Studies on Jack-Driven Briquetting Machine and Frequency Drive Controller

TECHNICAL AND ECONOMIC EVALUATION OF THE DESIGNED JACK-DRIVEN BRIQUETTING MACHINE

The machine can produce 200 to 239 pieces of briquettes per hour, however, this indicated a no significant difference (P>0.05) when it was evaluated using the three recommended mixtures. When production rate was analyzed in terms of weight of fuels produced per hour, statistically (P<0.01) more were produced by Briquette at 34.56 kg/hr followed by Briquettes 2 and 1 at 3.98 and 3.30 kg/hr, respectively.

The 15-day actual field production test performed by identified members of UCLA using the same mixtures exhibited an average production rate per day of 105 to 149 briquettes (1.68 to 1.92 kg/hr)). The analyzed data in pcs/hr confirmed the results of the laboratory testing where the number of briquettes produced had no significant difference among the different materials used.

The jack-driven type briquetting machine produced briquettes with a hole; the weight of each briquette ranged from 16 to 21 g. The briquettes produced had an average bulk density of 0.45 g/cc (446 kg/m^3) improving it by 246% when compared to using the previously developed hand-press briquette molder. The heating values of the produced briquettes ranged from 5,800 to 7,100 Btu/lb. The paper and sawdust combination obtained the highest value (7,153 Btu/lb) while briquettes mixed with CRH had the lowest value at 5,872 Btu/lb.

Results of the proximate analysis in terms of ash yield revealed that briquettes mixed with rice husk (in carbonized from) contained higher ash yield at 31% and, thus, have much ash-forming elements than most of forestry biomass like sawdust. The use of a hydraulic jack in compressing briquettes and the presence of many holes on the side of the molders resulted in briquettes with lower moisture at 5.6 to 7.1%.

Results of ultimate analysis in terms of H content in the three briquettes produced ranged from 4.8 to 5.9% with Briquette 2 having the highest. All three types of briquettes produced N of less than 0.1% of its dry matter weight. The value obtained for S ranged from 0.028 to 0.036% of the dry matter weight.

Briquettes 1 and 2 boiled 2 li of water significantly the fastest (P<0.01) at 12.5 min followed by Briquette 3 and Charcoal at 16 min and 19 min, respectively. In cooking 750 g of rice, Briquette 1 exhibited significantly (P<0.01) the fastest cooking time at 19 min followed by Briquettes 2 and 3 at 23 min and Charcoal at 25 min.

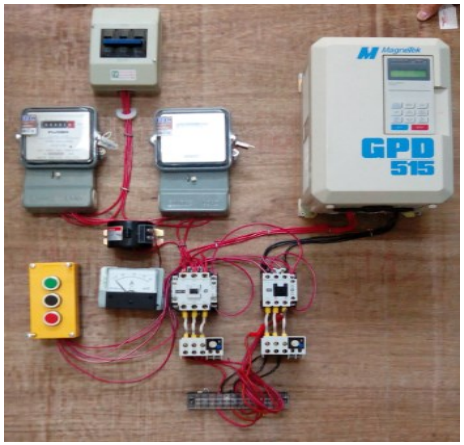
The development and fabrication of the jack-driven briquetting machine and the production of briquettes have high positive response (93.1%) as to its usefulness as substitute fuel for cooking when it was surveyed for product acceptance by the waste reclaimers found at the *Calajunan* Disposal Facility. The results of the survey also indicated that 81% of the respondents are willing to buy them as cooking fuel in their respective households.

Briquette 1 generated the highest operating cost per hour at Php25.46 due to the additional expense on longer pulping operations for paper. Briquettes 2 and 3 incurred the same expense at Php23.91 per hour of operation. More earnings may be earned per day from Briquettes 3 at Php355.92 followed by Briquettes 2 at Php286.32 and Briquette 1 at Php192.32

(Source: Technical and Economic Evaluation of the Designed Jack-Driven Briquetting Machine by Aries Roda D. Romallosa - completed August 2014)

LEVEL OF HARMONICS PRODUCED BY THE VARIABLE FREQUENCY DRIVE CONTROLLER

The determination of the level of harmonics produced by the variable frequency drive (VFD) controller used to control the induction-type water pump motor at the water pumping station of Central Philippine University (CPU) was focused specifically on the electrical noise or harmonic level generated by the controller in terms of its amplitude and frequency. The level of harmonic content was acceptable based on the IEEE Std 519-1992 of no more than 5% with the use of the controller and its effects on electronics and electrical systems connected in the same pick off point. It was also determined whether the system would significantly improve motor performance. Lastly, it was determined whether the system would significantly reduce energy consumption. Based on the results of the tests, the harmonics of the supply voltage at no load was 2.25%. During the system operation where a five (5) Hp induction



type motor load was controlled direct-on-line (DOL), the harmonics generated was about 2.10%.

However, by using the controller, it was found out that there was an increase in the amplitude and the number of harmonics present in the system. The harmonics produced at the source terminal with controller was about 3.93 %, showing an increase of 1.83% compared to without the use of the controller. However, the increase is minimal because 3.93 % is within the acceptable limits of 5% for electronics circuits and systems. However, this is not acceptable for medical and other related highly sensitive instruments, which require a THD of not more than 3%. In contrast to this, the harmonics generated at the load terminal was about 8.42%, which was higher compared to the THD at the input terminal and was very much higher than the required allowable level. The controller produced a significant level of harmonics that could cause interference to nearby electronic appliances that are sensitive to electrical noise. Nevertheless, this noise or harmonic generated was not significantly induced at the source terminal. Furthermore, there was no reduction on the energy consumption with the use of the controller over the DOL control mode. In contrast, the use of the controller gave the following benefits: it eliminated the very high current surges and sudden high starting torque during the motor start up; balanced the motor supply between phases; and, caused an increase in the revolution-per-minute (rpm) of the motor thereby improving the performance of the motor. The same controller could be put to good use with some of the other pump motors around the campus.

(Source: Level of Harmonics Produced by the Variable Frequency Drive Controller Used in the Induction Type Water Pump Motor of Central Philippine University by Vitini Edhard O. Idemne, Ramon A. Alguidano Jr., Alberto A. Java, Ruben M. Armadillo, Gelvie C. Lagos, Babylou G. Nava, Yeisel S. Sacramento and Caesar Rico S. Acanto - completed November 2014)

University Research Center
Central Philippine University
5000 Jaro, Iloilo City
Philippines
http://www.cpu.edu.ph
E-Mail: urc@cpu.edu.ph

UNIVERSITY RESEARCH CENTER

Salient findings

This information series features major research findings of CPU faculty and staff researchers

Info. Series No. 12-04

Central Philippine University
5000 Jaro, Iloilo City
Philippines