TESTING OF BRIQUETTE PRODUCTION FOR HOUSEHOLD USE BY INFORMAL WASTE WORKERS AT THE CALAJUNAN DUMPSITE IN ILOILO CITY, PHILIPPINES

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ABSTRACT. Three recommended mixtures for briquette production were tested by eight identified informal waste workers within a 10-day briquette production test at the Calajunan dumpsite in Iloilo City, Philippines. The test revealed that Briquette 1 utilized a total of 127.50 kg dry waste paper; Briquette 2 was produced out of 183.80 kg of paper and sawdust while Briquette 3 was formed using 152.00 kg of paper, carbonized rice husk and sawdust. Briquette 2 produced the highest dry briquettes at 175.50 kg per 4.27 hr/day briquetting time followed by Briquette 3 at 142.74 kg for 4.18 hr/day and Briquette 1 at 122.25 kg for 4.19 hr/day. When all briquettes produced per day would be sold by the local waste worker's association at a rate of Php15 (US$0.34) per kg, Briquette 2 would give the highest approximate daily earnings of Php263 (US$6). Heating value of the pillow-shaped briquettes produced ranged from 6,500 to 7,000 Btu/lb.

Keywords: Household briquettes; charcoal substitution; informal sector integration; waste to energy

Introduction

The proposed conversion of Iloilo City's dumpsite in Calajunan into a controlled sanitary landfill would mean that the usual activities of the informal waste workers such as recovery of resources through collection and separation of specific wastes would become impossible [1]. To augment this foreseeable predicament, alternative livelihoods have to be initiated for the waste workers. With the integration and registration of the informal waste pickers into Uswag Calajunan Livelihood Association, Incorporated (UCLA) in May 2009, they can now enter official contracts with project partners. Briquetting was identified as one of the alternative livelihoods for the informal waste workers. Five different types of briquettes utilizing a household briquette molder were initially tested to determine the most viable mixtures from biomass and urban wastes that would be assessed further for production by the informal waste workers of the dumpsite. To further verify the three recommended mixtures [2], briquette production for household use was tested by the informal waste workers at the Calajunan dumpsite in Iloilo City, Philippines. Specifically, it aimed to: (a) Conduct a

10-day actual production test to determine the technical requirements and output in producing briquettes; (b) Determine the quality of the briquettes produced; (c) Analyze the socio-economic implications of the production test as to the potential gross earnings when sold in the market by UCLA; and (d) Determine options on the improvement of operation in briquette production.

Material and Methods

Preparation of Materials

Waste papers, carbonized rice husk (CRH) and sawdust were prepared for this study. The papers used were shredded waste papers generated from Central Philippine University while others were wastes coming from the different offices and establishments in Iloilo City that were delivered at the dumpsite for disposal. The biomass wastes in the form of CRH and sawdust from nearby areas were also delivered to UCLA Center for testing.

Production of Briquettes

Production of briquettes was done for 10 days and was test wise conducted by 8 workers (2 males and 6 females) of UCLA. Two members were assigned each for mixtures that use pure paper (100%); paper (50%) + sawdust (50%); and paper (50%) + CRH (25%) + sawdust (25%) while the other two were responsible for supervising the operation. Production was done at UCLA's Center located just 100 m across Iloilo City's dumpsite. Operation started at 8 AM, in which the members would prepare and weigh all the necessary dry materials needed for the whole day testing. The papers were then pulped using a 1-Hp electric-motor pulping machine after which, these were mixed in plastic containers by hand. Smaller sizes of balled materials were placed in each of the molder of the machine for compaction by closing and pressing down the movable upper half portion of the molder. The briquettes produced were then taken out and placed on an improvised platform for sun-drying. Production would briefly stop at lunchtime and continue around 1 PM then ended between 4 to 5 PM. The dried briquettes were later on subjected for heating value test at the laboratory facility of Victorias Milling Company, Inc. at Victorias City, Negros Occidental.

