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Kusuma N Waded
M.Tech Scholar, Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu, India

S Anandakumar
Assistant Professor, Department of Food Packaging and System Development, Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu, India

V Hema
Assistant Professor, Food Processing Business Incubation Center, Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu, India

Correspondence
Kusuma N Waded
M.Tech Scholar, Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu, India

Optimize the process parameters and study the characteristics of coconut spread

Kusuma N Waded, S Anandakumar and V Hema

Abstract
Coconut (*Cocos nucifera*) is a type fruit which is widely cultivated globally. Coconut is having good nutritional qualities and health benefits Coconut milk, coconut cream and coconut oil are most important traditional commercial products traded in India. The demand for Ready to eat and Ready to serve products are increasing day by day hence the study has been conducted to optimise the parameters of coconut spread. The pre-treatment microwave heating is found to be an effective in inactivate the enzyme reaction and coconut milk extraction. It was found that at 80 ºC at 90 power level for 10 min followed size reduction were used for coconut milk extraction. Three different hydrocolloids such as Gelatin, Guar gum, Xanthun gum, and Gum Acacia with different concentration such as 0.5, 0.75, and 1.0% selected to optimize the processing. The initial color 'L' value of 1.0% has guar gum added spread has highest value when compare to 0.5, 0.75% and recorded as 89.78. The 'L' value has found ranges from 79.89 to 81.2; the pH of coconut spread was found as 5.4. The Protein, fat, free fatty acids and peroxide value of coconut spread was varying from 2.4 to 3.4%; 25.83 to 34.9%; 0.12 to 1.07g, and 1.4 to 3 meq/gm respectively.

Keywords: Coconut spread, FFA, PV, hydrocolloids, pre-treatments

1. Introduction
Coconut (*Cocos nucifera*) is a type fruit which is widely cultivated globally in India, Philippians and Indonesia. Coconut cultivation and its industry play a major role in rural economy of many countries. The coconut milk is being used by bakeries, and ice cream industries worldwide to enhance the flavour and taste of products. Coconut milk, coconut cream and coconut oil are most important traditional commercial product traded in India. Current trends in changing consumer needs indicate a great opportunity for innovations and developments in ready to eat/ cook products. It has shown a great nutritional, sensory appeal and market potential worldwide. Coconut milk found to be rich in calcium, minerals, and vitamin content (Belewu *et al.* 2007) [2] with total saturated fat content 10 per cent of the total energy.

Coconut milk is edible milk extracted from the kernel. A coconut fruit is composed of about 38.5 percent shell, 51.7 kernel and 9.8percent water (Dendy & Timmins, 1973) [1]. Coconut milk is oil-in-water emulsion. Coconut milk is important ingredient for traditional foods (curries and desserts). As reported by (Simuang, Chiewchan, & Tansakul, 2004) [14], coconut milk contains 54% moisture, 35% fat and 11% solid not-fat (SNF). Separation of an emulsion into cream and water phase is time dependents process. The stability of processed coconut milk emulsion depends on fat content, type and amount of stabilizing agents, homogenize and refrigeration conditions (Sringam, 1986) [15]. Coconut milk has been aimed at its potential value – added products, medical food (Arunima & Rajamohan, 2013) [3], emulsifying agents (Tangsuphoom & Coupland, 2005) and coconut protein. Coconut cream is having nutritional composition of Protein (4%), Fat (25%), and Moisture (74.4%), Total solids (25.4%) and pH (5). It also contains arginine in large quantity (Thaiphanit & Anprung, 2016) [18], which possess anti-diabetic (DebMandal & Mandal, 2011) [4] and antioxidant activity and potential health benefits.

The fresh coconut kernel has about 37 per cent oil and 4 per cent (w/w) protein and 40 per cent of moisture (Kisung Kwon, Park, & Rhee, 1996) [5]. Coconut cream is an oil-in-water emulsion formed from the aqueous extract of coconut solid endosperm. The high consumption of coconut milk and other products are back up by its property of lower cholesterol level in the body and further decreasing the chance of heart diseases (Thaiphanit & Anprung, 2016) [18].

