Analysis of Oil Contaminated Cotton Waste Briquettes

Dipti Ashok Ankalgi
Student, ME Chemical (Environment), PREC, Loni, India.

A. R. Warade
Guide, Chemical (Environment), PREC, Loni, India.

Abstract – Nashik is considered as a hub for automobile companies. Oil contaminated Cotton waste is generated at these industrial premises on a large scale. The only option of handling this waste presently is giving it for disposal. The disposal method used is incineration which is causing adverse impacts on environment. Hence an efficient way is briquetting of these wastes and using them as a fuel. The paper covers physical and combustion properties of briquettes.

Index Terms – Automobile, Oil Contaminated Cotton Waste, disposal, incineration, fuel.

1. INTRODUCTION

Nashik city has major 5 MIDC areas namely Satpur, Ambad, Gonde, Dindori and Sinnar. Satpur and Ambad are situated in the city whereas Gonde, Dindori and Sinnar are surrounded by the city. Major category of industries belong to automobile (engineering) category and hence Nasik has one of the biggest sectors for automotive industry, manufacturing 2 wheelers, 3 wheelers and 4 wheelers and heavy vehicles.

Mahindra and Mahindra Ltd, Mahindra Sona Ltd, Bosch India, Thyssen Krupp Automotive Engines Ltd, are major automotive industries flourishing in this city. Thus their presence has attracted large number of vendors and hence Nasik is being considered as a hub of automobile manufacturing industries. Thus there are many small, micro, medium and large industries manufacturing vehicles parts, assembly and other parts contributing a large share of the total industries in MIDC area.

As manufacturing of automobiles takes place, the process requires large amount of oil like cutting oils, lubricating oils, engine oil, motor oils, spent oils, quenching oils etc. Also there are service centers for maintenance of vehicles and its allied parts throughout the city. Cotton cloth is used in cleaning those oils from machines, spills etc thus leading to generation of oil contaminated cotton waste. With the increase in demand of cotton waste, the question of disposal of cotton waste is of big concern.

Also used cotton waste comes under Hazardous waste category as mentioned by CPCB. Thus management of cotton waste should be done properly as far as safety is concerned. Hence briquetting of cotton waste can help in solving this disposal issue.

2. MATERIALS AND METHODS

2.1 Materials used in this work:

Oil Contaminated Cotton Waste, binder, filler

2.2 Method for briquette formation:

The oil contaminated cotton waste was obtained from industries. It was roughly shredded using a waste shredder. The known amount of mixture was prepared using binder, shredded waste and fillers. The mixture was placed into the briquetting machine and briquettes of diameter 10 cm and height 8cm were produced. They were sun dried and its analysis was done.

3. ANALYSIS OF BRIQUETTES

1. Physical properties:

1.1 **Durability Index:**

Durability Index was determined using Vibration Test. Sample was placed on vibration machine for 10 minutes. Initial weight before placing and final weight after placing was noted.

Durability index is calculated by:-

DI= (final wt. / initial wt.)* 100

1.2. **Shatter indices**

The briquette was dropped ten times on a concrete floor from a height of 1m. Weight of briquetted before and after shattering was noted. The percent loss of material was calculated. The shatter indices of the briquette were calculated as below:

$$\text{Percent weight loss} = \frac{w_1 - w_2}{w_1} \times 100$$

% shatter resistance = 100- % weight loss

Where,

w_1 = weight of briquette before shattering, g

w_2 = weight of briquette after shattering, g

1.3 **Bulk Density:**

Bulk Density was carried out by using a cylindrical shaped container of 1000 ml. The container was weighed empty for its mass determination. Then it was filled with the briquette and was weighed again.

$$\text{Bulk Density} = \frac{Mass\ of\ \ briquette\ sample\ (kg)}{Volume\ of\ measuring\ cylinder\ (m3)}$$

2. **Moisture Content:**

Moisture Content is the amount of water in the briquettes. This determines the quality of briquette. Lower moisture content shows high calorific value. The weight of briquette after formation of the briquette and final weight of briquette after drying it for one day were recorded.

$$\text{Moisture Content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where,

W_1 = weight of crucible, g

W_2 = weight of crucible + sample, g

W_3 = weight of crucible + sample, after heating, g

3. **Gross Calorific Value of briquettes:**

Calorific value was found out using bomb calorimeter taking 200 gm of each briquette.

