I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3.03

Comparative evaluation of Low and High pressure Biomass briquettes

Kusuma G[1], Kranthi Kumar Ch[2] and Balachand Ch[3]

ABSTRACT: *Low and high pressure biomass briquettes made of rice husk, bagasse, saw dust and dried leaves were studied for physical and thermal characteristics. The physical and chemical characteristics studied were bulk density, shatter resistance, water penetration, and calorific value. The maximum values of BD, SR, WP and CV for high pressure biomass briquettes are 1899 kg/m3, 100%, 110.5% and 4900 kcal/kg respectively. The maximum values of BD, SR, WP and CV for low pressure biomass briquettes are 565.33kg/m3, 100%, 9.29% and 4500 kcal/kg respectively. Bulk density & water penetration were found significant and calorific value & shatter resistance were found insignificant in high and low pressure biomass briquettes. Hence use of low pressure biomass briquettes is economical to use in rural areas.*

Key words: *Bio mass, Briquette, Bulk density, Shatter resistance, Water penetration, calorific value*

INTRODUCTION

Briquetting of biomass is a booming alternative energy source found in rural areas. Biomass fulfills 90% of the rural energy and 40% of urban energy needs (Wakchaure *et al.*, 2007). In India Agricultural & Horticultural activity generates annually about 500 – 600 million tons of Agricultural waste (Madhava *et al.* 2011). The major residues are rice husk, coffee husk, coir pith, jute sticks, Bagasse, tree leaves, groundnut shells, saw dust, mustard stalks and cotton stalks etc (Bhattacharya *et al.*, 2002). In this study biomass briquettes made from low pressure and high pressure briquetting machines were compared for its bulk density, shatter resistance, water penetration capacity and calorific value Low pressure machine (Fig. 1) is a screw press type machine which can be operated manually. High pressure machine (Fig. 2) used in the study is power operated screw press. Low pressure and high pressure biomass briquettes are shown in Fig. 3 and Fig. 4.

MATERIALS AND METHODS:

Abundantly available agricultural wastes, viz., Rice husk, bagasse, sawdust and dried leaves were taken for the study. Binding element used was sodium silicate. The independent parameters were High pressure and low pressure briquettes where as dependent parameters were bulk density, shatter resistance, water penetration capacity and calorific value. The bulk density was found out by dividing the weight of the briquette with its volume. Shatter resistance was determined by dropping the briquette continuously 10 times from a height of 1m (Lindey *et al.* 1989). Then the percentage weight loss is calculated. For calculating amount of water absorbed each briquette was immersed in water at 27°C for 30 s. A measure of the percentage water absorbed by a briquette when immersed in water is determined. Each briquette was immersed in 25 mm of water at room temperature for 30 s. The percent weight gain was then calculated and recorded. The calorific value of briquettes were calculated by using following equation (Srivatsava *et al.*, 1995).

$$CV_f = \frac{[M_W \times Cp \times \Delta T] + [M_W \times LH_W]}{M(f)}$$

Where,

$\mathbf{Q_i}$ = Heat value of the fuel taken, Kcal

$\mathbf{M_f}$ = Mass of the fuel taken, kg

[1]* Assistant Professor- Vignan's University, Guntur, Andhra Pradesh

[2] Senior Research fellow – PJTSAU, Hyderabad, Telangana State.

[3] Teaching Associate –ANGRAU, Tirupathi.