Hydrocolloids are heterogeneous group which is naturally occurring macromolecules like proteins and polysaccharides, which plays major role in conferring food structure and stability (Glicksman, 1982) [6]. Hydrocolloids are biological macromolecules also known as hydrophilic colloids due to the presence of hydroxyl (-OH) group which shows affinity toward water molecules. Hydrocolloids perform number of functions *viz*. thickening and gelling, stabilizing foams, emulsions and dispersions. Rheological characterization of this macromolecules have unique property, which is essentially applied for large number of industrial application involving fluid flow like pasteurization, homogenization, evaporation, drying, aseptic processing and other processes (Capitani *et al*., 2015) [7]. Hydrocolloids as a thickener, alters rheological properties of the foods by the nonspecific entanglement of conformationally disordered polymer chains which in turn influences the sensory of the food products (Tadros, 2004) [16].

By keeping this as a view and the demand for ready to eat and serve products in the market. The new product development is focused on development of Coconut spread from coconut milk with different hydrocolloids to fulfil the nutritional and health benefits of consumers need.

2. Materials and Methods

2.1 Raw materials

The fresh matured coconuts free from damage were procured from local market of Thanjavur. Coconut milk is extracted from coconut cubes using mechanical extractor and cream is separated by centrifugation (10000 rpm) method. Twin stage homogenizer at a pressure of 20 Mpa for 10 min at 10000 RPM was used for uniform droplets. For the optimization of coconut spread different hydrocolloids plant and animal based such as gelatin, guar gum, Gum acacia and Xanthun gum were used at different concentrations 0.25, 0.5, 0.75 and 1% (w/w) respectively.

2.2 Pre-treatments

The pre- treatment was carried out with Microwave heating at three power levels (80, 90, and 100%) at 80 ºC for 10 min to increase the milk extraction yield and to decrease microbial load (Seow, C. C., & Gwee, C. N. 1997) [13].

2.3 Preparation of Coconut Spread

Fresh matured coconuts were dehusked and shells were removed. Then paring (removal of brown skin) was done by using sharp knife. These coconuts were cut into small pieces and soaked in hydrogen peroxide solution (0.1 ppm) for 10 min for controlling the microbial load. The water was drained and coconut cubes were wiped with clean cloth. The pre-treatment of microwave heating (80 ºC) at 900 W for 10 min were given for softening cubes and get more milk extraction. The pre-treated coconut cubes was fed in to the screw press mechanical extractor for extraction of milk. The collected milk samples homogenised and the cream was separated using centrifugation process. For the production of coconut spread hydrocolloids Guar gum and Xanthun gum (1%) emulsifier (soy lecithin) was added and homogenised with proper mixing for 10 min then sodium benzoate is added (0.3%) level as preservative and the samples were storage at refrigeration condition at 5^0 C.

The standard methods were followed for the measurement of Physico-chemical parameters such as colour (Hunter Color Lab) and pH, Protein (Kjeldhal method), Fat (Rose-Gottlieb Method), FFA (Titration method), PV (Titration method) were analysed by AOAC methods 2002.

2.4 Statistical analysis

All the experiments were done in triplicate. The statistical analysis was done in the IBM SPSS software Version 20.0 with different statistical tests such as one-way ANOVA (Raghavendra and Raghavarao, 2010) [12].

3. Results and Discussion

3.1 Colour L* value

The hunter colour 'L' value (lightness, ranging 0-100 indicating black to white) of the coconut spread is given in Figure 1. It is observed that the 'L' value of coconut spread was increased with decreasing the storage time. The initial 'L' value of coconut spread (1%) guar gum added has higher value compared to coconut spread 0.5and 0.75% respectively. It was found that Gum acacia has obtained very low value of color values 89.78, 79.89 to 81.2 during storage. It shows the increase in hydrocolloids cause changes in the color value in the initial reparation. Statistically significant differences were not observed in the coconut spread samples up to storage period. (Sit *et al.* 2014) [8].

