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Properties of Frozen Rice Noodle Product: Sen Mee Rad Na

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ABSTRACT

This research aims to develop a frozen rice noodle product; Sen Mee Rad Na.The moisture content of dried vermicelli was adjusted to 50% prior to mixing with black soy sauce and vegetable oil at a ratio of 500:20:20 by weight. The vermicelli and gravy with vegetables and pork were separately cryogenically frozen using liquid nitrogen. The thaw process of frozen vermicelli and gravy were provided by using microwave at 900 Watts for 2 min and 5 min, respectively. Sensory evaluation revealed that the panelists could not detect the difference among the frozen products upto the fifth freeze-thaw cycle. The total plate count of the products was not higher than 3.0×10^3 cfu/g, and other microflora such as *E. Coli* and *Coli form* was less than 3 MPN/g. Also there was no pathogenic found. The gravy using potato starch and gelatin had higher acceptance score than gravy using modified cassava starch. The frozen vermicelli product could be stored not less than 3 months at -20°C.

Key words: vermicelli, Rad Na, frozen rice noodle

INTRODUCTION

Frozen food is now great growing interest as the demand for ready to eat food product items rises. Freezing is known as an effective method of preserving food; however, some deteriorations in frozen food quality occur during storage from many factors. Among the frozen food products, cooked starch gel always shows great changes in its quality during freezing and thawing such as syneresis, retrogradation and textural characteristics. Phase transition in carbohydrate substantially influence the physical properties and stability of food matrices. Subsequent freeze-thaw cycles aggravate the phase separation which leads to the formation of larger ice crystals and appear of coarse aggregate starch network (Martin and Schoch, 1977). Usually, the stability upon freeze-thaw cycles of starch gels was different, depending on their botanical sources. Food additives added into starch gel were also reported to affect the starch retrogradation (Chang and Lui, 1991; Baker and Duarte, 1998). Rad Na, one of favorite Asian dishes, is a one dish food containing rice vermicelli and a starch-base sauce. Usually, it is prepared as fresh cooking, while there is a limit information on frozen rice noodle product, especially in the form of ready-to-cook such as Rad Na. Therefore this research aims to prepare frozen rice noodle product, Sen Mee Rad Na by using cryogenic freezing process. The qualities changes of the frozen products upon freeze-thaw cycles such as physical, chemical, microbiological, textural characteristics and sensory properties were investigated.

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MATERIALS AND METHOD

Raw materials: Commercial dried Sen Mee, or vermicelli was purchased from Cho Henge Rice Vermicelli Fac.,Co.,Inc. Pork, vegetables, and seasoning; such as fish sauce, sugar, soy sauce, and oyster thick sauce were perchased from a local market.

Preparation of frozen Rad Na product

Vermicelli preparation

Dried vermicelli was soaked in water for 10 min at room temperature (27°C), drained for 10 mins, and then blanched in boiling water for 1 min. The cooked vermicelli (500 g) was mixed throughly with 20 g rice bran oil and 20 g black soy sauce. The brown vermicelli was obtained.

Rad Na sauce preparation

Three kilogram of pork spare ribs was cleaned and gently boiled in water for making clear soup. For making gravy, 3 litre of soup was added with 55 g fish sauce, 110 g sugar,15 g 5% acetic acid, 85 g fermented soy bean, 1.29 g black pepper powder, 100g hydrolyzed soy sauce and 125 g oyster thick sauce. All ingredients were mixed and heated to boil. The mixture solution was divided into two portions. Then the solution of 100 g potato starch and 1.0 g gelatin in 100 ml water was added to the first portion, whereas 115 g modified cassava starch (Frigex) in 200 ml water was added to the second portion. Both were done while the soup was boiling.