**Corresponding author E-mail: kusumaguturu.10@gmail.com*

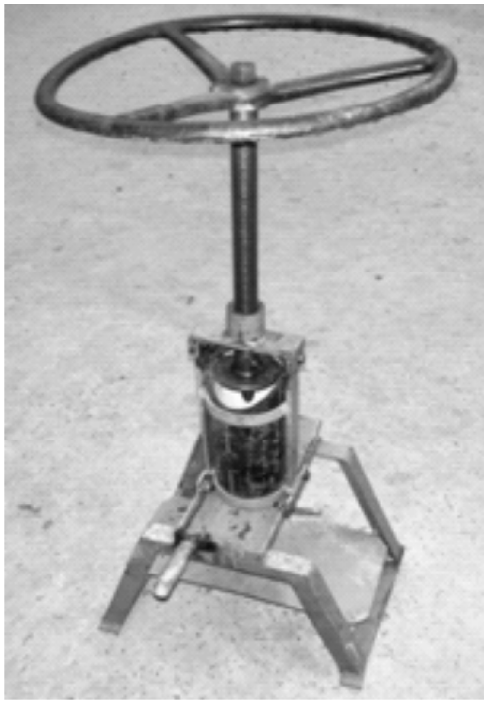


Figure 1: Low pressure biomass briquetting machine

Figure 2: High pressure biomass briquetting machine

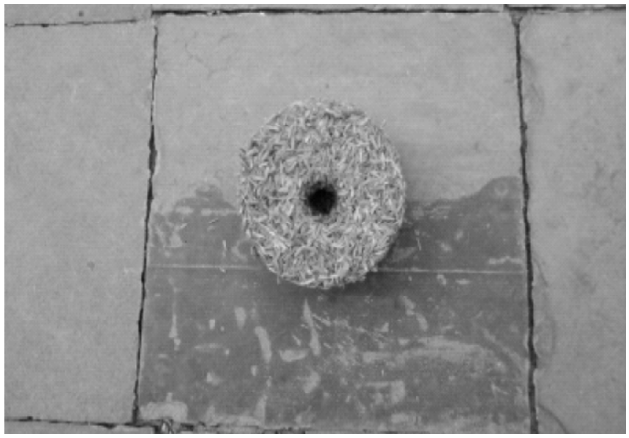


Figure 3: Low preesure biomass briquette

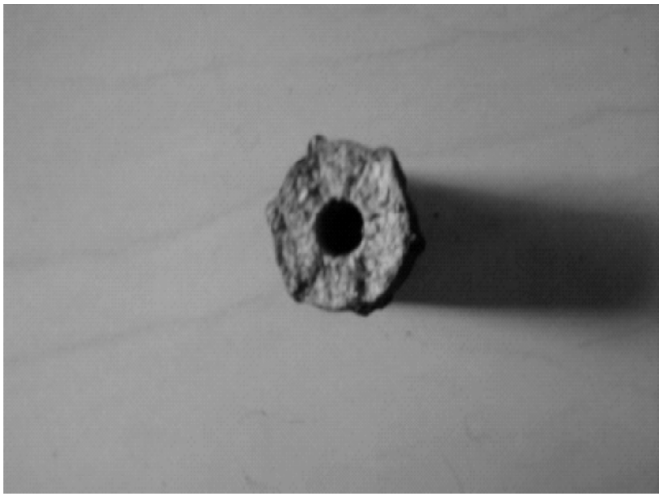


Figure 4: High pressure biomass briquette

$\mathbf{CV_f}$ = Calorific Value of the fuel, Kcal/kg

$\mathbf{Q_f}$ = Heat generated by burning the fuel, Kcal

$\mathbf{M_w}$ = Mass of water taken, kg

Cp = Specific heat value of water, KJ/kg K

ΔT = Difference of initial and final temperatures, ^{0}C

$\mathbf{LH_w}$ = Latent Heat Vaporization of Water, KJ/kg K

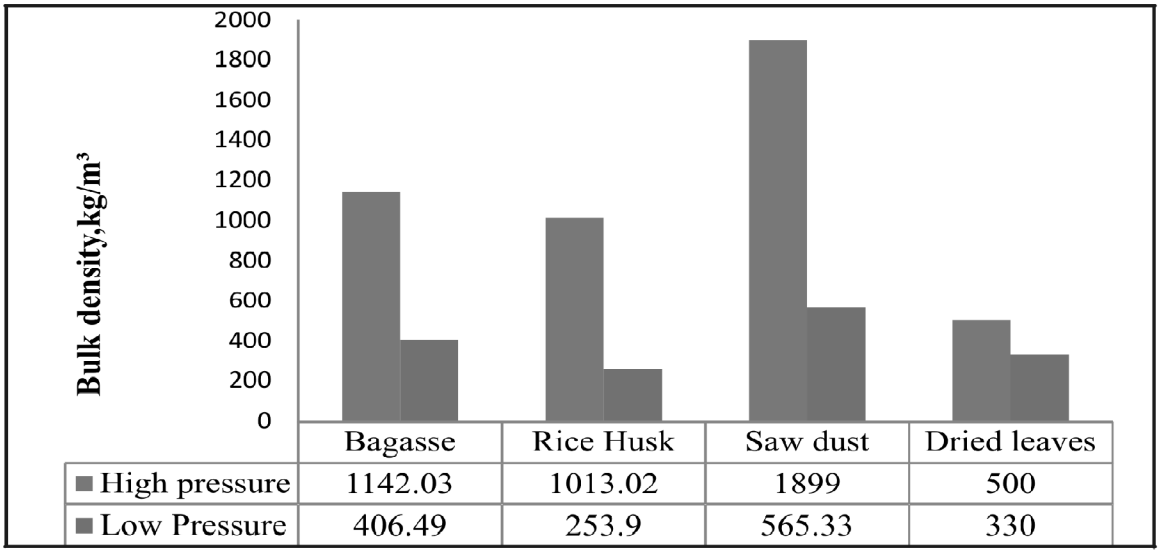
RESULTS AND DISCUSSIONS

Bulk density of all the agricultural biomass namely bagasse, rice husk, sawdust and dried leaves were found higher in high pressure biomass briquettes than low pressure biomass briquettes. The values are shown in Fig. 5. A uniform and significant variation in bulk density was observed in all the biomass residues.

