

Extraction of Producer Gas from Solid Fuel

N. Chandra Kanth¹, Gangakhedkar Sujith², Byrishetty Abhishek³, Gattikoppula Karthik⁴, Garikapati Vamshi krishna⁵, Malothu Rajender⁶

¹ Asst.Professor, Department of Mechanical Engineering, NNRG, Hyd, Telangana, India ^{2,3,4,5,6} Student,
Department of Mechanical Engineering, NNRG, Hyd, Telangana, India

Abstract : Producer gas, which is derived from a biomass gasification process, is considered as one of the alternative fuels, which is suitable for the heating process and power generation. Due to low heating density and impurities, combustion in an external combustion chamber constitutes an obvious option for the utilization of producer gas using combustion process. Wood gas is a syngas fuel which can be used as a fuel for furnaces, stoves and vehicles in place of gasoline, diesel or other fuels. During the production process biomass or other carbon-containing materials are gasified within the oxygen-limited environment of a wood gas generator to produce hydrogen and carbon monoxide. These gases can then be burnt as a fuel within an oxygen rich environment to produce carbon dioxide, water and heat. In some gasifiers this process is preceded by pyrolysis, where the biomass or coal is first converted to char, releasing methane and tar rich in polycyclic aromatic hydrocarbons.

1. INTRODUCTION :

In this process of extraction of producer gas by burning wood, we are using a rocket stove. we are burning the wood indirectly by placing solid waste in a gas generation container. This gas generation container is placed on rocket stove and thus burning of wood for extraction of producer gas (wood gas) is achieved.

2. DESIGN DESCRIPTION :

1. Rocket stove : Rocket stoves are small efficient stoves that can produce a hot flame with only a few small pieces of wood. The reason it is called a rocket stove is because when wood is added to the fire the flames create an internal draft. As the draft is created, the fire begins to produce a jet of fire coming through the stove pipe. The stove flame eventually becomes so hot that it produces very little smoke. The stove should be able to produce a hot continuous flame that will lick the bottom surface of a pot or pan placed on top of the stove.



Fig. no. 1 Rocket stove

2. Gas generation container : In this container solid waste is indirectly burnt , by placing

it on rocket stove and the generation of wood gas is achieved in this container itself



Fig. no. 2 Gas generation container

3. Cylindrical gas collection tank : This cylinder is used to store the gas produced in the gas generation container. And this whole setup is made up of stainless steel. The cylinder setup consists of inner and outer cylinder, in which inner cylinder is inserted into the outer cylinder whose diameter is greater than inner cylinder. The

Upper portion of inner cylinder is enclosed and are subjected with inlet and outlet valves. This inlet and outlet valves are used to allow gas into the cylinder and also to send gas out of the cylinder.



Fig. no. 3 Gas collection tank

- I. **Working** : In a rocket stove only few pieces of wood are burnt at the lower portion of its. Due to this high amount of heat is supplied to the cylindrical metal container which contains of solid waste is also heated, resulting in gas production. This gas is collected in a cylindrical gas collection tank which is made up of stainless steel. The cylinder setup consists of inner and outer cylinder, in which inner cylinder is inserted into the outer cylinder whose diameter is greater than inner cylinder. The Upper portion of inner cylinder is

enclosed and are subjected with inlet and outlet valves. This inlet and outlet valves are used to allow gas into the cylinder and also to send gas out of the cylinder. The outer cylinder is filled fully with water which is actually used to lift the tank and filter the gas, through which gas storage is possible. At this stage inlet valve is opened so that the gas can enter into the cylinder and outlet valve is closed. After the tank is filled with gas, the outlet valve can be opened and used to ignite the flame, while inlet valve is closed.



Fig. no. 4 Producer gas extraction setup

3.

DESIGN ANALYSIS :

- i. Selection of material : Rocket stove is made of stainless steel and inside its refractory material is used to maintain the heat inside the stove and reduce heat loss. Cylindrical gas storage setup is also made of stainless steel sheet of 202 grade and gauge of 1.2mm. This sheet is rolled by Rolling machine where inner cylinder is rolled to the diameter of 22.5cm and outer cylinder is rolled to the diameter of 24cm. This rolled cylinders are welded using TIG Welding process.
- ii. Inlet and outlet valves are fitted and welded to the upper portion of inner cylinder. The upper portion of cylinder which is enclosed, is drilled at two points and in this drilled holes valves are fitted and welded using ARC Welding process.

II. **Test Procedure** : Rocket jet fuel inlet is filled with wooden pieces and it is burnt. On the top of stove gas generation container is placed. This gas generation container is filled with solid waste more than half of the gas generation container and takes 3-4 mins to generate gas from its. This generated producer gas is sent into the gas collection tank through inlet valve. It takes 8-10 mins to fill the producer gas in the tank . In this whole process of

test procedure the temperature is measured by using Non-contact digital thermometer.

III. Test Results :

- i. Inlet valve temperature : 56⁰C
- ii. Outlet valve temperature : 43⁰C
- iii. Inner cylinder temperature : 46⁰C
- iv. Outer cylinder temperature : 37⁰C
- v. Gas generation container temperature : 111.4⁰C
- vi. Rocket jet temperature : 550⁰C
- vii. Time taken for gas to fill in the collection tank : 9 mins 30 secs

4. CONCLUSION :

It is observed that the extraction of producer gas from the prepared setup is successful.

REFERENCE :

- [1] https://en.wikipedia.org/wiki/Rocket_stove
- [2] <https://www.sciencedirect.com/science/article/pii/S174396711830268X>
- [3] <https://hackaday.com/2018/07/11/building-a-gasometer-to-store-wood-gas-and-other-bio-fuels/>
- [4] https://en.wikipedia.org/wiki/Wood_gas