4. RESULTS AND DISCUSSIONS

1. Durability Index:

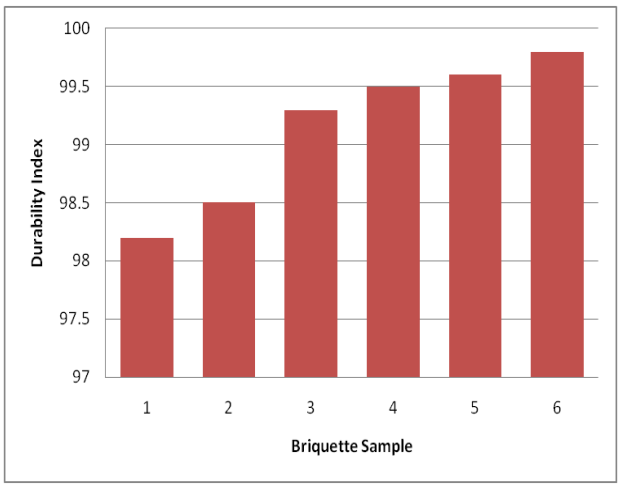

Figure 1 Durability Index

Index value above 90 is considered to be good for transportation and handling purposes. Thus all samples are fit for transportation and handling purposes.

2. Shatter Indices:

These indices show the shock and impact resistance properties of briquetted fuel.

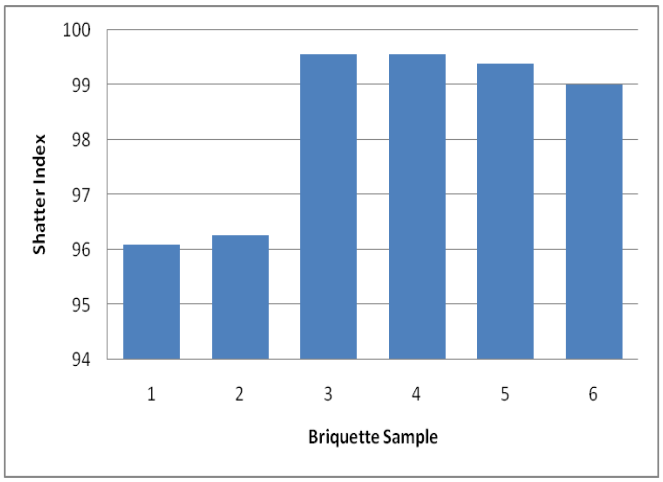

Figure 2 Shatter Indices

It shows that Sample 3 and Sample 4 have maximum shatter resistance with retention of 99.57 per cent. This is due to high binding properties of briquettes.

3. Bulk Density:

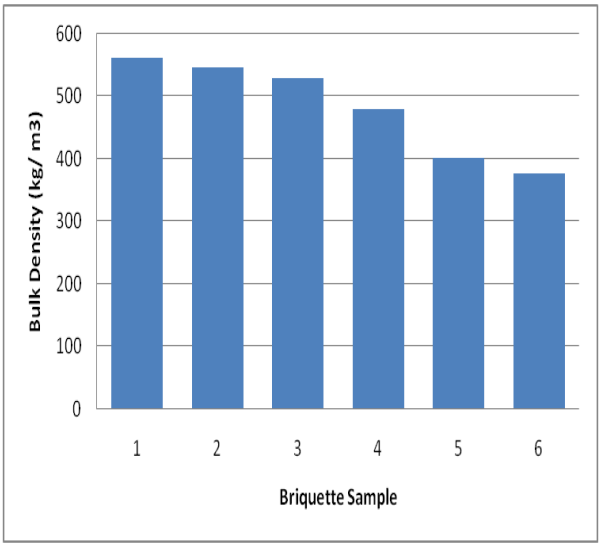

Figure No 3 Bulk Densities

From the above table, bulk density decreased as the percentage of cotton waste decreased.

4. Percentage Moisture Content (PMC):

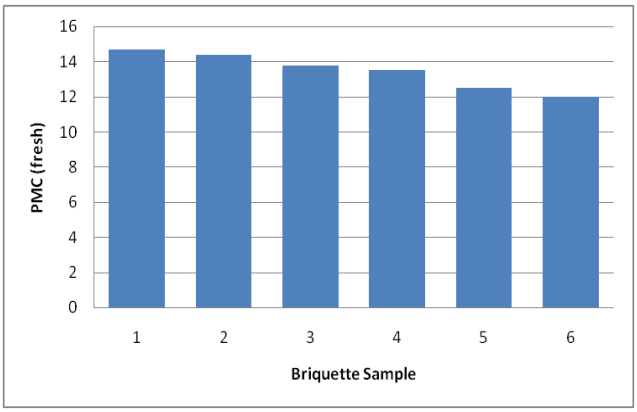

Figure 4 Percentage Moisture Content (fresh Briquettes)

Moisture Content was reported very high just after the formation of briquette. It decreased with the addition of fillers. Moisture content was observed between 11- 15 %. It affects the raw materials cost, storage, transportation and quality of the briquettes.