Shatter resistance indicates percentage loss of weight from shattering. Shatter resistance of all the agricultural biomass namely bagasse, rice husk, sawdust and dried leaves were found nearly equal in high pressure biomass briquettes except in Rice husk briquettes which is because of high pressure requirement to press the highly porous material. Fig. 6. indicates the pictorial view of the data.

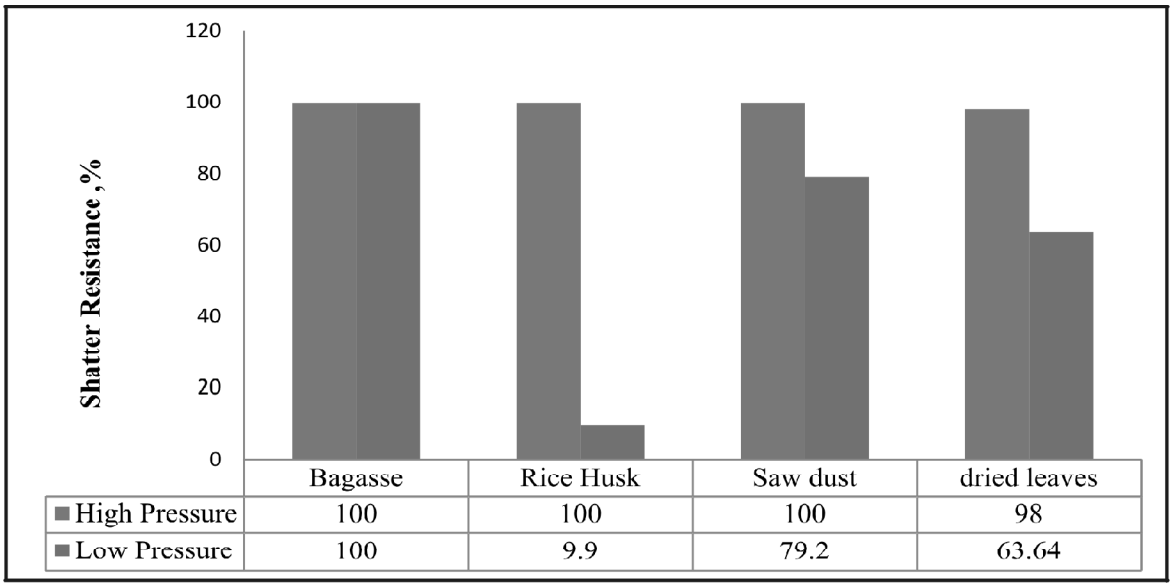
Water penetration percentage was found as discussed Art.3. A significant difference was found in high pressure and low pressure biomass briquettes. This is due to the reduced pore space in High pressure biomass briquettes. The pictorial view is shown in Fig. 7.

Calorific value of the briquettes was found by using equation 1. There is no significant difference between high and low pressure biomass briquettes calorific values. The pictorial view is shown in Fig. 8



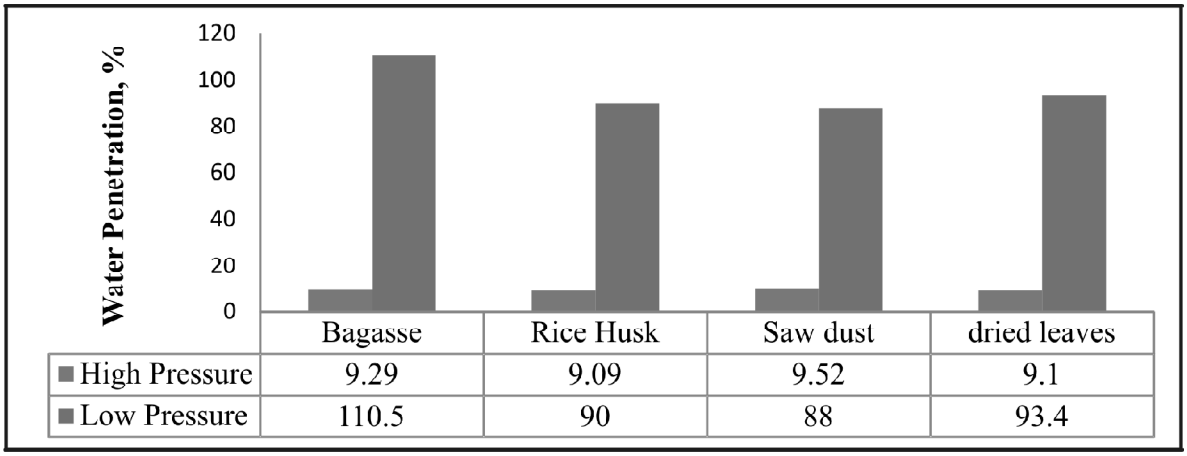
	Bagasse	Rice Husk	Saw dust	Dried leaves
High pressure	1142.03	1013.02	1899	500
Low Pressure	406.49	253.9	565.33	330

