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Experimental analysis of pine needle briquettes using different binding material

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Abstract— The study is undertaken to investigate the Thermal properties of pine needle in the preparation of biomass briquettes. Forest fires are the annual phenomenon in Himalayan region as the forests are dense and catch fire easily due to natural and man-made reasons. Himalayan forests are rich in Pine trees and the pine needle is one of the reasons to enhance the forest fire. There is a necessity to handle this forest waste efficiently. The dry pine needles are a major cause of forest fires and destroy the local ecology and the unburned pine needles damaging the fertile top layer of the soil.
This paper attempts to explain the briquetting technology of pine needles and the results showed that a significant improvement in calorific value with the different binding material, and also help to find out the most suitable or efficient binding material for pine needle briquetting.
Keywords: Pine Needles, Briquetting, Himalayan Region, Thermal Analysis, Forest Fire, Forest waste, Biomass

I. INTRODUCTION

Biomass is one of the most promising renewable energy resources on earth which is used in the form of solid, liquid and gaseous fuels. The demand for bioenergy systems in small scale industry is increasing at faster rate due to its lower investment cost. Currently bioenergy is the second largest commercial renewable energy source. Current total biomass energy usage ranges around 12% of world total primary energy consumption, mainly in traditional applications like cooking in developing nations like India. Also the usage of wood for heating purposes is increasing day-today. Normal domestic wood-burning appliances include fireplaces, pellet stoves and burners, central heating furnaces and boilers for wood logs and wood pellets [1]
Biomass can be converted into either heat energy or electrical or energy carriers like charcoal, oil, or gas using both thermochemical and biochemical conversion methods. Combustion is the most developed and frequently applied process used for solid biomass fuels because of its cheap cost and high reliability. During combustion, the biomass first loses its moisture at temperatures up to 100°C, using heat from other particles that release their heat value. As the dried particle heats up, volatile gases containing hydrocarbons, CO, CH4 and other gaseous components are released. In a combustion process, these gases contribute about 70% of the heating value of the biomass. Finally, char oxidizes and ash remains [2]
Among the usage of biomass the wood pellet is also included. Many new techniques are available to turn wood and crop wastes into standardized pellets that are eco-friendly and easy to handle [3]This document is a template. For questions on paper guidelines, please contact us via e-mail.

II. MATERIEL & METHODS

10 kg of pine needle sample was collected from Uttarakhand hill region of India During May 2014. Sample was received in the form of long fibrous mass. It was chopped in order to get uniform representative sample
Char (biomass produced by pine needle carbonization) which can be further use as briquette by briquetting which is the process of converting low bulk density biomass into high density concentrated fuel briquetting. In this process we use modified kiln and briquetting mould.

Sample	Char	Binding material
S1	1 kg	500g clay
S2	1kg	350g clay
S3	1kg	50g Starch
S4	1kg	50g Starch+ 100g clay
S5	1kg	50g paper
S6	1kg	50g paper+ 100g clay

Table 1 sample preparation

The process can be defined as follow

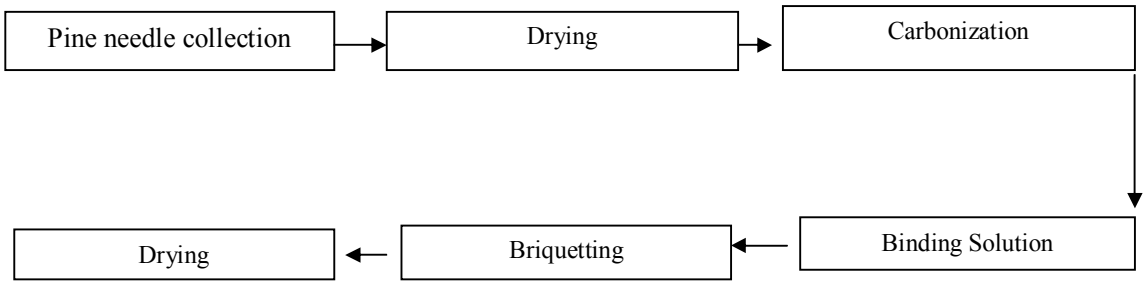

Fig.1.Briquetting Process

PROXIMATE ANALYSIS WAS CARRIED OUT ON THE BRIQUETTE SAMPLES TO DETERMINE THE PERCENTAGE VOLATILEMATTER CONTENT, % ASH CONTENT, % CONTENT OF FIXED CARBON AND HEATING VALUE OF THE SAMPLES. THE PROCEDURES OF ASTM E711-87

