PALM MID FRACTION (PMF)-BASED FAT IN ICE CONFECTION FORMULATION

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Ice confection is made by frozen preparation of water with other food ingredients. The other food ingredients are from milk or milk products, vegetable fat, sugar, colouring, flavouring and food conditioner (Malaysian Food Act 1983 and Food Regulation, 1985).

The fat component has several functions in ice confection. It contributes to the sensory properties, acts as flavour carrier and is responsible for the rich creamy sensation typical of ice confection. Milk fats are commonly used in the production of ice cream. They are derived from milk, cream, butter and anhydrous milk fat (AMF). However, in ice confection, vegetable oils and fat mixtures are widely used. Coconut oil (CNO) and palm kernel oil (PKO) are the most common fat in ice confection (Cook and Hartel, 2017). CNO and PKO are rich in saturated fatty acids and the price is expensive compared to palm oil (PO). PO and its fractions with balanced unsaturated and saturated fatty acids and cost competitive are suitable options for ice confection fats. Besides being comparatively cheaper than milk fat, CNO and PKO, PO and its fractions are most versatile for food application. PO could be fractionated into solid fraction (palm stearin, POS) and liquid fraction (palm olein, POo). Further fractionation process of POo, produces palm mid fraction (PMF). PMF is used in confectionery fats as cocoa butter substitute (CBS) (Saadah and Nazaruddin, 2010), cocoa butter equivalents (CBE) (Ogan *et al.*, 2015) and cream filling (Biswas *et al.*, 2017). PMF is also found suitable as hard stock for bakery fat and cake margarine (Miskandar *et al.*, 2016; Noor Lida *et al.*, 2016). MPOB has successfully conducted research on the usage of PMF in ice confections. PMF of iodine value (IV) of 40 – 45 was found to be suitable for ice confection fat due to their higher solid fat content (81%) at 5°C and has low residual solid (0.3%) at 35°C. The fat totally melted below body temperature.

Malaysia produced 4.19 million tonnes PKO in 2016, (MPOB, 2016). The average price of PKO in February 2017 was RM 7329 t^{-1} while the price of PO was RM 3247.50 t^{-1} and PMF was RM 3921.66 t^{-1} (http://bepi.mpob.gov.my/price/daily/Feb 2017). The average price of CNO in the same month was RM 6872.68 (http://www.indexmundi.com/commodities/coconut oil/May 2017). Therefore, the use of PMF as fat ingredient in ice confection is more economical compare to PKO and CNO.

TECHNOLOGY OFFERED

The technology offered is PMF-based fat formulation and its application in ice confection production. Four PMF-based fats have been formulated (PF1 to PF4) for ice confection. The slip melting points (SMP) (*Table 1*) and solid fat content (SFC) profiles (*Figure 1*) of the experimental fats are comparable to commercial samples. The desired fat was achieved by direct blending method. Blending is the most cost effective to tailor the fat to suit the physicochemical requirements for ice confection fat such as the SMP and SFC.

TABLE 1. SLIP MELTING POINT (SMP) OF ICE CONFECTION FAT

Sample	Slip melting point (°C)
PF1	28.6 ± 0.58
PF2	27.4 ± 0.32
PF3	34.4 ± 1.99
PF4	28.5 ± 1.42
Milk fat	33.9 ± 0.26
PO	36.8 ± 0.06
PKO	27.5 ± 0.21
VF	34.6 ± 0.12

Note: PF = Experimental palm fat; PO = palm oil; PKO = palm kernel oil; VF = vegetable-based fat.

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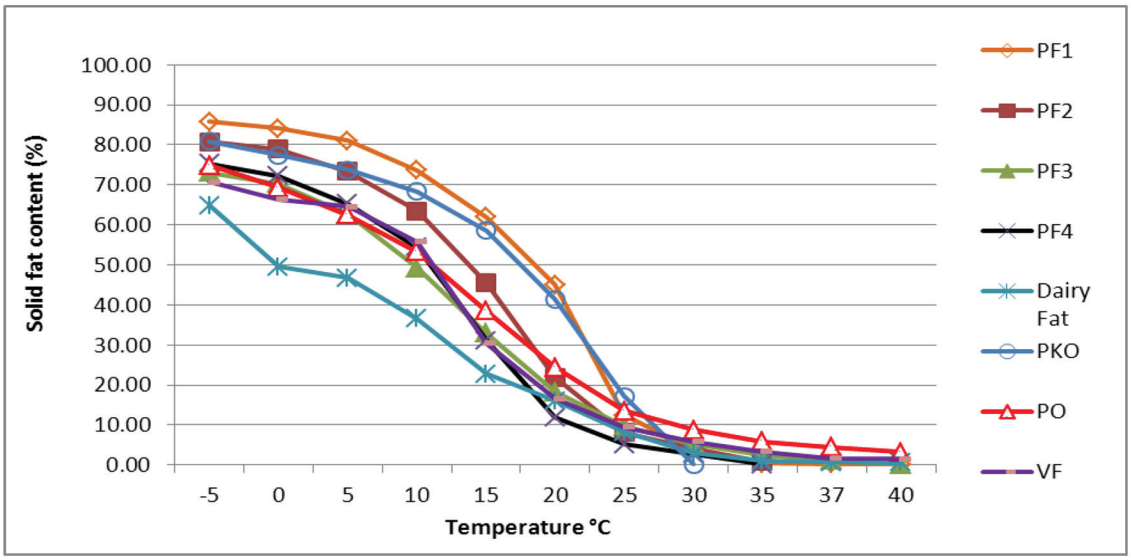

Note: PF = Experimental palm fat; PO = palm oil; PKO = palm kernel oil; VF = vegetable-based fat.

