DEVELOPMENT OF A CHOCOLATE ENROBING MACHINE FOR COOKIES

by

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ABSTRACT OF THESIS

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ABSTRACT

Chocolate coating is usually applied using a chocolate enrobing machine. This is a machine in which the products to be coated pass through a continuous curtain of chocolate. Due to immense demand of cocoa value added products, several Self Help Groups (SHGs)/ home made units have started several enterprises in cocoa processing. However, a small capacity enrobing machines suitable for small and medium scale entrepreneurs are not available. Hence, an attempt has been made to develop economically feasible chocolate enrobing machine for cookies that will be suitable for small and medium scale entrepreneurs and beneficial to SHGs. Physico-chemical and engineering properties of cookies and compound milk chocolate were determined prior to the development of machine. The machine was designed and fabricated by considering critical parameters related to both cookies and chocolate. The developed chocolate enrobing machine consists of chocolate tank with agitator, water tank with heater, conveyor belt, chocolate flow pan, air flow duct connected with ring blower, vibrator, collecting tank and control panel. To optimize the process parameters for the enrobing process, Box-Behnken design was selected for the experimental design with 3 levels of independent variables viz. flow rate of chocolate (3, 4.5 and 6 kg/min), belt speed (2.1, 2.3 and 2.5 m/min) and flow rate of hot air (3.3, 3.6 and 3.9 L/s). The optimization of process parameters was done based on the responses viz. capacity, enrobing efficiency, energy requirement and coating thickness. The optimal conditions for the chocolate enrobing process were chocolate flow rate of 4.5 kg/min, belt speed of 2.5 m/min and hot air flow rate of 3.3 L/s. Performance evaluation of machine was done under optimized condition in terms of capacity, enrobing efficiency and energy consumption. The machine achieved a capacity of 190 cookies/hour, enrobing efficiency of 94.74%, energy consumption of 5.48 kWh and coating thickness of 2.79 mm. The quality attributes of optimized chocolate enrobed cookies were evaluated in terms of thickness, diameter, water activity and proximate analysis. The energy value of chocolate enrobed cookies was higher than that of base cookies. Sensory evaluation revealed that the optimized enrobed cookies was superior in terms of colour, appearance and overall acceptability among the other samples. The benefit-cost ratio and payback period were calculated as 1.05:1 and 3.15 years, respectively. It is concluded that the developed chocolate enrobing machine marks a significant step towards supporting small and marginal cocoa growers and entrepreneurs. It not only boosts the economic potential of cocoa growers, but also encourages new entrepreneurial ventures in rural as well as semi urban areas.