Pilot Scale Vacuum Fryer for Fruits and Vegetables

Final Report

By

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Submitted to
The Prince of Songkla University
upon completion of the research project

November 2004

Department of Chemical Engineering
Faculty of Engineering
FINAL REPORT

Project Title:
Pilot Scale Vacuum Fryer for Fruits and Vegetables

Project Leader:
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Overall Budget: 199,919 Baht

Duration of Research: 1 Year
From September, 2003 through August, 2004

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EXECUTIVE SUMMARY

A 400 L vacuum fryer was designed and constructed to investigate the production of vacuum fried snacks on a pilot scale. The stainless steel fryer is 60 cm x 60 cm x 100 cm. The frying basket is separated into 3 trays, 50 cm x 50 cm x 10 cm each. Each tray can hold up to 5 kg of raw products depending on their characteristics. Ripe bananas were used as the main testing product and its optimal capacity was 7-8 kg of peeled bananas per batch or about 2.5 kg per tray. The bananas were cut into 2 mm thick coins and fried for 1 hour at 90°C and 60 mm Hg. In this study, approximately 200 L of palm oil was used as the frying oil because of its lower price (vegetable oil is recommended for industrial applications).

After frying, the products were centrifuged at 350 rpm for about 5 minutes. From 8 kg of raw bananas, about 2.5 kg of products were obtained. Compare to the lab scale unit, the pilot scale unit can produce as much as 10 times as much per batch, while the colors and flavors have been found to be comparable. To test the acceptability of the products in the market, the fried bananas were placed into 50 g plastic bags and sealed using a table top plastic sealer. With the 50 g bags selling for 10 baht each, about 40-60 bags of snacks can be sold in one afternoon at the PSU (Prince of Songkla University) fresh market.

After 30 batches of frying, the FFA (free fatty acid) value increased from 0.12% (as palmitic acid) to 0.51%, the PV (peroxide value) increased from 1.18 (milliequivalent, peroxide/kilogram sample) to 9.10, and the TBA (thiobarbaturic acid) value increase from 0.36 (mg malonaldehyde/kg sample) to 1.07. Even though the FFA value was much lower than the standard for oil quality (1.0%), but since the suggest PV value is less than 10.0, several more batches of frying may be possible before discarding the oil. Moreover, the used oil also developed a darker coloration which yielded darker color products compared to the fresh oil.

Finally, even though the total cost of the pilot scale unit is about 300,000 baht, it is estimated that the Rate of Return will be less than 6 months. Food companies, SME’s, and community enterprises with sufficient funding and good business planning can certainly make reasonable profit using the vacuum fryer.
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ACKNOWLEDGEMENTS

The researcher would like to acknowledge the Prince of Songkla University for funding this research project. Without its generosity, this project would not have been possible. Furthermore, the researcher would like to thank the Department of Chemical Engineering and the Faculty of Engineering for providing the space, supporting materials and equipment necessary for the completion of this project.

In addition, I would like to thank my two Senior Project students, Mr. Pathomwong and Ms. Salika, for their contributions in putting together the design of the pilot-scale vacuum fryer. A special thanks also goes to Mr. Sohn, Mr. Somkid, and Mr. Wathin, the departmental technicians and electricians for helping to put together entire unit and making sure that they work properly. Finally, last but not least, I would like to thank my former Senior project student and research assistant, Mr. Nuttaporn, for his most tireless work in finalizing the construction and installation of the pilot-scale vacuum fryer, testing the equipment, and performing much of the experimentations needed in evaluating the performance of the unit.

A multitude of appreciations also go to the undergraduate and graduate students in the Department of Chemical Engineering who contributed valuable time in preparing samples for experimentations, not to mention assisted in the packaging of the products for market trials. They include Yada, June, F, Dao, Dao (PhD), and many others. If I have left out any names, please accept my apologies and may kindness and generosities be rewarded in your future endeavors.