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Physical, Sensorial and Chemical Characteristics of Simulated Chips of Cassava (*Manihot esculenta* Crantz): Rice (*Oryza sativa* L.) mix.

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Abstract

Cassava-rice ratio and cooking time-temperature combinations in baked and fried simulated chips making enriched with carrot, celery, curry leaves and skim milk were studied using completely randomized design. Research found that interaction between mix formula and cooking methods was significantly affected ($p<0.05$) the physical, sensorial and chemical characteristic of the simulated chips. The best baked simulated cassava-rice simulated chips was resulted from 80:20 ratio, baked at 140 ºC for 14 minutes, and the fried cassava-rice simulated chips with 60:40 ratio fried at 150 ºC for 2.5 minutes. The fried chips have finer microstructure and more preferable than the baked one. However, both best chips were potential to be further developed.

Keywords: cassava-rice simulated chips, physical, sensorial, chemical characteristics, microstructure

INTRODUCTION

Major constraints in developing indigenous agricultural products processing industries were perishable, high energy costs, water inefficiency and variability of raw materials quality due to the variety, strains, seasons, and bad agricultural practices. Cassava as one of the main agricultural product of Indonesia [4, 14, 15, 16] is not an exceptional. Various kinds of cassava processing and products are available in Indonesia despite its poor nutritional value. Currently, cassava has commercially been processed into either fried sliced tuber or other kind of chips prepared from cassava flour with some addition of flavorings [4, 5, 10]. In either case the poor nutritive value of cassava chips remain unimproved. Cassava simulated chips from cassava flour demanded energy spendthrift. High energy cost of cassava flour making was recently major concern in food industry development. Therefore, demand of energy thrift cassava processing development is increasing.

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Simulated-chips technology offers breakthrough to overcome limitations of individual raw materials quality, e.g. nutritional, physical and sensorial properties, through its complementary principles. Other advantages of simulated chips-making were the quality improvements of the amalgamated products, competitive advantage and higher probabilities of value additions. Simulated chips technology also gave more comparative advantages than traditional ones because it offers more flexible ways of improving process efficiency, controlling variability of quality of raw materials and, easier process to enrich products quality with various functional compounds.

Concerns pertain to the conventional chips making were generally due to the complexity of processing steps. This includes mixing of dry raw materials flours, dough making, sheeting and molding, cooking, drying and frying [4, 10, 15] that not only demanded a lot of energy but also time consuming. Research in optimization of processing conditions of cassava base chips making were, so far, very limited despites it advantages. This research was advancement of previous research [4] wherein steamed cassava was directly ground and made into composite dough with rice flour. The previous research on cassava base simulated chips making were done using conventional processing method. Previous research was carried out using dry raw materials base, i.e. tapioca and soybean flours and, flavoring agents were added to the final fried products. Applications of conventional method of cassava base simulated chip making were concerned by community due to various reasons. Some small-medium industries were recently concerned about price hike of tapioca recently as consequence to tight industrial competition in tapioca utilizations and high energy cost of tapioca extraction. Some others concerned not only about their dependency on large industry but also due to the manufacturing practices that consumed huge amount of clean water and energy intensive during tapioca extraction, and its waste emission that were not environmentally friendly. The small and medium industries demanded breakthrough of concepts and products that give them more flexible raw materials supply, effective and efficient technologies both from cost of energy and time of production point of view.

Underlying concepts of process engineering used in this research was paradigm shift of product design from food processing emphasis to product and processing in human body [3]. People are nowadays more aware to healthy diets and demanded healthier snacks containing herb and antioxidants. Enrichment of snacks with powders of drum dried carrot, celery and curry leaves in this research was aimed at enhancing nutritional as well as functional properties of simulated chips. Moreover, addition of skim milk powder was specifically aimed to enhance protein quality of the simulated chips. Steaming of cassava tubers directly after cleaning, peeling, washing and quarterly cut and the dough making prior to sheeting stage were intentionally directed to simplify the processing steps prior to final cooking. It was also aimed to reduce energy cost of production in the future small-medium industrial scale applications.

The critical issues in the preliminary research therefore were how to find optimum steaming conditions of cassava tuber and dough prior to the final cooking treatments of simulated chips baking or frying. While the main research issues were to find the optimum formula and combinations of time and temperature of the final cooking of the simulated chips. The preliminary research indicated that the pre-steaming conditions dictated the process control. Easiness of dough handling, especially in obtaining the targeted chips thickness of 1 mm prior to molding, was a major prerequisite of further industrial applications.

The objectives of this research were to obtain best formula, i.e. ratio of cassava: rice mix, i.e. 60:40, 70:30 and 80:20 and, best combination of time and temperature of final cooking conditions to produce baked and deep-fat fried cassava base simulated chip. Benefits from this research were applicable data base, process and product technology concept for small and medium scale up of simulated chip industries in the future.