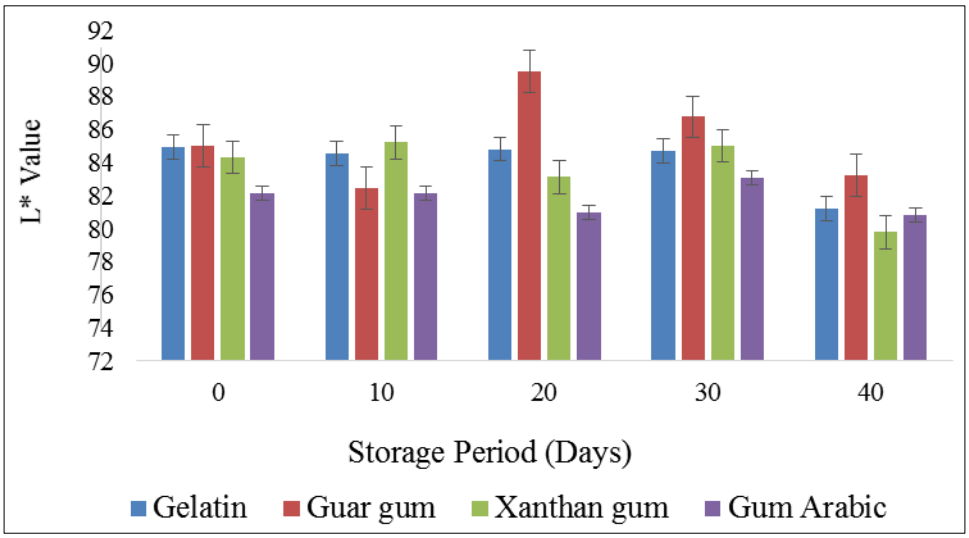

Fig 1: Colour L* value of Coconut spread during Storage

3.2 pH

The pH of the coconut spread was obtained during storage time is given in Figure 2. It is observed that the initial pH of coconut spread is varied from 5.4 to 5.6. During the storage period pH of spread was found decrease. The initial pH of coconut spread was (0.5) has highest value when compared to spread (0.75) and (1.0). (Tangsuphoom & Coupland, 2008) [17] reported that coconut milk proteins easily coagulated and precipitated at pH 4.0. Coconut milk emulsion can be separated by adjusting pH of the coconut milk emulsion between pH 3 and 5.6. There is no effect of hydrocolloids on pH of coconut spread where the P value is < 0.05 significantly.

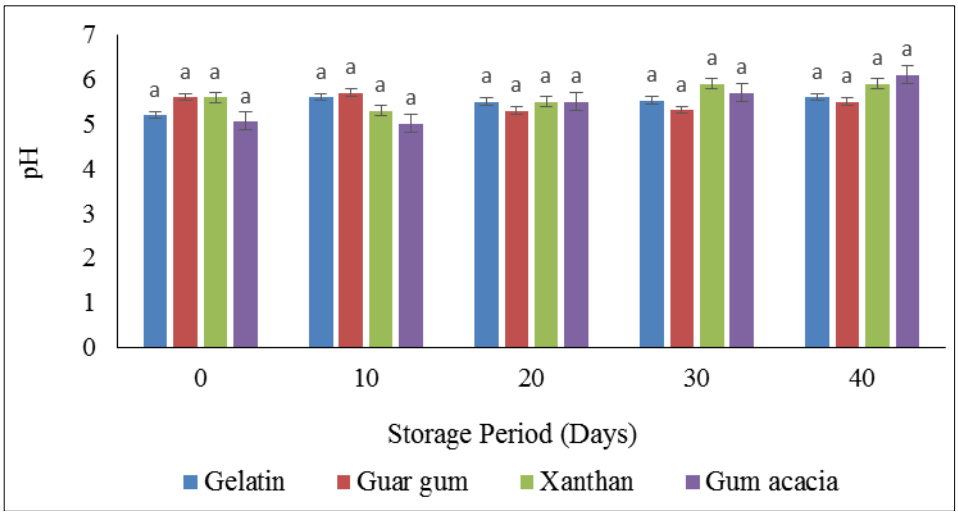

Fig 2: pH of Coconut spread during Storage

3.3 Protein

The protein content of different hydrocolloids added coconut spread was given in Figure 3. From the figure it is observed that protein content of coconut spread maintained same with storage period. The initial protein value of Gelatin, guar gum, xanthan gum and gum acacia are 3.1, 2.6, 2.9 and 3.2 respectively. Also at the end of storage the values were found as 3.1, 3, 3.2 and 3.01 respectively. Among the hydrocolloids Guar gum added coconut spread maintained the protein content during the storage period up to 40 days. Considering the hydrocolloids gelatin and xanthan gum added spread has found poor in retention the protein content. In fact, there were no apparent changes in protein denatures observed in refrigeration condition. Similar results were observed in (Gunetileke & Laurentius, 1974) [11]. Among the treatments with storage periods (P>0.05) significant difference were observed.

