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Clean Cook Stove Technology for Artisanal Palm Oil Clarification and Biochar Production in Ghana

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Abstract

The method of heat provision for artisanal palm oil production is riddled with inefficient systems which create unfavourable working conditions (use of spent tyres, smoke filled work tents etc.) for the women who engage in this process. This creates health hazards for the women and sometimes the children they carry along to work. This study therefore seeked to produce a cook stove that provide a healthy work environment, is efficient, easy to use, and affordable for medium scale clarification of palm oil. Further it should have a sustainable source of fuel (biomass from processing the palm fruits) and simultaneously produce heat and biochar. Since the adopted design procedure was iterative, eight preliminary tests were conducted; each an improvement of the previous stove tested. After obtaining the best stove configuration, design calculations were done and the final stove fabricated and tested. The final stove consisted of a cut out barrel, a chimney, a grate, insulation for the stove and other additions to make handling easier. At the end of the stove evaluation tests, which were done by the water boiling tests and controlled cooking tests, the thermal efficiency of the stove was found to be 32.59 ± 7.11 % representing a 400 % increase in efficiency when compared with the local replica stove. The cook stove can process approximately 103 litres of press liquor into 23 litres of palm oil within 55 minutes for one cycle of clarification while running on 10 kg of fuel mix and has biochar yield of 5 %. Also the stove provides a healthy work environment with a maximum CO emission of 5 ppm. Overall, the study showed that palm oil clarification with the designed cook stove can be done in an affordable, self-sustaining and smokeless work environment whiles recovering some biochar at the end of the process.

Keywords: Biochar, biomass, CO emission, cook stove, Palm fruit fibre, Palm kernel shell

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