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Charcoal : A Value Addition Option For Utilizing Tree Waste

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ABSTRACT

Charcoal is a common form of fuel derived from wood. Potential multipurpose tree species are available in the study area and their plant parts can be used for the charcoal making. Present study was under taken to see the suitability of different tree species for charcoal making and study the quality of charcoal prepared from different tree species. Charcoal was prepared using the improved paraboloid mobile charcoal making kiln developed by ARTI, Pune. The experiment was laid with five treatments; (T1- Prosopis, T2- Babul, T3- Subabul, T4- Bamboo and T5- Teak) with five replications. The highest percent of ash after complete burning of charcoal was found in Teak (31.31%) and the lowest was found in Prosopis (25.17 %). The time required for the complete combustion was found highest in Prosopis (19 min.) and the lowest was found in Teak (15 min.).The litter of *Prosopis juliflora* is suitable for preparation of charcoal as it has less ash content; time required for complete combustion is more and has high calorific value as compared to Acacia, Subabul, Bamboo and Teak species.

Key Words:

Ash, Briquettes, Charcoal, Pyrolesses

INTRODUCTION

Fuel is one of the great necessities of modern life, it is indispensible both in home and in industry as source of heat. Any material that burns readily in air is suitable. It is available in all three phases of matter namely; solid, liquid and gas. Among the solid fuels, various forms of coal, peat and wood are the most popular. However, wood has been used as a fuel from time immemorial. Out of world's output of wood, 37% was used for timber, 15% for wood pulp, 6% for other industrial purpose and 42% as fuel-woods (FRI 1984)

Wood is generally used as fuel with little or no treatment or modification except that of cutting into billets of suitable size and splitting round wood of large diameter. Charcoal is a common form of fuel derived from wood. Charcoal burning is an important industry and provides livelihood to forest dwellers in many parts of India. Charcoal industry provides positive means of large scale utilization of agroforestry and tree residues. As a practice of disposing unwanted slash that would impede regeneration, invites fungal and insect pest and fire hazards, charcoal making finds to be best option. Converting the slash into charcoal will act as a value addition to the otherwise unutilized slash. Further charcoal making generates great potential for additional income to the tree growers

and also provides employment opportunity to the rural people.

Potential multipurpose tree species are available in the study area and their plant parts can be used for the charcoal making. But very less work has been undertaken to study quality of charcoal made from those species. In view of this the present study was under taken to findout suitability of different tree species for charcoal making and study the quality of charcoal prepared from different tree species.

MATERIALS AND METHODS

The study was conducted at College of Forestry, Dr. PDKV, Akola. The raw material for the study was procured from Dr. PDKV campus. The experiment was conducted using the improved paraboloid mobile charcoal making kiln developed by ARTI, Pune (ARTI 2005).

Leaf litter of five forest tree species Prosopis, Babul, Subabul, Bamboo and Teak was used for charcoal making. Charcoal was prepared using the improved paraboloid mobile charcoal making kiln developed by ARTI, Pune. The experiments were laid with five treatments; T1- *Prosopis juliflora* (Prosopis), T2- *Acacia nilotica* (Babul), T3- *Leuceana leucocephala* (Subabul), T4- *Dendracalamus strictus* (Bamboo) and T5- *Tectona grandis* (Teak) with five replications.

For each treatment 3.5 kg of sun dried litter was used. Litter was added into individual cylindrical metal container of size: 37.5 cm wide and 60 cm tall. For the preparation of charcoal standard procedures has been followed and the below given observation has been recorded; time required for complete combustion of charcoal, ash content, strength of the pellet by dropping at one meter on cemented floor and resistance of pellet.

The containers were loaded into mobile charcoal making kiln. Ten kg of slash was placed underneath for pyrolesses. The top of the kiln was closed with the metal lid which is provided with the chimney. Each batch took 40 to 45 minutes to complete the pyrolesses. The 10 kg char was powdered mixed with 1 kg of selected crushed tree leaves as a binder. The desired quantity of water was sprinkled on above mixture in order to prepare briquettes using briquetting machine. The briquettes were sun dried. 10 g of briquettes were used per replication per treatment for recording observations on time required for complete combustion (minutes) and ash content (percentage). The calorific values (Kcl kg^{-1}) were recorded by using Bomb calorimeter.

RESULTS AND DISCUSSION

The percentage of the Charred material after pyrolesses is given in table 1, fig 1 and fig 2. The mean of charred material after pyrolesses and percentage of charred material was 1.43 kg and 41.03 respectively. Fig 2 revealed that the highest percent of the char material was found in *Acacia nilotica* (52.29%) followed by *Dendrocalamus strictus* (50%), (Karve and Karve 2014, Deshmukh et al. 2016)

Table 1. Percentage of Charred material after Pyrolesses

Sr.No	Treatments	Weight of dry raw material (kg)	Weight of Charred material (kg)	% of charred material from dry raw material
1	T1 (*Prosopis juliflora*)	3.5	1.33	38.00
2	T2 (*Acacia nilotica*)	3.5	1.83	52.29
3	T3 (*Leuceana leucocephala*)	3.5	0.92	26.29
4	T4 (*Dendracalamus strictus*)	3.5	1.75	50.00
5	T5 (*Tectona grandis*)	3.5	1.35	38.57
	Mean		1.43	41.03

Fig 1. Weight of dry raw material and weight of charred material after pyrolesses