Results and Discussion

Results in Table 1 show that more input materials were utilized during the 10 days test by Briquette 2 with 183.80 kg. It also numerically produced the highest total dry weight of fuel at 175.50 kg at an average briquetting time of 4.27 hr/day. Based on this rate, more income could be generated by Briquette 2 at Php263 (US$6) compared to that of Briquette 3 at Php213.75 (US$5) or that of Briquette 1 at Php184 (US$4). This would reveal differences in terms of the estimate of potential gross earnings done at initial production [2] because Briquettes 2 and 3 would only have Php233 (US$6) and Php188 (US$4), respectively – a value which is numerically less if compared with

production done on an actual scenario. For the 10-day production, the involved waste worker could only operate for about 6 hours. Four hours for briquetting while the remaining time was needed for material and equipment preparation and clean-up of the work area.

Table 1. Technical requirements and output in briquette production.

Parameters Measured	Briquette 1 (Paper)	Briquette 2 (Paper + Sawdust)	Briquette 3 (Paper + CRH + Sawdust)
Total weight of materials, kg	127.50	183.80	152.00
Ave. dry weight per briquette, g	16.55	16.62	18.38
Total dry weight of all briquettes, kg	122.25	175.50	142.74
Ave. briquetting time, hrs/day	4.19	4.27	4.18
Briquettes produced, pcs/hr	256	250	184
kg/day	12.23	17.56	14.25
Approx. earnings per day (@Php15/kg), Php	184.00	263.00	213.75

The three briquettes produced were pillow-shaped and had an approximate length and width of 5 cm and a height close to 4 cm. Bulk density [3] of the fuels was similar to those in previous studies [2], indicating that manual mixing and application of pressure to the molder during compaction are very comparable. A heating value (HV) of about 5,000 Btu/lb or greater is needed to sustain combustion [4]. Results of laboratory analysis revealed that the three fuels have numerically similar HV that ranged from 6,500 to 7,000 Btu/lb. This would imply a promising potential for the briquettes as substitute fuel since charcoal has an HV of 8,627 Btu/lb [5] whereas bituminous coal, a commonly used fuel in industries, has an HV ranging from 10,500 to 15,500 Btu/lb [6].

Table 2. Quality of briquettes produced.

Parameters Measured	Briquette 1 Paper	Briquette 2 Paper + Sawdust	Briquette 3 Paper + CRH + Sawdust
Briquette size, cm (≈)	4.86L x 5.10W x 4.17H	5.09L x 5.12W x 4.19H	4.96L x 5.22W x 4.20H
Bulk density, g/cc	0.20	0.14	0.17
Heating value, Btu/lb	6,500	6,683	7,061

Socio-Economic Implications of Briquette Production

The earnings (Php263/US$6) that two members of UCLA could potentially gain from the production of briquettes made of paper and sawdust can even be increased if all the provided eight units of briquette molders already available at the UCLA Center could be utilized for this purpose. In terms of

production rate, it would also imply that more briquettes can be produced since the members of UCLA are becoming inclined and familiar with the process of briquette production. The 227 kg waste paper recovered daily at the dumpsite so far [7] would double its value if fully utilized for briquette production by adding sawdust. This would result in an estimated daily earnings of Php6,000 (US$148) when marketed at Php15 (US$0.34) per kg. When sold as plain paper at a current rate of Php1.50 (US$0.03) per kg, UCLA would only earn Php338 (US$7) daily.

Options for Improvement of Production

The established UCLA Centre needs to enlarge its drying facilities in order to increase production, process efficiency and product quality, especially moisture content. To further enhance production of briquettes, the acquisition of equipment such as bigger pulping machine and mechanized mixer are also recommended.

Conclusions

It was concluded that Briquette 2 is the most viable mixture due to ease in preparation and maximization of material leading to high production rate and consequently higher daily earnings. The 227 kg waste paper partially recovered daily at the dumpsite can double its value if maximized as an add-on material to sawdust giving estimated daily earnings of Php6,000 (US$148). The briquettes have promising potential as fuels due to its high HV. It is recommended to subject the fuels to further chemical analysis such as determination of volatile compounds, fixed carbon content, and to clarify the elementary composition and quality of these alternative fuels.

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