Figure 1. Solid fat content profile of ice confection fat.

INGREDIENT AND PROCESSING

The ice confection was formulated using 10% PF1 as fat component. A balanced ice confection mix was formulated having 38% total solids and 62% water. The processing condition was similar to ice cream production (*Figure* 2). The ice confection mixture was frozen in a batch ice cream processor (De'Longhi gelataio, Italy). The ice confection was packed in 85 ml containers and stored at –18˚C.

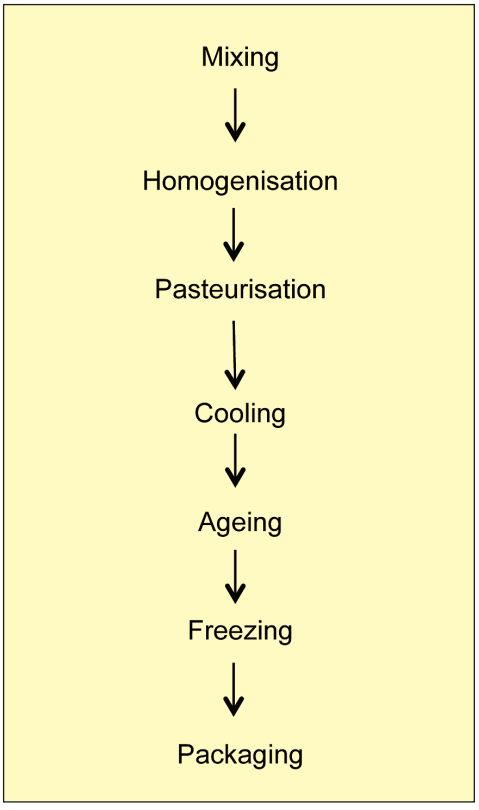

Figure 2. Flow process of PMF-based ice confection.

PRODUCT CHARACTERISTICS

Ice confection produced has an overrun of between 40% to 55%. Overrun is the incorporation of air into the ice confection mix during freezing. Overrun provides a light texture and smoothness to ice confection.

The percentage of melting of the ice confection was 85% to 90% and the firmness of 300 to 350 mm for penetration depth. PMF-based ice confection has a smooth appearance and creamy mouth feel.

NOVELTY

- PMF-based fat formulation for ice confection.

PMF-based fat.

PMF-based ice confection.

BENEFITS

- Cost effective ingredient.
- Free from *trans* fatty acids.
- Free from cholesterol.

MARKET POTENTIAL

PMF-based fat has potential as fat ingredient in the frozen desserts industry for both domestic and global markets. Frozen desserts have approximately 36% share of the overall desserts and ice cream market category and the share in Asia was 27% in 2015 (www.innovadatabase.com/Feb2017).

ECONOMIC EVALUATION

The investment in the production of ice confection is financially feasible as shown in *Table 2*. The estimated total investment is RM 2 061 356 with capital asset of approximately RM 486 943. The parameters shown are evaluated based on the price of ice confection at RM 6.80 kg^{-1}. The investment will generate income of RM 249 358 after three years. Current prices of frozen confection are RM 7.99 – RM 8.99 kg^{-1} compared to dairy ice cream is RM 15 – RM 49.40 kg^{-1}.

TABLE 2. ESTIMATED EXPENDITURE AND ECONOMIC VALUES

Items	Value
Capital asset	RM 486 943
Benefit to cost ratio	1:1.09
Pay back period, (year)	3
Internal rate of return (IRR),%	33
Net present value (NPV)	RM 304 844
Return of Investment (ROI),%	45.03

CONCLUSION

The PMF-based fat formulated has higher SFC at 5°C and is totally melted below body temperature. The SFC profile is comparable to commercial samples. The ice confection produced from PMF-based fat has a smooth appearance and creamy mouth feel.

REFERENCES

BISWAS, N; CHEOW, Y L; TAN, C P and KANAGARATNAM, S (2017). Cocoa-butter substitute (CBS) produced from palm mid-fraction/palm kernel oil/palm stearin for confectionery fillings. *J. Am.Oil Chem.Soc*. DOI 10.1007/s11746-016-29404.

COOK, K L K and HARTEL, R W (2017). Mechanisms of ice crystallization in ice cream production. *Comprehensive Reviews in Food Science and Food Safety*, *9*: 213-222.

MALAYSIAN STANDARD. Malaysian Food Act 1983 and Food Regulation 1985.

MALAYSIAN PALM OIL BOARD (MPOB). (2016). *Overview of the Malaysian Oil Palm Industry 2016*. MPOB, Bangi, Selangor.

MISKANDAR, M S; FAIRUS, M H; ROSNANI, O; NOOR LIDA, H M D and SIVARUBY, K (2016). Palm mid fraction (PMF)-based bakery fat. *MPOB Information Series No. 608*.

NOOR LIDA, H M D; SIVARUBY, K; MISKANDAR, M S; ZALIHA, O and RAFIDAH, A H (2016). Palm mid fraction (PMF)-based hard stocks for cake margarines. *MPOB Information Series No. 605*.

OGAN, I M; MARIE-JOSEE, D and MICHAEL, N (2015). Palm Oil: Processing, characterization and utilization in food industry-A Rewiew. *Food Bioscience*, *10*: 26-41

SAADAH, M S and NAZARUDDIN, R (2010). Melting behavior of binary mixtures of palm mid fraction and rice bran oil. *Sains Malaysiana*, *39*: 785-790.

http://bepi.mpob.gov.my/price/daily/Feb 2017.

http://www.innovadatabase.com/Feb2017.

http://www.indexmundi.com/commodities/coconut-oil/May 2017.

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