Accepted Manuscript

Energy efficiency and emission assessment of a continuous rice husk stove for rice parboiling

E.M. Kwofie, M. Ngadi, S. Sotocinal

PII: S0360-5442(16)31909-0

DOI: 10.1016/j.energy.2016.12.104

Reference: EGY 10106

To appear in: *Energy*

Received Date: 20 September 2015

Revised Date: 22 December 2016

Accepted Date: 25 December 2016

Please cite this article as: Kwofie EM, Ngadi M, Sotocinal S, Energy efficiency and emission assessment of a continuous rice husk stove for rice parboiling, *Energy* (2017), doi: 10.1016/j.energy.2016.12.104.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



ACCEPTED MANUSCRIPT

1	Energy efficiency and emission assessment of a continuous rice husk stove for rice
2	parboiling
3	Kwofie E. M^{l} ., Ngadi M^{*l} ., Sotocinal S^{2} .
4	¹ Department of Bioresource Engineering, McGill University, 21.111 Lakeshore Road, Ste-Anne-de-Bellevue, QC,
5	Canada
6	² SAS Technologies, 3 Ste Joseph, Ste-Anne-de-Bellevue, QC, Canada
7	*Corresponding Author – Email: <u>michael.ngadi@mcgill.ca</u> ,
8	Phone: +1-514-398-7779; Fax: +1 514-398-8387
9	Abstract

The study presents a performance evaluation of an integrated rice parboiling stove (IRPS) fuelled with 10 11 either rice husk or wood in comparison with the three stone fire (TSF) stove currently being used. The stoves were initially tested using the water boiling test. The efficiency, fire power and specific fuel 12 consumption of IRPS were found to be 29%, 16kW and 0.14kg/kg rice husk, respectively. To enhance 13 continuous steam production, a heat exchanger extension was made to the IRPS and the efficiency re-14 evaluated using the indirect boiler efficiency estimation approach, together with pollutants emission 15 factors and safety. The stove efficiency after the extension increased to 46%. The emission factors for 16 CO, CO₂ and C_xH_y were in ranges from 10.6-12.0, 785-793, 0.4-2.2 g/kg of rice husk, respectively. 17 Comparison between rice husk and wood combustion in IRPS shows that emission factors for rice husk 18 19 were significantly lower than wood but decrease with stove fire power.

20 **1 Introduction**

21 Rice has become an important crop and the most rapidly growing food for population in Sub-Saharan Africa [1]. This is evident in the rise in per capital consumption which has increased by more than 50% in 22 the last two decades [2]. In 2012, more than $62\%^{1}$ [3] of rice within the region was locally produced. To 23 enhance the physical and nutritional quality of local rice, a pre-milling technology known as parboiling is 24 25 adopted [4-6]. This three-stage starch gelatinization process rectifies the problem of cracks and 26 incomplete grain filling and lead to many favourable changes including easy shelling, higher head rice 27 yield, fewer broken rice, increase resistance to insect and nutrient retention [7], reduced disintegration and 28 solubilisation of kernels on cooking [8], hence, improving consumer preference for local parboiled rice. 29 The process as practiced in the sub-region is arduous and energy intensive with thermal energy provided 30 through combustion of fuelwood in an inefficient three-stone fire (TSF) stove.

¹ Estimated from FAOSTAT

Download English Version:

https://daneshyari.com/en/article/5476261

Download Persian Version:

https://daneshyari.com/article/5476261

Daneshyari.com