life. Apprehensions were also raised regarding monitoring of the process from raw material coconut shells to the product charcoal in order to avoid the product getting totally burnt will be difficult in the above the ground level method especially for the labourers.

As per the direction of the Hon'ble National Green Tribunal (NGT) dated 28.10.2016, the TNPCB constituted an internal committee for recommending suitable design and detailed guidelines for setting up of above ground level process of charcoal units. The committee visited a continuous process charcoal unit at Kanchikovil and also had a meeting with stake holder. Based on the field visit, literature review on the continuous process methodology for the manufacturing of charcoal, the committee has prepared "DESIGN AND GUIDELINES FOR CHARCOAL UNITS" on March 2017 and submitted to the Hon'ble Tribunal.

A Joint Committee was constituted by NGT in the year 2019 to consider the revised technical design proposal submitted by the charcoal units and to assess the damage caused due to the Charcoal units. The committee recommended that, in order to continue natural restoration, the industries shall not be allowed to operate with the existing underground pit technology because this technology may lead to further pollution. Considering the reports of the Committee and hearing the views of the different parties, NGT disposed the applications on 20.11.2020 with the direction that the charcoal units operating in the State of Tamil Nadu and other Southern States are directed to shift over to above ground level technology with the recommendation and the conditions imposed by the TNPCB Committee and the design approved either by the Indian Institute of Technology, Chennai or Anna University as suggested by the Board and till then they are directed not to operate such units. It was ordered that ,in order to

protect the environment and prevent ecological damages all TNPCB consented charcoal units of open earthen pit shall switch over to continuous process of charcoal manufacturing from 1.4.2020 and follow the guidelines of air pollution control measures and control fugitive emissions from charcoal units.

In this context, TNPCB sought the vetting of the "DESIGN AND GUIDELINES FOR CHARCOAL UNITS" by Centre for Environmental Studies (CES), Anna University, Chennai. Accordingly, the technical opinion of the CES Team consisting of Prof.Dr.S.Kanmani, Director and Prof.Dr.Kurian Joseph is presented in this Report.

2.0 TNPCB DESIGN AND GUIDELINES FOR CHARCOAL UNITS

The guideline for Charcoal units proposed by TNPCB is prepared in consultation with the Charcoal manufactures and based on the designs submitted by M/s. United Carbon, M/s. Tiruppur District Coconut Shell Manufacture Association and M/s. Balasubramaniam Charcoal unit. The TNPCB committee also visited a continuous process charcoal unit (not operated) at Kanchikovil on 3.2.2017 and then proceeded to Kangeyam to observe charcoal units practicing open earthen pit batch method (not in operation) and to assess the technologies. Further, the committee studied literature on the continuous process methodology for the manufacturing of charcoal. (Resource: Unite States Environmental Protection Agency – source assessment charcoal manufacturing state of art,1978) .

The recommended continuous charcoal production plant (Figure 1) has an elevated Charcoal pit with its bottom 1200 mm above the ground level and the water quenching tank with its bottom 600 mm above ground level. The charcoal pit/pits firing chamber, oil mist eliminator and venue wet scrubber shall have pressure releasing valves. Suitable non return valves are recommended to be provided in the system to prevent back fire. Ash tray is to be provided beneath the chimney to collect ash generated. An ID fan attached to chimney is provided with damper valve and a Platform with port hold arrangement in the chimney to monitor process emission.