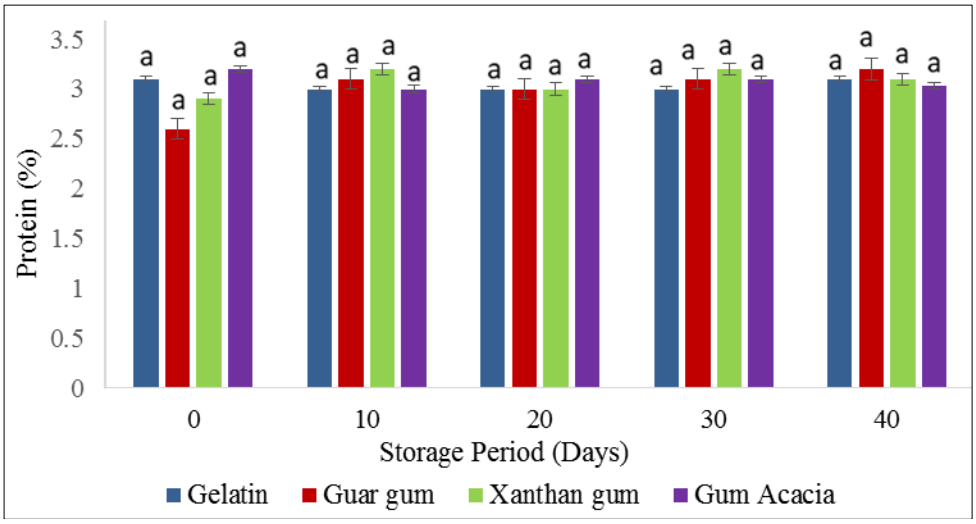

Fig 3: Protein Content of Coconut spread during Storage

3.4 Fat

The fat content of different hydrocolloids added coconut spread was given in Figure 4. The initial fat content Gelatin, Guar gum, xanthan gum and gum acacia added coconut spread were measured as 25.4, 22.6, 32.4 and 30% respectively. Also at the end of storage the values were found as 31.08, 30, 31.5 and 34.8 respectively. Among the hydrocolloids added coconut spread the Fat content were found (p > 0.05) significant differences.

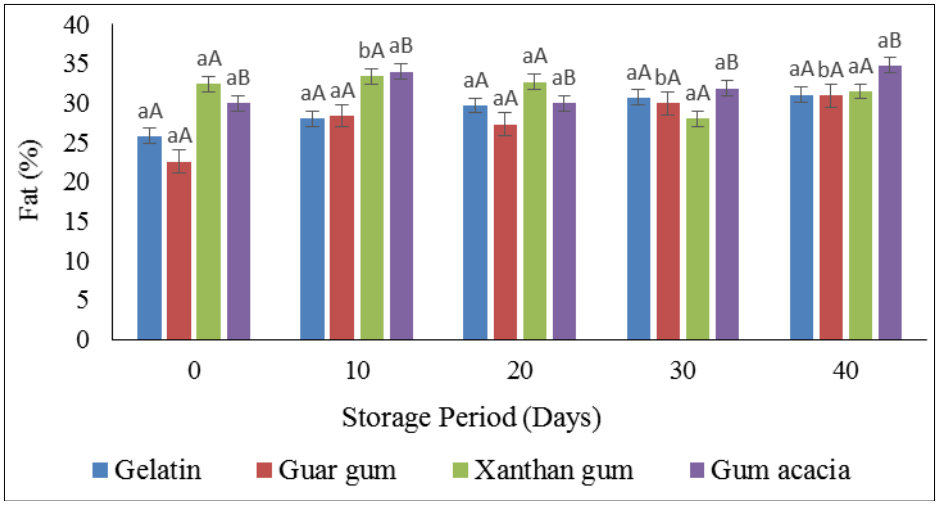

Fig 4: Fat Content of Coconut spread during Storage

3.5 Free Fatty Acid

The FFA content of different hydrocolloids added coconut spread was given in Figure 5. FFA content was found increase with increasing the storage period of different hydrocolloids added coconut spread during refrigerated storage condition. The initial FFA values of gelatin, Guar gum, Xanthun gum and Gum acacia are 0.61, 0.15, 0.5 and 0.65% respectively. Also at the end of storage the values were found as 1.04, 1.07, 1.02 and 1.01 up to 30 days respectively. Among the hydrocolloids Xanthun gum added spread has shown gradual increase during storage period 40 days. This may be due to the increasing effect of lauric acid present and microbial lipase that may have produced during the storage time. So similar results were reported by the critical limit for FFA is 1 percent (Gunethilake *et al.* 2006). Among the treatments with storage periods ($P < 0.05$) significant differences have observed.

