

Comparison of Vibration Power Applied into a Modified Bark Peeling Tools for the Reduction Force Required for Cinnamon Processing (*Cinnamomum zeylanicum*)

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Abstract

At present, cinnamon (*Cinnamomum zeylanicum*) is the main processed spice export from Sri Lanka. However, the industry is facing a challenge to meet its skilled labour demand due to its special nature of processing steps. Bark peeling is the removing step of cinnamon bark after scraping and rubbing steps in which the force required is second only to the rubbing step. The existing peeling tools are inefficient and that demands strenuous arm power. Therefore, this study assess the possibility of reducing required force for cinnamon peeling by using vibration assisted peeling tools when they were applied different levels of vibration. Three eccentric rotating mass motors (RF-555, R260 and MABUCHI RF-M50WA) that were different in their power ratings as 2.4W, 1.125W and 0.5W were used in the experiment. A traditional peeling knife was modified to fix to the above motors as one motor at a time to evaluate the operating performances. A voltage regulator was used to obtain the best operating power for each motor type. Cinnamon sticks (diameter 3.5cm and length 10cm) were peeled out for 5mm width strip at all peeling operations. The peeling force was recorded as 10 data points per second in real-time by using Sundoo SH-500 force gauge. The stroke speed of the peeling knife was - 40cm/min. As a control, similarly sticks were tested without vibration effects. Data were analysed through one way ANOVA to select the better force reduction ratings. Results revealed that there was a significant reduction of force when using all three motor types compared to the control. Moreover, the force reductions were directly proportional to the applied vibration strengths in the studied range. The motor with the highest power ratings 2.4W (RF555- ERM), offered the highest force reduction (78.6%) to the control while the other two motor types with lower power ratings (1.125W) and (0.5W) recorded respective lower performance (69.8 % and 36.1%), force reduction to the control. Therefore, it is recommended to test the performance with further elevated operation power (greater than 2.4W) for further force reductions. All three motor types recorded their best operating performance when the applied voltage level reached to 70% to 80% to their maximum allowable voltage ratings. The results have shown that the potential possibility of using eccentric rotating mass vibration motors in vibration assisted tools for the reduction of force required for bark peeling forces of cinnamon sticks.

Keywords: Bark peeling force, Cinnamon (*Cinnamomum zeylanicum*), Eccentric rotating mass vibration motors (ERM), Frequency-acceleration, Mechanical vibration assisted tools

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