Preparation of vegetable and pork

Vegetables; baby corn, carrot , bamboo shoot, and dried mushroom; were washed, pre-cut, blanched for about 30 sec and immediately cooled down in the water to avoid further cooking. The vegetables were drained before use. Cleaned pork fillet (2.3 kg) was cut into thin small pieces and blended with fresh white egg (10 g), vegetable oil (10 g) and salt (3 g) . The mixture was chilled for 2 hr in the refrigerator and later fried with 20 g of chop garlic to get 80 % cooked pork.

Packing of Rad Na product

Plastic box with tolerated to freezing and provided small area part of 6.3 × 10.3 × 3.8 cm and big area part of 9.8 × 10.3 × 3.8 cm was used for Rad Na packing. Weighed brown vermicelli 80 g in the small block, while 10 g of each blanched vegetables; carrot, bamboo shoot and baby corn, 5 g of mushroom,10 g of cooked pork and 130 g of each Rad Na sauce type were weighed into the large portion of the box and it was sealed on top. All the products were subjected to freezing under cryogenic using liquid nitrogen. The product's temperature decreased every 1 min was recorded until the temperature reached below -18°C. Freezing curve was plotted between the temperature and time. All frozen Rad-Na were stored in the freezer at -20°C for quality evaluation.

Quality evaluation of Frozen Rad Na

The qualities changes of frozen Rad Na through five freezing and thawing cycles were investigated. Each freeze-thaw cycle was done by placing frozen Rad Na at room temperature for 4 hrs thereafter the thawed samples was refreezed by placing in the freezer at -20°C.

Physical, chemical and microbiological properties of frozen Rad Na

Frozen vermicelli were thawed in the microwave at high heat level (900 Watts) for 2 min. Properties of the noodle with different freeze-thaw cycle were determined for color (Colorimeter), moisture content (AOAC, 2000) and microbiological test such as total plate count (TIS 335 part 1 method), *Coli form*, *E. Coli*, *Staphylococcus aureus, Clostridium perfringent*, *Salmonella* and *Bacillus cereus* (FDA-BAM method). Nutritional informations per serving of the product were investigated; Calories from fat and total carbohydrate by calculation while total

fat, saturated fat, sugar and sodium by AOAC method (2000), cholesterol by Compendium of method for food analysis (2003).

Textural properties

Frozen vermicelli were thawed, as the procedure described above, and covered with plastic sheet to prevent moisture loss. Textural characteristics of fifteen noodles per cycle as hardness and stickiness were carried out on a Texture Analyzer model TA-XT2i (Stable Micro System Ltd., England) using a 50 mm diameter cylinder prob and testing condition as measure force in compression. The maximum compression was defined as the sample hardness while the minimum force as the sample stickiness.

Sensory evaluation

Sensory evaluation was performed using both vermicelli and sauce which were separately thawed; whereas the gravy was poured on the vermicelli just prior to sensory testing. Twenty five panelists were selected from the Institute of Food Research and Product Development staff and sensory evaluation of five ready-to-eat Rad Na were conducted by using 9 point Hedonic Scale. Organoleptic qualities evaluated were appearance, color, flavor, taste, texture and overall acceptance. Sensory test of frozen Rad Na stored for 3 months at -20°C were also performed.

Statistic analysis

Data collected from the sensory evaluation were analyzed using SAS data analysis software version 6.12. Analysis of variance and Duncan's New Multiple RangeTest at P= 0.05 were used to determine differences between treatments.

RESULTS AND DISCUSSION

Freezing curve of Rad Na product (Figure 1) revealed that vermicelli and gravy had different freezing time. Vermicelli needed the shorter time for freezing (43.81 min), while the sauce with potato starch plus gelatin (46.82 min) and modified cassava starch (53.33 min) was longer. The freezing time among the products were different, depending on product's nature, the presence of dissolved solids, the interaction of other constituents which related to the amounts of water, and also the product thickness (Ramaswamy and Tung,1984). The results from Table 1 shown the moisture content of vermicelli was about 50%. The moisture content of vermicelli showed slightly decrease when increasing numbers of freeze-thaw cycles (1-5 cycles). This might be the effect of syneresis as Baker and Duarte (1998) had reported that syneresis rate of starch gel was higher in the first freezing and thawing cycle and had similar percent of water separation with an increasing

