

## Development and testing of a *Jatropha* fruit shelling process for shell-free kernel recovery in biodiesel production

### ABSTRACT

Achieving shell-free kernel recovery from *Jatropha* fruits is important to improve oil yield and oil quality during oil extraction in biodiesel production. A shelling process with two stages of cracking and separation to remove the shells completely and husks partially was designed. Both stages used double-level cracking rollers and a blower with ducting as a separation unit. For the first, the performance was evaluated using five different roller clearances (9.5 mm, 10.0 mm, 10.5 mm, 11.0 mm and 11.5 mm) with a combination of five blower air speeds ( $8.5 \pm 0.5 \text{ m s}^{-1}$ ,  $9.0 \pm 0.6 \text{ m s}^{-1}$ ,  $9.5 \pm 0.5 \text{ m s}^{-1}$ ,  $10.0 \pm 0.4 \text{ m s}^{-1}$  and  $10.5 \pm 0.5 \text{ m s}^{-1}$ ). A roller clearance of 10.5 mm and air speed of  $10.0 \pm 0.4 \text{ m s}^{-1}$  were selected as the optimal conditions with the highest separation efficiency between kernels and shells at 94.59%. The shells and husks achieved 95.88% and 12.20% removal respectively while kernel recovery achieved 98.65%. For the second stage, the performance was evaluated using five different roller clearances (5.0 mm, 5.5 mm, 6.0 mm, 6.5 mm and 7.0 mm) with a combination of five blower air speeds ( $6.5 \pm 0.4 \text{ m s}^{-1}$ ,  $7.0 \pm 0.2 \text{ m s}^{-1}$ ,  $7.5 \pm 0.4 \text{ m s}^{-1}$ ,  $8.0 \pm 0.2 \text{ m s}^{-1}$  and  $8.5 \pm 0.5 \text{ m s}^{-1}$ ). At the optimal conditions, with a roller clearance of 6.0 mm and air speed of  $7.5 \pm 0.4 \text{ m s}^{-1}$ , the maximum separation efficiency was 97.69%. Total shell and husk removal achieved for the stages were 100.00% and 45.46% respectively. A total of 2.40% kernels were lost.

**Keyword:** Shell-free kernel recovery; *Jatropha* fruits; Biodiesel production