



National Education Society (R)

**JAWAHARLAL NEHRU
NATIONAL COLLEGE OF ENGINEERING, SHIMOGA**

MECHANICAL ENGINEERING

Experiment to study Direct Combustion Process:

This experiment is conceived and conducted to enhance the understanding of direct combustion process. The procedure is as follows:

A simple wood stove is selected. Even a three stone wood stove is enough. The stove is kept in a place where there is no external wind force. Small wood pieces of less than 5 cm diameter and 3 cm length are selected. The wood pieces should be sufficiently dried (Less than 10% moisture content). The wood pieces are inserted into stove and with the help of any inflammable material like paper or kerosene the wood is ignited. The direct combustion is thus initiated. The different stages of combustion are carefully observed and recorded.

When the biomass is ignited, the initial stage results in evolution of water vapor and oxygenated gases (mainly carbon dioxide). This results in smouldering and evolution of smoke. As the temperature is further increased with the help of external burning source, the volatile matters present in the wood start liberating. This is known as **pyrolysis**. The evolved gas get progressively enriched in combustible constituent such as carbon monoxide and hydrocarbons and with the availability of oxygen from air, these constituents catch fire and **flaming combustion** is obtained. At this stage the heat generated due to combustions sustains the further combustion process and it combustion reaches maximum rate and then start receding due to progressive depletion of volatiles available in the fuel. Finally, the flames die down and the residual **Char combustion** continues with glowing. It is also known as **surface combustion** as the layer by layer of char is exposed for combustion. Due to non-availability of volatiles, the burning is relatively smoke free and the temperature of combustion is maximum. Occasional blue flame is observed due to conversion of carbon to carbon monoxide and further to carbon dioxide. Any residual volatile present in the fuel also gets thermally cracked at high temperature and clean smoke free combustion is obtained.