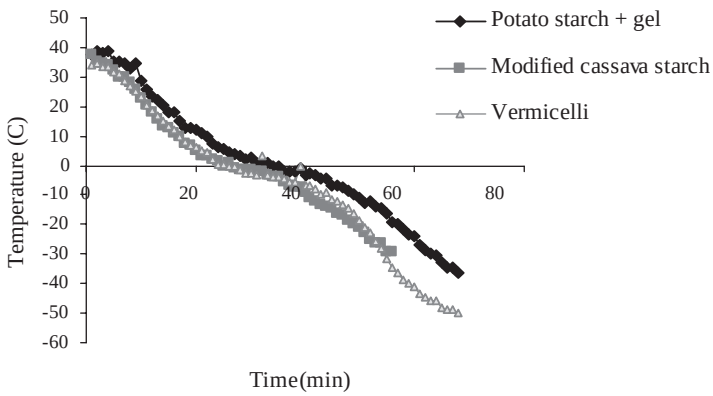

Figure 1 Freezing curve of vermicelli and Rad Na sauce.

number of cycles. Hardness of the vermicelli exhibited similar value at 1-3 freeze-thaw cycles, thereafter the value was significantly lower. Stickiness of vermicelli was slightly different as freeze-thawed cycle increased. Color value of the vermicelli, L* a* and b* were no greatly changed.

Sensory score of frozen Rad Na (Table 2), using potato starch and gelatin as the thicken ingredients in gravy shown that number of the freeze thawed cycle did not affect the color, flavor and taste of the product. Appearance showed significantly different after 3 cycles, while texture as well as acceptance score had significantly different after 2 cycles. The panelists gave the acceptance score of all the products in the level of slightly-like to like level. While sensory score of Rad Na (Table 3) using modified cassava starch as the thickener ingredient through five freeze-thawed cycles were not different. However, after storing for 3 months the Rad Na product using different thickener in gravy showed no significantly different (p> 0.05) score in all

Table 1 Changes of moisture, texture and color of frozen vermicelli for Rad Na at different freeze-thaw cycle after thawing by microwave.

Cycle	Moisture content (%)	Hardness[1](gf)	Stickiness[1] (gf)	Color value		
				L*	a*	b*
1	57.68	844.93[a]	5.41[a]	40.55	6.35	10.46
2	54.60	795.81[a]	4.96[ab]	42.97	6.64	11.44
3	53.48	822.26[a]	5.43[a]	39.82	6.52	9.60
4	52.96	685.38[b]	4.74[ab]	43.38	6.96	11.91
5	52.89	792.00[b]	4.63[b]	42.69	7.61	12.74

In column, means followed by the same superscript are not significantly different (p≥0.05) by DMRT

[1]Average values as hardness and stickiness were obtained from 15 measurements.

Table 2 Sensory evaluation score of frozen Rad Na using potato starch and gelatin as the thicken ingredients in gravy at different freeze-thaw cycle (7days/cycle).

Freeze -thaw cycle	Appearance	Color[ns]	Flavor[ns]	Taste[ns]	Texture	Acceptance
Cycle 1	7.27[a]	6.93	6.87	7.27	7.17[a]	7.23[a]
Cycle2	7.20[a]	6.93	6.80	6.60	6.00[b]	6.20[ab]
Cycle 3	6.60[ab]	6.47	7.00	7.00	6.13[ab]	6.13[b]
Cycle4	6.87[ab]	6.67	6.80	6.67	6.00[b]	5.93[b]
Cycle 5	6.33[b]	6.40	6.87	6.93	6.87[ab]	6.73[ab]

In column, means followed by the same superscript are not significantly different (p≥0.05) by DMRT

ns : not signifieanlly different (p>0.05)

Table 3 Sensory evaluation score of frozen Rad Na using modified cassava starch as the thicken ingredients in gravy at different freeze-thaw cycle(7 days/cycle).