Figure 5: Bulk density in high and low pressure biomass briquettes



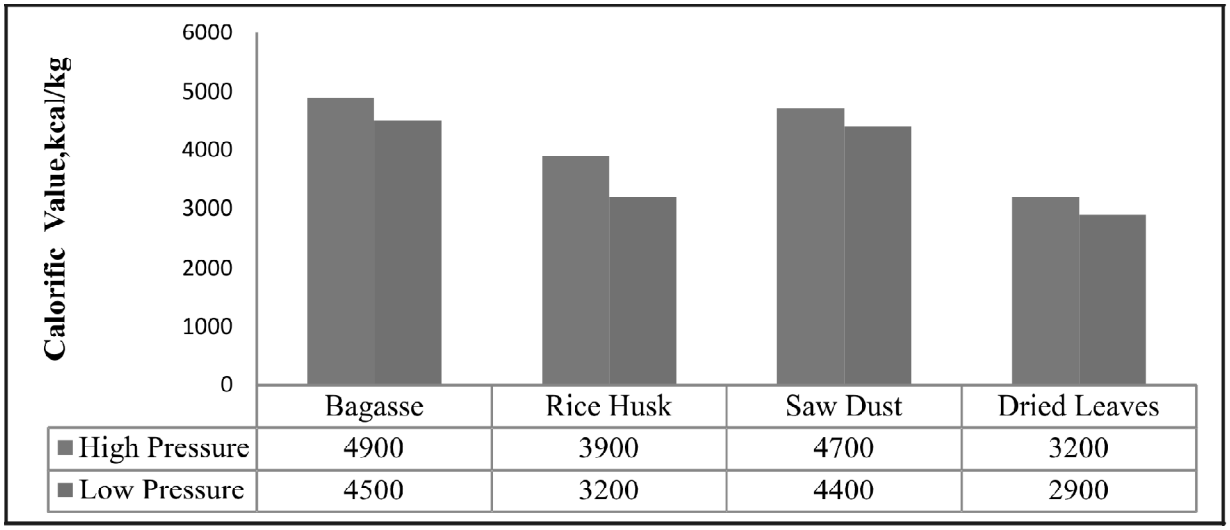
	Bagasse	Rice Husk	Saw dust	dried leaves
High Pressure	100	100	100	98
Low Pressure	100	9.9	79.2	63.64

Figure 6: Shatter resistance in High and Low pressure Biomass briquettes



	Bagasse	Rice Husk	Saw dust	dried leaves
High Pressure	9.29	9.09	9.52	9.1
Low Pressure	110.5	90	88	93.4

Figure 7: Water penetration in High and Low pressure Biomass briquettes



	Bagasse	Rice Husk	Saw Dust	Dried Leaves
High Pressure	4900	3900	4700	3200
Low Pressure	4500	3200	4400	2900

Figure 8: Water penetration of High and Low pressure Biomass briquettes

CONCLUSION

The study was conducted to compare the properties of briquettes made with high and low pressure biomass briquetting machines. The bulk density and water penetration characteristics of high pressure briquettes were found significant compared to low pressure briquettes. So use of low pressure biomass briquettes occupy more space in storage and also sensitive to water exposure. Shattering resistance and Calorific values of the briquettes were not significantly different in high and low pressure biomass briquettes. This indicates the use of low pressure biomass briquettes whose making cost is highly less can be suggested in rural areas as the calorific value and shattering resistance are not affected.

REFERENCES

Bhattacharya, S.C., Augustus Leon, M and Md. Mizanur Rahman. (2002), A study on improved biomass briquetting. Energy for Sustainable Development, 4(2): 11-19.

Lindley, J. A. and Vossoughi, M. (1989), Physical Properties of Biomass Briquets. Journal of American Society of Agricultural Engineers. 32(2): 32-38.

Madhava, M. and Prasad, B. V. S. (2011), Development and evaluation of hand Operated, Low Pressure Biomass Briquetting machine. National Seminar on Technological interventions for Evergreen Revolution, ISAE, A.P chapter. 175-182.

Srivastava, P.K., Maheswari, R.C and Ojha, T.P. (1995), Biomass Briquetting and Utilization. Jain Brothers, New Delhi. 314-319.

Wakchaure, G.C and Sharma, P. K. (2007), Physical Quality of Some Biomass Briquettes. Journal of Agricultural Engineering. 44(1): 111-118.