Tropentag, September 17-19, 2013, Stuttgart-Hohenheim

"Agricultural development within the rural-urban continuum"

Performance Analysis of De-Shelling Process for *Jatropha curcas* L. Seeds

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Abstract

De-shelling practices for *Jatropha curcas* L. seeds has become an essential process in the integrated production of biofuel and enriched protein byproduct. *J.curcas* seed de-shelling was reported as suboptimal since no specific machine was designed for the purpose but existing machines were adapted for the process. The objective of the study is to investigate the optimum conditions of the de-shelling process of *J. curcas* seeds via a disc spinning prototype. *J. curcas* seeds imported from Cape Verde, Africa with moisture content about 7 % (w.b.) were used. The seeds material was classified into four fractions according to their size using four different sieves (12, 11, 10, and 8 mm). In this study, a de-shelling prototype machine developed at Universität Hohenheim with constant motor speed of 750 rpm was used for performing de-shelling of *J. curcas* seeds. The prototype machine consists of two rotating parallel discs; the gap between the discs was varied from 5 to 10 mm. The de-shelling output was classified into different groups using a pneumatic conveyor which determines the terminal velocity of each group; (i) complete seeds, (ii) broken seeds, (iii) complete kernels, (iv) broken kernels and (v) shells. The efficiency was recorded between 38 and 51 %, and breakage capacity was obtained from 81 to 92 %. Terminal velocity to classify *J.curcas* material into groups broken seeds, complete kernels, broken kernels, and shells was obtained at 9.1 – 10.6 $m\,s^{-1}$; 6.8 – 10.7 $m\,s^{-1}$; 6.1 – 7.9 $m\,s^{-1}$; 3.5 – 3.9 $m\,s^{-1}$, respectively. The highest de-shelling efficiency was achieved at fraction III, gap opening 7 mm (51 %), and breakage capacity at fraction I, 6 mm (92 %). The experiments allow some optimisations which are used to investigate the optimum operating condition in the system.

Keywords: Breakage capacity, de-shelling efficiency, jatropha seeds, terminal velocity

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