Freeze-thaw cycle	Appearance[ns]	Color[ns]	Flavor[ns]	Taste[ns]	Texture[ns]	Acceptance[ns]
Cycle 1	6.53	6.27	6.47	6.47	6.20	6.13
Cycle2	6.73	6.47	6.27	6.33	5.93	6.13
Cycle 3	6.93	6.73	6.40	6.53	6.07	6.03
Cycle4	7.23	6.87	6.47	6.47	6.47	6.47
Cycle 5	7.13	6.87	6.60	6.73	6.53	6.53

ns: not significantly different (p> 0.05)

product' s characteristics, but gravy using potato starch and gelatin had higher score than gravy using modified cassava starch. Average acceptance score of both products were in the like level (Figure 2).

The analysis of micro-organisms in the frozen products (Table 4), showed the total plate count was not higher than 3.0×10^3 cfu/g, there was no other microflora such as, *Coli form, E.Coli*, *Clostridium perfring*, *Staphylococcus aureus, Salmonella* and *Bacillus cereus* found. Nutrition information of the product per box (275g) or serving was found as the following; total calory was 240 Cal, total fat 4.5 g, no saturated fat, cholesterol 5 mg, protein 7 g, carbohydrate 44 g, no fiber (less than 0.5 g/100 g), sugar 4 g and sodium 90 mg.

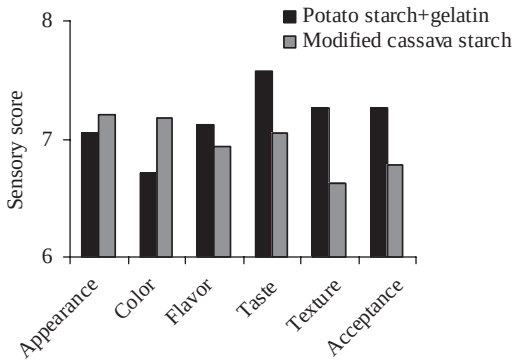

Figure 2 Sensory score of frozen Rad Na using different starch types stored for 3 months at -20°C.

CONCLUSION

Preparation of ready to eat frozen vermicelli Rad Na with fairly good quality seems to be possible. Vermicelli and gravy, either consists of potato starch with gelatin or modified cassava starch, provided the product to stand freeze-thaw process upto 5 cycles. This frozen Rad Na could be kept for not less than 3 month at -20°C. Difference between the samples using various starch gravy, at 3 months storage, could not be detected by taste panels. The frozen product at various freeze-thaw cycles found to contain micro-organism not higher than the standard limitation.

ACKNOWLEDGEMENTS

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Table 4 Microbiological test of frozen Rad Na products with different freeze-thaw cycles (7 days/ cycle).

sample	no. of cycle	Total plate count cfu/g	*Coli form* MPV/g	*E. Coli* MPV/g	*Clostridium perfringent* /.01 g	*Staphylococcus aureus*/0.1 g	*Salmonella* spp/25g	*Bacillus cereus* /0.1g
	1	None	<3	<3	ND	ND	ND	ND
P+G	2	None	<3	<3	ND	ND	ND	ND
	3	110	<3	<3	ND	ND	ND	ND
	4	None	<3	<3	ND	ND	ND	ND
	5	3.0×10^3	<3	<3	ND	ND	ND	ND
MCS	1	None	<3	<3	ND	ND	ND	ND
	2	None	<3	<3	ND	ND	ND	ND
	3	None	<3	<3	ND	ND	ND	ND
	4	None	<3	<3	ND	ND	ND	ND
	5	None	<3	<3	ND	ND	ND	ND

Where : P+G = potato starch + gelatin; MCS = Modified cassava starch , ND = not detected

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