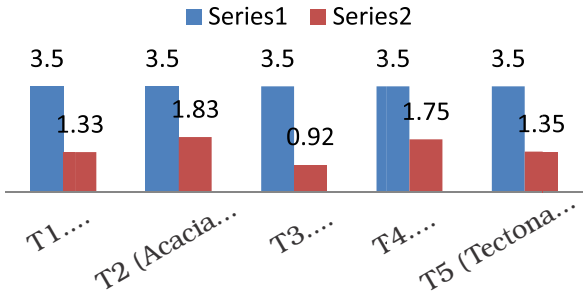
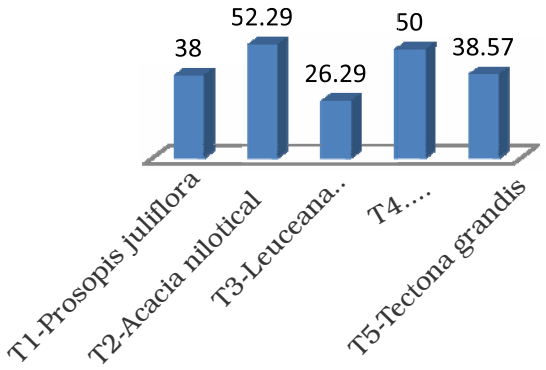


Fig 2. Percent of Charred material from dry raw material



The time required for combustion and the quantity of ash from briquettes is given in table 2 and fig 3.

Table 2. Time required for combustion and the quantity of ash produced from briquettes

Sr.No	Treatments	Quantity of charcoal (gm)	Time required for complete combustion (minutes)	Quantity of ash produced (gm)	% of ash Content from charcoal
1	T1 (Prosopis)	10	19.00	2.517	25.17
2	T2 (Babul)	10	17.00	2.979	29.79
3	T3 (Subabul)	10	18.00	2.853	28.53
4	T4 (Bamboo)	10	16.00	3.035	30.35
5	T5 (Teak)	10	15.00	3.131	31.31
	Mean		17.00	2.93	29.03
	SE (M) ±		0.53	9.22	
	CD		1.58	0.21	

Table 2 reveals that there is significant difference in quantity of ash produce after complete combustion of charcoal. Significant lowest quantity of ash produces after complete combustion of charcoal was found in Prosopis juliflora followed by Leuceana leucocephala. However the significant difference was observed in the time required for the complete combustion of charcoal. Significantly highest time required is recorded in Prosopis juliflora followed by Leuceana leucocephala. The highest percent of ash after complete burning of charcoal was found in Tectona grandis (31.31%) and the lowest was found in Acacia nilotica (25.17 %). Fig 3. Shows that the time required for the complete combustion was found highest in Prosopis juliflora (19 min) and the lowest was found in Tectona grandis (15 min) (Karve and Karve 2014, Negi 1992, Deshmukh et al. 2015).

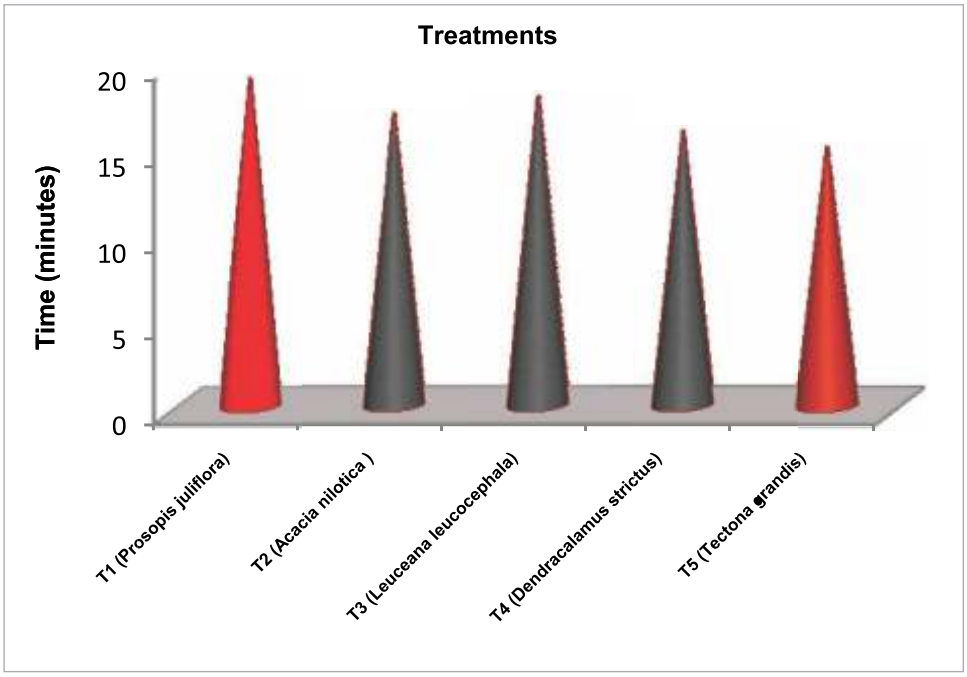


Fig 3 : Time (minutes) required for combusion

CONCLUSION

The litter of *Prosopis juliflora* is suitable for preparation of charcoal as it has less ash content, time required for complete combustion is more and has high calorific value as compared to *Acacia nilotica*, *Leuceana leucocephala*, *Dendrocalamus strictus* and *Tectona grandis* species.

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