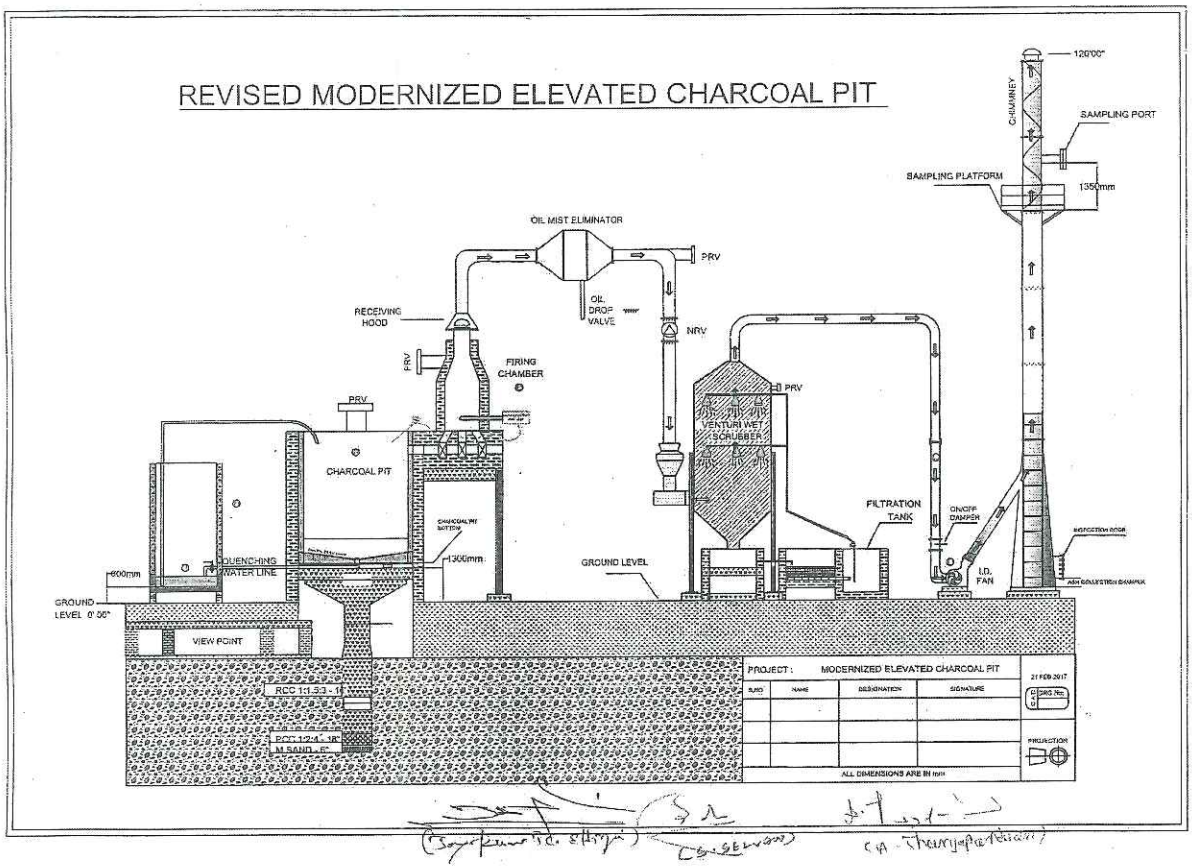

Figure 1 Schematic Diagram of the continuous Charcoal Production Plant

No charcoal manufacturing unit shall be allowed within 1 km from approved habitation/ approved layouts. Charcoal unit shall be allowed 500 m away from National/State Highways and distance shall be ensured from the edge of the metalled road to the physical/administrative boundary of the charcoal manufacturing unit. No charcoal units shall be located in declared wildlife sanctuaries/reserved forests and its buffer zones declared for the same. There should be at least 1 km distance between to charcoal manufacturing units from its physical/administrative boundaries. Buffer stock of raw materials of not more than 10 days requirement shall be stored within the unit premises to ensure continuous operation of the plant.

The Flue gas arising from the continuous process shall have water scrubber arrangement attached to a stack of minimum height of 10 meters with necessary platform and port holes for periodic collection of stack emission samples. The Charcoal units shall meet the emission standards, especially for particulate matter (not more than 150 mg/Nm^3) and National ambient air quality standards as per CPCB Notification.

Stack/ambient air quality/ambient noise level surveys to be periodically conducted and reports should be furnished to TNPCB.

Waste heat energy of the flue gas may be used for drying of raw materials and for other purposes. The assembly of continuous process method shall be housed within a closed shed with suitable access. Loading of raw materials and unloading of finished products shall be mechanized. Compound wall shall be provided on all sides of the unit to a minimum height of 4 m from the ground level so as to control fugitive emissions. It shall maintain good housekeeping practices within the unit premises to control fugitive emission.

Raw materials and finished products shall be stored separately and all steps shall be taken to comply with the fire safety procedures enacted in law. Adequate measures of safety for workers working in the charcoal units shall be taken. Personally protective devices such as mask, helmet, safety shoes etc shall be provided to workers. It is also recommended that the Charcoal industry should plant three rows of spreading crown & fast growing varieties of evergreen thick foliage tall trees all along the boundary.

3.0 TECHNICAL OPINION OF THE CES TEAM

The process of making charcoal is only by partial combustion (pyrolysis) in the absence of oxygen with Charcoal as the product. Emission of volatiles, particulate matter CO, CO_2, oily substances etc., which is about 2/3rd of the raw material feed, are being liberated during the process. The critical issue is whether the technology will be able to achieve the process requirements, safety of workers and meet the prescribed environmental standards. TNPCB is the regulatory body and the choice of technology to be adopted by the industries for manufacturing is to be done by the industry taking into account of the process requirements, environmental controls, operational safety and economy of production.

