

NUTRI-MEAL-CONVENIENT PREMIX COMPOSITE DRINKS FROM PURPLE SWEET POTATO USING DRUM DRYING TECHNIQUE

Wan Nur Zahidah Wan Zainon
Food Science and Technology Research Centre, MARDI Headquarters,
Persiaran MARDI-UPM, 43400 Serdang, Selangor
Email: zahidah@mardi.gov.my

Madzlan Kasran
Food Science and Technology Research Centre, MARDI Headquarters

Faridah Hussin
Technology and Business Commercialization Centre, MARDI Headquarters

Noor Zainah Adzaly
Food Science and Technology Research Centre, MARDI Headquarters

Syahida Maarof
Food Science and Technology Research Centre, MARDI Headquarters

Mohd Effendi Mohamed Nor
Paddy & Rice Research Centre, MARDI Headquarters

ABSTRACT

NUTRI-MEAL is a premix composite drink developed according to the recommended daily calorie intake by RNI Malaysia. The development of this product has gone through the process of screening raw materials and optimizing the formulation to obtain a balanced nutrient content in the final product. The composite drink powder was prepared by using a purple sweet potato puree as a main ingredient. The sweet potato puree was processed into a slurry and drum-dried at 200 rpm with steam pressure. The powder was then mixed with other ingredients and packed in Aluminium/PE packaging. NUTRI MEAL product is able to supply 410 kcal of energy, 14.5g / 100g of protein, 11 / 100g of dietary fiber, as well as other micronutrients needed to supply complete nutrition for the health of adult men/women. This product is also high in antioxidant activity (based on DPPH analysis). The shelf life of this product is 12 months of storage at room temperature. This product is very convenient and easy to brew using cold or hot water. No addition of artificial colourants, artificial flavour and preservatives added. The production of this product is based on local sources which can increase the value of local tubers and fruits and reduce the cost of production and selling prices in the market.

Keywords: premix drink, composite drink, sweet potato, convenient food, drum drying

INTRODUCTION

Nowadays, rapid development has transformed the trend of food intake among consumers to eat food that is fast and easy to prepare. Today's consumers are also increasingly aware of the importance of complete nutrition for the body including vitamins, minerals, proteins, and fibre. This scenario has increased the global market demand for drinks in powder form which is fast to prepare and rich in nutritional composition. To diversify and further enhance the value of using local agricultural resources in Malaysia, a composite powder drink from a mixture of local agricultural resources such as purple sweet potatoes, mango, bananas and legumes was developed. This composite drink can be a substitute for daily diets and is ideal for vegetarian consumers where the source of this drink is from plant sources. The drink which is formulated in powder form is expected to extend the shelf life of the product as well as facilitate the process of storage and distribution of products. The use of a rich source of local resources with a variety of nutrients in composite powder can optimize the content of substances in drinks.

Drying is an ancient technique, used to preserve food by removing moisture content and water activity. Many drying techniques have been invented such as spray drying, freeze drying, and tray drying to increase productivity and product quality. Among the drying techniques, drum drying is usually applied to produce the fruit juice powder. Drum drying is commonly used in the production of low-moisture baby foods and fruit powders (Caparino et al. 2012). A drum dryer consists of two hollow cylinder drums rotating in opposite directions. The drums are heated with saturated high temperature (120–170 °C) steam inside the drums. Raw materials are spread in thin layers on the outer drum surface and dry rapidly. The product is scraped from the drum in the form of dried flakes (Caparino et al. 2012). A major likely drawback is undesirable cooked aromas and other severe quality losses in the final products caused by the high temperature used in the drying process (Nindo and Tang, 2007).

MATERIALS AND METHODS

Preparation of Materials

The purple sweet potato was prepared by washing the samples using chlorinated water, blanching, manual trimming, removal of any black portions of the peel and separation of stone/peel. The blanched and cleaned local sources went through a

pulping machine/chopping machine and grounded into slurry/puree. Then the samples were packed in aluminium polyethylene (AL/PE) bags, sealed and blast-frozen at -35°C. Then they were stored at -18°C until it was ready for drying.