Parameters	Pine Briquette
Appearance	Black color,Cylindrical Shape witht holes
composition	S1,S2,S3,S4,S5,S6
Weight	185g

TABLE 2 PHYSICAL PARAMETER OF BRIQUETT

III.RESULT AND DISCUSSION

Result of each briquette analysis of on water boiling test This was carried out to compare the cooking efficiency of the briquettes. It measured the time taken for each set of briquettes to boil an equal volume of water under similar conditions.

Ignition time

Each briquette sample was ignited at the base in a drought free corner. The time required for the flame to ignite the briquette was recorded as the ignition time using stop watch.

SAMPLE	S1	S2	S3	S4	S5	S6
Moisture Content (%)	6.2	5.9	4.6	5.1	4.4	5.5
Ash Content (%)	32.6	29.3	15.2	19.2	14.5	22.4
Volatile matter (%)	50.7	55.4	73.21	67.41	75.2	69.2
Fixed Carbon (%)	10.5	9.4	6.99	8.29	7.1	8.2
Calorific Value(Kcal/Kg)	4907	5745	6447	6343	6501	6350

Table 3 The result of proximate analysis briquette samples

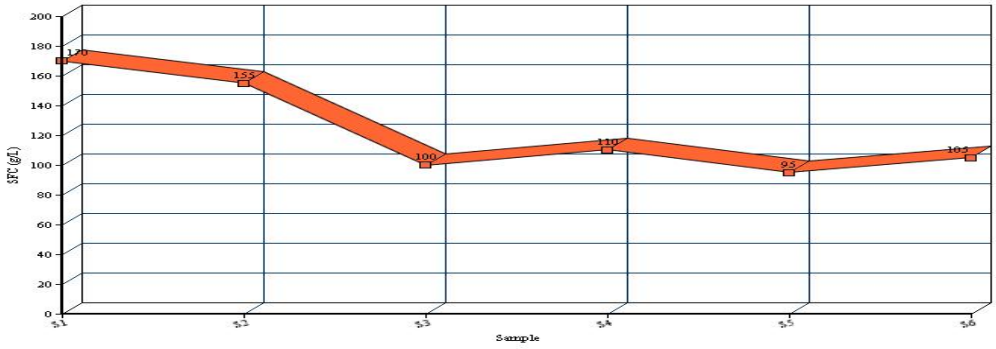