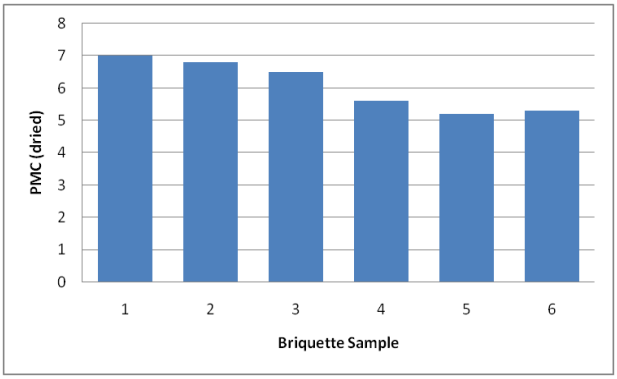

Figure 5Percentage Moisture Content (Dried Briquettes)

After sun drying for 3 days, moisture content was observed between 5 to 7 %.

5. Gross Calorific Value:

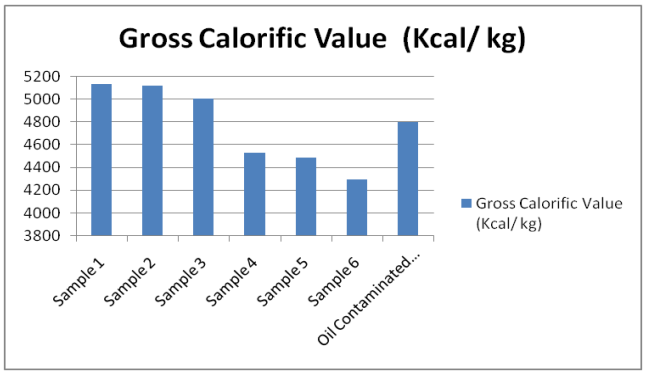

Figure 6 Gross Calorific Value

Calorific values of briquettes were high than that of cotton waste. As the percentage of cotton waste decreases, calorific value decreases. Sample 2 and 3 were best suited for burning as their calorific values were good. This value being higher than calorific value of coal, briquettes can be used in industries for heating purposes.

5. CONCLUSION

From the above results, it can be concluded that the briquetted produced from oil contaminated cotton waste are easy for transportation and handling purposes. Also they can withstand shock and are impact resistant. Initial moisture content was reported high but after sun drying adequate moisture content was present which was desirable. Calorific values of briquettes are reported higher than conventional bituminous coal, thus they can easily replace coal for industrial purposes.

Thus automobile industries throughout Nasik can adopt briquetting of cotton waste and help in minimizing hazardous impacts on environment which are generated due to disposal methods of the same.

REFERENCES

[1] Sriram N1, Sikdar D C2, Sunil H3, Mahesh KumarShetty4 Department of Chemical Engineering, "Study On Briquetting Of Cotton Waste" International Journal of Technical Research and Applications e-ISSN: 2320-8163.www.ijtra.com Volume2, Issue 6 (Nov-Dec 2014), PP. 102-106

[2] Tembe, E.T., Otache, P.O. and Ekhuemelo, D.O., "Density, Shatter index, and Combustion properties of briquettes produced from groundnut shells, rice husks and saw dust of Daniellia oliveri", Journal of Applied Biosciences 82:7372 – 7378, 2014.

[3] Siripol Suvunnapoba, Borvorn Israngkura Na Ayudhyab and Boonsri Kusuktham, "A Study of Cotton Dust Mixed with Wood Dust for Bio-Briquette", Engineering Journal Volume 19 Issue 4, 2015.

[4] Maninder, Rupinderjit Singh Kathuria, Sonia Grover, "Using Agricultural Residues as a Biomass Briquetting: An Alternative Source of Energy", IOSR Journal of Electrical and Electronics Engineering (IOSRJEEE) ISSN: 2278-1676 Volume 1, Issue 5 (July-Aug. 2012), PP 11-15

[5] Dipti Ankalgi & Yugandhara Gujar, "Briquettes Production Using Oil Contaminated Cotton Waste", Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-4, 2016 ISSN: 2454-1362

[6] Grover P.D. and Mishra S.K, "Biomass Briquetting Technology and Practice. Food and Agriculture Organization of the United Nations, Bangkok. Regional Wood Energy Development Program (RWEDP)" 1996

[7] David K Chirchir, Daudi M Nyaanga and Jason M Githeko, "Effect of Binder Types and Amount on Physical and combustion characteristics," International Journal of Engineering Science and Technology, Vol. 2, February 2013.

[8] B.M. Jenkins , L.L. Baxter , T.R. Miles Jr., T.R. Miles, "Combustion properties of biomass", B.M. Jenkins et al 54 (1998) 17–46