Drum Drying Process

The drum dryer was set to rotate at 200 rpm with a steam pressure of 2 bar and a 0.1 mm drum gap. The drum temperature was allowed to stabilise before feeding the puree. This prepared puree was poured evenly over the hot pool area between the two drums. For each batch, 400 g of slurry was dried until a powder was produced and was scraped by the blades on each drum, which took approximately 5–10 min. The powder was grounded and sieved. The powder was immediately collected and combined with other ingredients to make a composite drink, packed in an aluminium polyethylene (AL/PE) sachet and kept at room temperature until analysis.

Convenience pre-mixed beverage processing

Anggun sweet potato that has become powder is weighed and mixed with other ingredients such as banana powder, soybean powder, mango powder, full cream milk powder and dextrose using a tumbler mixer. The pre-mixed beverage powder is packed in aluminium polyethylene (AL/PE) packaging and stored at room temperature. The shelf life of this product is for 12 months of storage where humidity <5% and water activity <0.6 (stable from microbial growth).

Quality assessment

The nutritional composition of the NUTRI-MEAL sample was determined according to the methods of the Association of Official Agricultural Chemists (AOAC). For antioxidant capacity, total phenolic content (TPC), radical scavenging 2,2-diphenyl-1-picrylhydrazyl (DPPH), and Ferric Ion Reducing Antioxidant Power (FRAP) assay were determined according to the method of Lim et al. (2006).

For microbiology analysis, total plate count, *Yeast & Mould*, *Coliform/E.coli* and *Staph. aureus* bacteria were analysed. For total plate count (TPC) analysis, the pour plate method was performed using the following media and culture conditions: plate count agar (PCA) (Oxoid, UK) incubated at 35 °C for 48 ± 2 h. For yeast and mould counts and *Staphylococcus aureus* analysis, the spread plate method was performed using the following media and culture conditions: potato dextrose agar (PDA) (Oxoid, UK) with the addition of 10% tartaric acid incubated at 32 °C for 48 ± 2 h and baird parker agar (BPA) (Oxoid, UK) with the addition of egg yolk tellurite emulsion incubated at 37 °C for 48 ± 2 h, respectively. For Coliforms and *Escherichia coli*, all counts were performed using 3M Petrifilm (3M, USA) incubated at 37 °C for 48 ± 2 h. After incubation, colonies were enumerated, and results were reported as colony form unit (CFU)/g of sample.

RESULTS AND DISCUSSION

Drum drying is an alternative technique for preparing composite drink powder. The drum-drying process does not involve a filtration step that eliminates insoluble matter; hence, it is expected to maintain a higher content of dietary fibre. As the retention time of peel slurry on the drying drums is relatively short, the slurry may cause minimal destruction of heat-sensitive antioxidants. Thus, this composite drink has the potential to become a new complete drink which is high in dietary fibre. Table 1 shows the nutritional content of NUTRI-MEAL.