Fig. 2 Variation in specific fuel consumption with different binding material

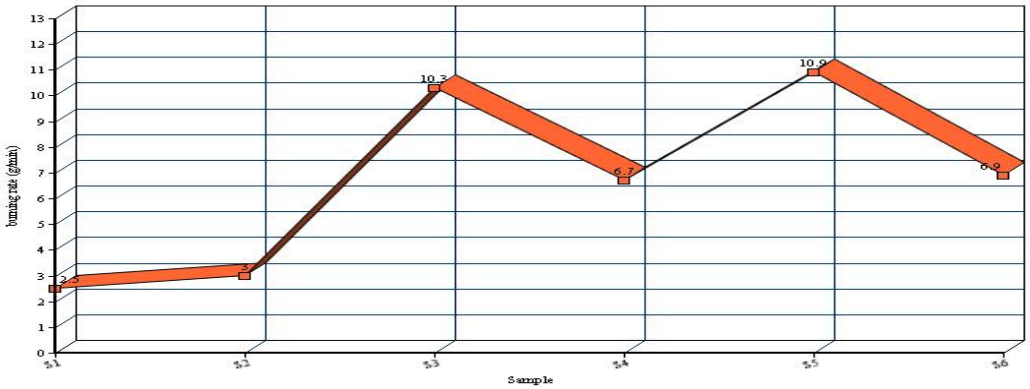

Fig. 3 Variation in burning rate with different sample

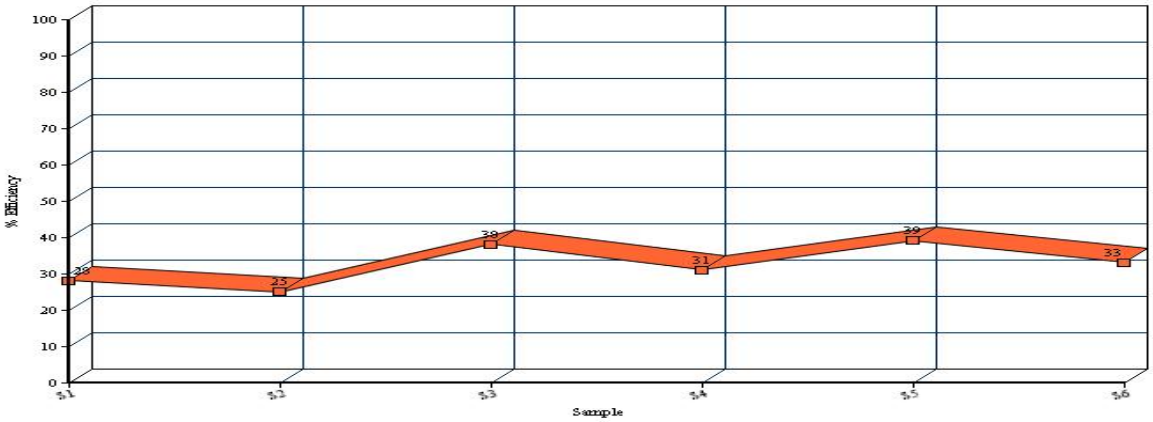

Fig. 4 Effect of binding material on the efficiency

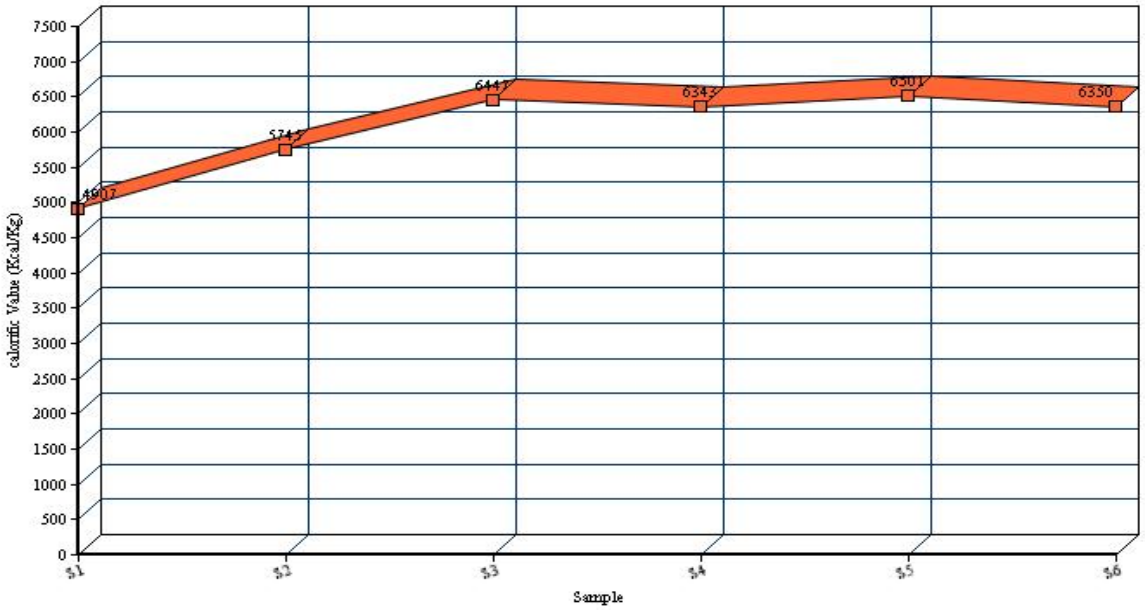

Fig. 5 Effect of binding material on the calorific values

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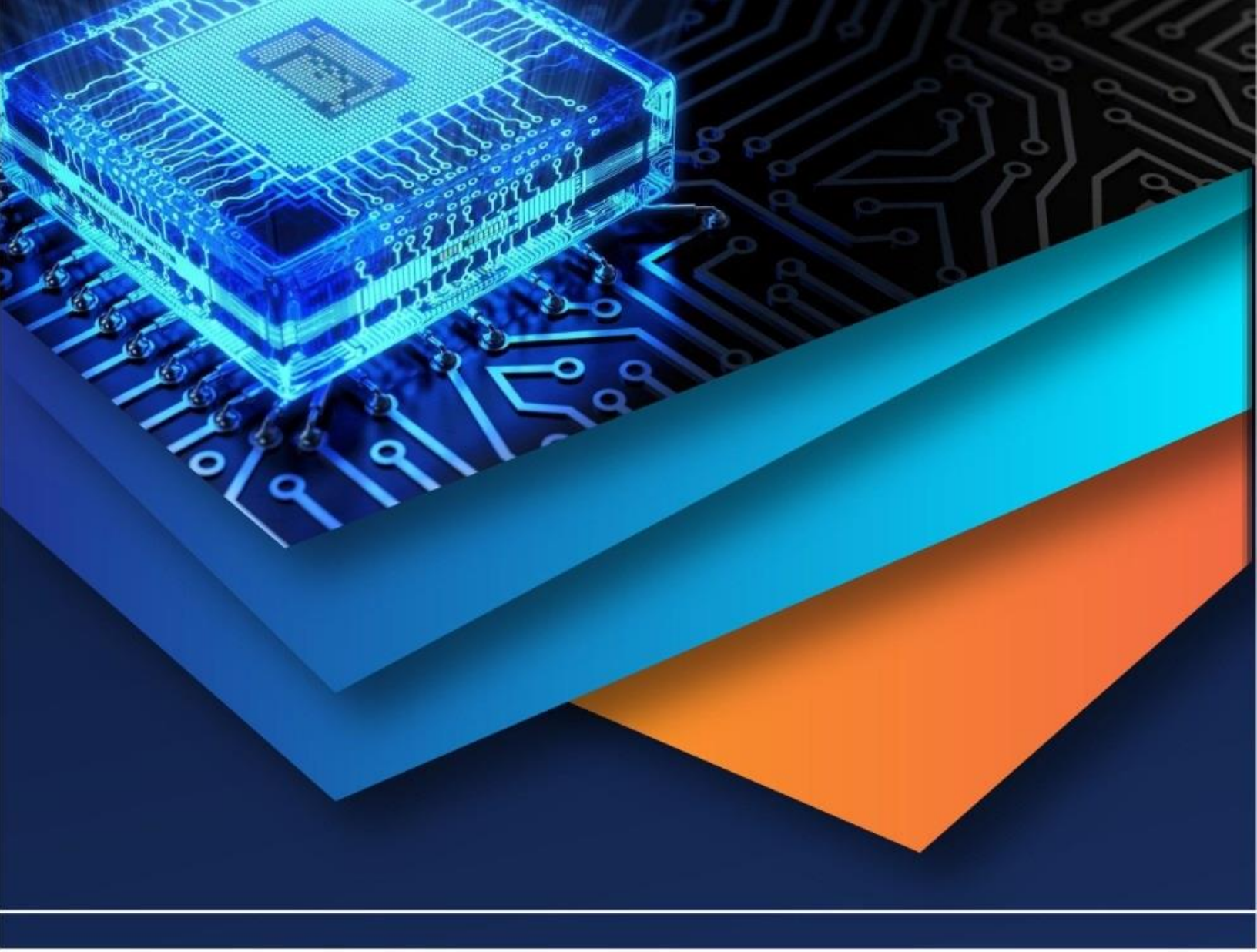

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