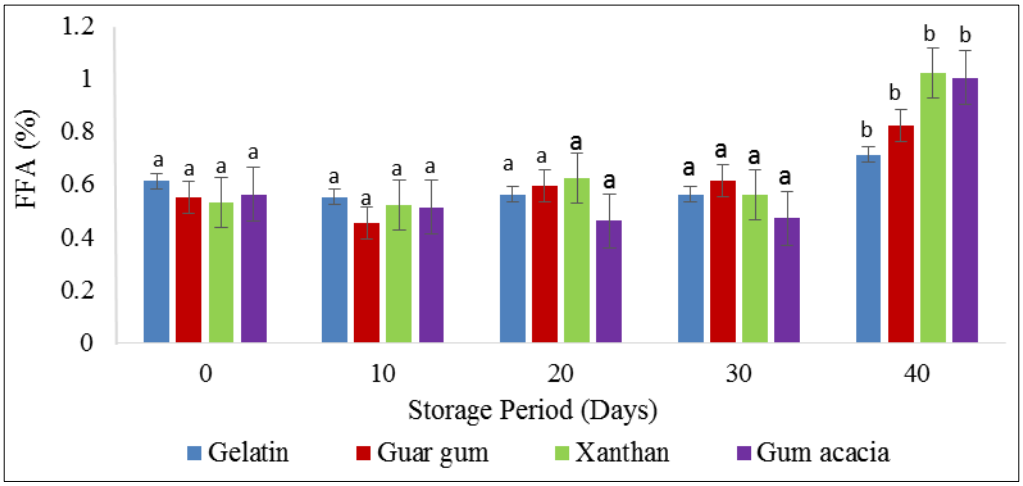

Fig 5: Free Fatty acid Content of Coconut spread during Storage

3.6 Peroxide value

The Peroxide value (PV) of different hydrocolloids added coconut spread was given in Figure 6. PV content was found increasing with increase the storage period of different hydrocolloids added coconut spread during storage at refrigeration condition. The initial PV values of gelatin, Guar gum, Xanthun gum and Gum acacia are 1.4, 1.09, 0.74 and 1.5% respectively. Also at the end of storage the values were found as 2.7, 2.9, 3 and 3.1 respectively. The peroxide value indicates the rancidity value above 35.5 meq in kg of oil (Waisundara *et al.* 2007) [9]. Generally coconut products had the peroxide values below 35.5 meq of peroxide O_2 per kg of oil. In fact, there was no apparent rancid odour during refrigerated storage condition. The heat treatment at 80°C given to the coconut meat were adequate to inactivate peroxidase lipoxygenase enzymes. (Waisundara *et al.* 2007) [9] observed similar results. Among the treatments during storage statistically ($P > 0.05$) showed significant differences.