The guidelines for continuous charcoal production suggested by TNPCB with the entire plant and activity above the ground level is a precautionary measure that there are any direct physical contact with the ground while operating. As recommended in the report, the pit and tank are 1200 mm and 600 mm above ground level respectively. The design addresses the limitation of the traditional pit method and reduces the potential for

groundwater pollution due to leaching of quench water. The design and guidelines for the charcoal units has elaborated the air Pollution parameters of PM 2.5, PM 10, CO, SO2 & NOx. These air pollutants with heat energy are being controlled while passing through the oil mist eliminator, venture wet scrubber and chimney attached with ID fan. The issues on water and air pollution are detailed wherein the waste water generate is collected and reused in the process.

The merit of the proposed design is that the generated volatiles with CO would be oxidized within the kiln. Continuous production of charcoal is more amenable to emission control than batch process as the composition and flow rate are relatively constant. Better process control to achieve consistent yield is feasible. Pressure relief valves and non return valves are included in the design to provide protection against development of pressure and fire hazard during processing. It is expected to minimise the use of water for quenching of carbonized coconut shell as the waste water arising can be easily collected and recycled. The technology proposed in the manufacturing process of charcoal will be controlled and partial combustion, hence there will not be any ash generation even then if there is any ash generated it will be very minimal and the same may be utilised for agricultural requirements and any other beneficial purposes. Moreover while quenching, the ash will get mixed with quenching water and as per the recommendation of the committee the quenching water is recycled after filtration. The filtered solid waste may be utilised for agriculture or any other beneficial purpose.

Merely because the proposed technology of switch over to the above ground level process will have some more expenditure for the units will not be a ground for allowing the units to continue with the present process which will have more impact on environment as well as health of the people. It is concluded that that the design and guidelines for charcoal units recommended by TNPCB committee may be considered for manufacturing of charcoal by following the guidelines and conditions mentioned therein in the report. The entire process area flooring shall be made impervious and covered shed shall be provided for the process area. The Oily/tarry waste collected from the oil mist eliminator may be used for beneficial purposes such as tar production, oil for medicinal purpose etc. or disposed scientifically such as Co-processing, incineration through Common TSDF etc. As most of the charcoal units in Kangeyam do not have green thick foliage tall trees to arrest fugitive emissions and it may take years for plantation of green belt and its attainment of height to reach about 3 to 4.5 m , the

construction compound wall of 4.0 m height may be insisted. It is advised that the units may have raw material storage capacity for 30 days so as to ensure continuous production. All oily/tarry waste collected from the oil mist eliminator are disposed scientifically. Waste water arising from the venture wet scrubber are collected and recycled. Quenching water of the hot shell carbon is collected is filtered and recycled.

Raw materials land finished products shall be stored separately and all steps shall be taken to comply with the fire safety procedures. Loading of raw materials and unloading of finished products shall be mechanized to minimise labour and manual handling. Personally protective devices such as mask, helmet, safety shoes etc shall be provided to workers.

As the practice of continuous process for charcoal manufacture is limited in Tamil Nadu, it is recommended that a Pilot unit may be constructed and operated as per the guidelines of TNPCB. Refinements, if any, in the design may be considered based on the performance of the pilot plant. The Project proponents may be permitted to develop and improvise their own design adopting all the modifications and general guidelines given by TNPCB and incorporating features of easy operation, higher safety, high efficiency, energy saving and environmental protection. The modifications undertaken in the plant shall be inspected and certified by an authorized process and safety consultant for the same and efficient working. In the meantime, TNPCB may conduct carrying capacity evaluation as to how many of such industries can be permitted to operate in a particular area considering its impact with the improvised technology on environment and thereafter restrict such number of industries to operate. All TNPCB consented charcoal units shall switch over to continuous process of charcoal manufacturing and follow the guidelines of air pollution control measures and control fugitive emissions from charcoal units.

08/02/2022

Dr. S. Kanmani, B.E.,M.E.,Ph.D
Professor & Director
Centre for Environmental Studies
Anna University, Chennai - 600 025

02/02/2022

Dr. KURIAN JOSEPH
PROFESSOR OF ENVIRONMENTAL ENGINEERING
CENTRE FOR ENVIRONMENTAL STUDIES
ANNA UNIVERSITY, CHENNAI-600 025.