Table 1. Nutritional composition of NUTRI MEAL during 12 months of storage

| Parameter | per meal (100g) | | | |
|-------------------------------------|------------------------|------------------------|------------------------|------------------------|
| | 0 month | 4 month | 8 month | 12 month |
| Energy (kcal/100g) | 414 | 410 | 412 | 410 |
| Total carbohydrate (g/100g) | 77.8±0.2 _a | 77.4±0.02 _b | 77.7±0.2 _a | 77.0±0.05 _c |
| Protein (g/100g) | 14.6±0.5 _a | 14.5±0.02 _a | 14.5±0.2 _a | 14.53±0.1 _a |
| Fat (g/100g) | 5.0±0.1 _a | 4.6±0.04 _c | 4.9±0.1 _{ab} | 4.8±0.03 _b |
| Total Dietary fiber (g/100g) | 10.9±0.2 _c | 11.6±0.2 _a | 11.2±0.1 _{bc} | 11.4±0.11 _b |
| Pottasium (g/100g) | 1.5±0.3 _a | 1.1±0.2 _a | 1.4±0.4 _a | 1.2±0.2 _a |
| Magnesium (mg/100g) | 92.4±0.2 _{ab} | 90.4±0.2 _b | 93.6±0.3 _a | 91.0±2.0 _b |
| Iron (mg/100g) | 2.3±0.5 _a | 2.0±0.6 _a | 2.3±0.5 _a | 2.1±0.1 _a |
| Calcium (mg/100g) | 176.3±0.4 _b | 178.3±0.2 _a | 178.6±0.6 _a | 178.1±0.2 _a |
| Phosphorus (mg/100g) | 198±0.6 _a | 191±0.3 _c | 190±0.4 _d | 192.3±0.3 _b |
| Sodium (mg/100g) | 68.4±0.1 _c | 68.8±0.9 _{bc} | 69.0±0.6 _{ab} | 69.3±0.6 _a |
| Vitamin A (beta carotene) (ug/100g) | 40.1±0.2 _a | 39.3±0.7 _b | 37.9±0.1 _c | 25.8±0.2 _d |
| Vitamin C (mg/100g) | 70.6±0.2 _a | 55.4±0.3 _b | 43.8±0.6 _c | 36.8±0.17 _d |

Different lowercase letters in the same row are significant differences (p <0.05)

Table 2. Antioxidant properties of NUTRI MEAL during 12 months of storage

| Month | FRAP (g FeSO ₄ Eq/100g) | DPPH (% absorption) | TPC (g GA Eq /100g) |
|-------|------------------------------------|-------------------------|------------------------|
| 0 | 2.26±0.03 ^a | 92.47±0.27 ^a | 1.54±0.17 ^a |
| 4 | 1.72±0.18 ^b | 91.59±0.99 ^a | 1.59±0.05 ^a |
| 8 | 0.36±0.01 ^c | 89.41±0.47 ^b | 1.33±0.03 ^b |
| 12 | 0.37±0.00 ^c | 86.92±0.20 ^c | 1.36±0.04 ^b |

Different lowercase letters in the same row are significant differences (p <0.05)

The values of antioxidant potential of NUTRI-MEAL are presented in Table 2. The total phenolic content (TPC) was decreased during storage similar with DPPH and FRAP. Generally, the TPC values in most cases have a coherent relationship with antioxidant

capacity values obtained in other assays (Smolskaite et al., 2015). Furthermore, the presence of phenolic compounds is the main characteristic of their antioxidant activity (Reis et al., 2012). The reduction of TPC at the 8 and 12 months of storage might be due to the instability of antioxidant compounds such as anthocyanin.

Table 3. Microbiological properties of NUTRI-MEAL during 12 months of storage

| | Total Plate Counts(CFU/g) | Yeast & Mould Counts(CFU/g) | Coliforms (Petrifilm)*(CFU/g) | Staph. Aureus(CFU/g) |
|----------------|--------------------------------------|--|--|---------------------------------|
| 0 month | < 1 x 10 | < 1 x 10 | < 1 x 10 | < 1 x 10 |
| 4 month | < 1 x 10 | < 1 x 10 | < 1 x 10 | < 1 x 10 |
| 8 month | < 1 x 10 | < 1 x 10 | < 1 x 10 | < 1 x 10 |
| 12month | < 1 x 10 | < 1 x 10 | < 1 x 10 | < 1 x 10 |

This microbiological properties data of NUTRI-MEAL (Table 3) shows that the production using high temperature drum drying technique (at 175°C) was able to eliminate all the microorganisms within an acceptable level and produce a safe premix product for human consumption.

CONCLUSION

NUTRI-MEAL is a new premix composite drink with a lot of health benefits which can create a new local market potential. This product also will be able to increase the utilization of local resources and fruits, while developing the economy of farmers and small entrepreneurs. Even though drum drying involves high temperature processing, this method was able to produce drum-dried composite drink powder which has good nutrient content for people's health. Thus, drum drying is an alternative for producing premix powder drink with high commercial value.

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