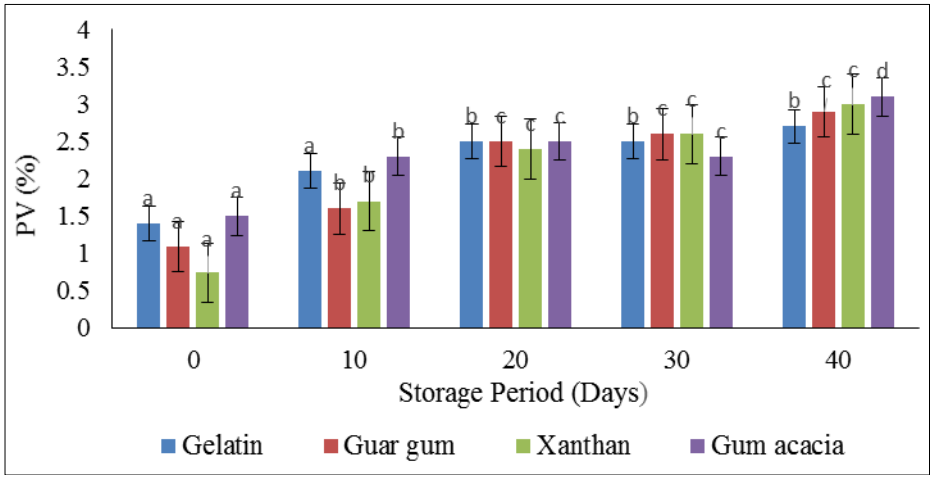

Fig 6: Peroxide Value of Coconut spread during Storage

4. Conclusion

The demand for Ready to eat and cook products high in food markets. Coconut spread is an easy convenience and nutrient food. Microwave heating method is used for pre-treatments has soften the coconut tissues and subjected to yield high milk. To get the standard physical flow characteristics of spread 1% guar gum added into the coconut cream. Among the different hydrocolloids treated guar gum added spread has maintained the quality parameters during storage period at refrigerated conditions. Among the treatments (P >0.05) significant differences observed during storage.

5. References

1. Dendy D, Timmins W. Development of a process to extract protein and oil from fresh coconut: The work of the Tropical Products Institutes. Oleagineux, 1973.
2. Belewu MA, Belewu KY. Comparative physico-chemical evaluation of tiger-nut, soybean and coconut milk sources. Int. J Agric. Biol. 2007; 5:785-787.
3. Arunima S, Rajamohan T. Coconut kernel protein in diet protects the heart by beneficially modulating endothelial nitric oxide synthase, tumor necrosis factor-alpha, and nuclear factor-kappaB expressions in experimental myocardial infarction. Journal of food and drug analysis. 2013; 21(3):325-331.
4. DebMandal M, Mandal S. Coconut (*Cocos nucifera* L.: Arecaceae): in health promotion and disease prevention. Asian Pacific Journal of Tropical Medicine. 2011; 4(3):241-247.
5. Kwon K, Park KH, Rhee KC. Fractionation and characterization of proteins from coconut (*Cocos nucifera* L.). Journal of Agricultural and Food Chemistry. 1996; 44(7):1741-1745.
6. Glicksman M. Functional properties of hydrocolloids [Food thickeners and gels], 1982.
7. Capitani MI, Corzo-Rios LJ, Chel-Guerrero LA, Betancur-Ancona DA, Nolasco SM, Tomás MC. Rheological properties of aqueous dispersions of chia (*Salvia hispanica* L.) mucilage. Journal of food engineering. 2015; 149:70-77.
8. Sit N, Misra S, Baruah D, Badwaik LS, Deka SC. Physicochemical properties of taro and maize starch and their effect on texture, colour and sensory quality of tomato ketchup. Starch-Stärke. 2014; 66(3-4):294-302.
9. Waisundara VY, Perera CO, Barlow PJ. Effect of different pre-treatments of fresh coconut kernels on some of the quality attributes of the coconut milk extracted. Food Chemistry. 2007; 101(2):771-777.
10. Arachchi LL, Gunathilake KDPP, Prasadi VPN. Shelf Life and Quality Evaluation of Deep Frozen Coconut Cream, Coconut Scrapings and Coconut Slices. Asian and Pacific Coconut Community, 2006, 34.
11. Gunetileke K, Laurentius S. Conditions for the separation of oil and protein from coconut milk emulsion. Journal of Food Science. 1974; 39(2):230-233.
12. Raghavendra S, Raghavarao K. Effect of different treatments for the destabilization of coconut milk emulsion. Journal of food engineering. 2010; 97(3):341-347.
13. Seow CC, Gwee CN. Coconut milk: chemistry and technology. International Journal of Food Science & Technology. 1997; 32(3):189-201.
14. Simuang J, Chiewchan N, Tansakul A. Effects of fat content and temperature on the apparent viscosity of coconut milk. Journal of Food Engineering, 2004; 64(2):193-197.
15. Sringam S. Preparation and stabilization of coconut milk. Food Science and Technology Research Project, Agro-Industry Faculty, Kasetsart University, Bangkok, 1986, 25p.
16. Tadros T. Application of rheology for assessment and prediction of the long-term physical stability of emulsions. Advances in colloid and interface science, 2004; 108:227-258.
17. Tangsuphoom N, Coupland JN. Effect of surface-active stabilizers on the microstructure and stability of coconut milk emulsions. Food Hydrocolloids. 2008; 22(7):1233-1242.
18. Thaiphanit S, Anprung P. Physicochemical and emulsion properties of edible protein concentrate from coconut (*Cocos nucifera* L.) processing by-products and the influence of heat treatment. Food Hydrocolloids. 2016; 52:756-765.