PALM-BASED *TRANS* FATTY ACID-FREE BUTTER OIL SUBSTITUTE

SIVARUBY KANAGARATNAM; GOH ENG MENG; MISKANDAR MAT SAHRI; NOR AINI IDRIS and JAYA GOPAL

477

MPOB INFORMATION SERIES • ISSN 1511-7871 • JUNE 2009 MPOB TT No. 435

Butter oil substitute (BOS) is widely used in the bakery industry to replace the expensive dairy-based butter oil. The functionality of BOS is similar to that of shortening, which is to 'shorten' or tenderize baked foods (O'Brien, 1996). The unique characteristics of the BOS product compared to shortening are its strong butter flavour and a deep yellow colour.

BOS is formulated mainly from combinations of animal fats (tallow or lard) and hydrogenated oils. Fats of animal origin contain cholesterol as the major sterol, which is normally considered to be of negative value in the diet (Jee, 2002). Similarly, partially hydrogenated fats contain *trans* fatty acids (TFA) which are associated with adverse health effects. TFA have an adverse effect on blood lipoproteins (cholesterol) and have been shown to increase the risk of heart disease. TFA increase the risk of elevating LDL-cholesterol (the bad lipoproteins) and reducing HDL-cholesterol (the good lipoprotein). This increases the risk of cardiovascular disease (Mozaffarian *et al.*, 2006). Currently, food manufacturers and retailers are systematically removing partially hydrogenated fats from their products. Solid fractions from palm oil are free from cholesterol and TFA, hence are suitable choices for the replacement of animal fats and partially hydrogenated fats in the formulation of BOS.

PALM-BASED TFA-FREE BUTTER OIL SUBSTITUTE

BOS is extensively used in the bakery industry for making a wide range of pastries. A well-known pastry in China (as well as in Malaysia) using BOS is the mooncake, which is made for the Autumn Festival as special gifts for family and friends (*Figures 1* and 2). The formulation of BOS using palm-based oils and fats for this project was based on commercial BOS products from China.

Figure 1. BOS from China with deep yellow colour.

Figure 2. The outer layer of the mooncake dough is softened with BOS.

Five commercial BOS products were obtained from China as reference. The fatty acid composition of these products confirmed the presence of animal fats in three of them. The fatty acids such as pentadecanoic acid C15:0, margaric acid C17:0 and margaoleic acid C17:1, which are present only in animal fats, were detected. The level of margaoleic acid C17:1 detected ranged from 0.3% to 0.4%, as shown in *Table 1*. The remaining two samples were

ISSN 1511-7871
9 771511 787001

Malaysian Palm Oil Board, Ministry of Plantation Industries and Commodities, Malaysia
P. O. Box 10620, 50720 Kuala Lumpur, Malaysia. *Tel:* 03-87694400 *Website:* www.mpob.gov.my *Telefax:* 03-89259446

MPOB

free of animal fats. TFA were detected in all the commercial products. Higher levels of TFA were detected in the two commercial products which were free of animal fats. The levels detected were 1.0%, 1.7%, 2.3%, 3.5% and 4.7% as shown in *Table 2*.

TABLE 1. LEVEL OF C17:1 DETECTED IN COMMERCIAL BOS AND BOS 001

Butter oil substitute	C17:1
Com 1	0.3
Com 2	0.3
Com 3	0.3
Com 4	n.d.
Com 5	n.d.
BOS 001	n.d.

n.d. – not detected.

TABLE 2. LEVEL OF *TRANS* FATTY ACIDS DETECTED IN THE COMMERCIAL BOS AND BOS 001

Butter oil substitute	*Trans* fatty acids
Com 1	2.3
Com 2	1.7
Com 3	1.0
Com 4	3.5
Com 5	4.7
BOS 001	40.2

Healthier palm-based TFA-free oils and fats blends were used to replace the animal fats and the partially hydrogenated oils in the formulation of a BOS. Palm-based raw materials that can be used for the BOS fat blends are shown in *Table 3*.

Palm-based TFA-free butter oil substitute BOS 001 was formulated. The palm-based blends were formulated to match the solid fat content (SFC) profile of the commercial products, at the working temperature of the product, *i.e.* with SFC of 24% at 20°C and 10% at 30°C. The SFC at 40°C was maintained below 3% to avoid a greasy mouth feel in the end-product as shown in *Figure 3*. The final product was produced by processing the fat blend through the perfector pilot plant (*Figure 4*).

The bakery performance of the BOS was determined by evaluating the creaming ability of the product. The specific volume values obtained from the creaming of a 500-g sample of the product for 12 min ranged from 2.3 to 3.4 cm^3 g^{-1} for the commercial products. The palm-based TFA-free formulation with the addition of a suitable emulsifier was able to give a reading of 3.3 cm^3 g^{-1}, as shown in *Table 4*. Hence, palm-based *trans*-free formulations have been successfully used to replace animal and partially hydrogenated fats in the production of BOS.

BENEFITS/ADVANTAGES

1. A healthier replacement for partially hydrogenated fats – free of *trans* fatty acids.
2. A healthier replacement for animal fats – free of cholesterol.
3. Natural fractions of palm-based oils and fats used without hydrogenation and/or interesterification.
4. Formulated with a specially selected emulsifier to give the required creaming properties.
5. Suitable for vegetarians.
6. *Halal* and kosher.

TABLE 3. PALM-BASED PRODUCTS FOR THE FORMULATION OF BOS

Palm fraction	High melting point fraction	Medium melting point fraction	Moderator or modifier
Function	Act as the backbone structure	Provides structure and texture to the product	Used as modifier to achieve the required solid fat content profile to give the required mouth-feel
Suitable palm products	Palm stearin IV < 32	Palm oil, palm kernel, palm soft stearin IV < 40	Palm olein, super palm olein, palm kernel olein, soyabean oil, sunflower oil, canola oil
Suitable level in blend	10% to 20%	40% to 50%	30% to 50%

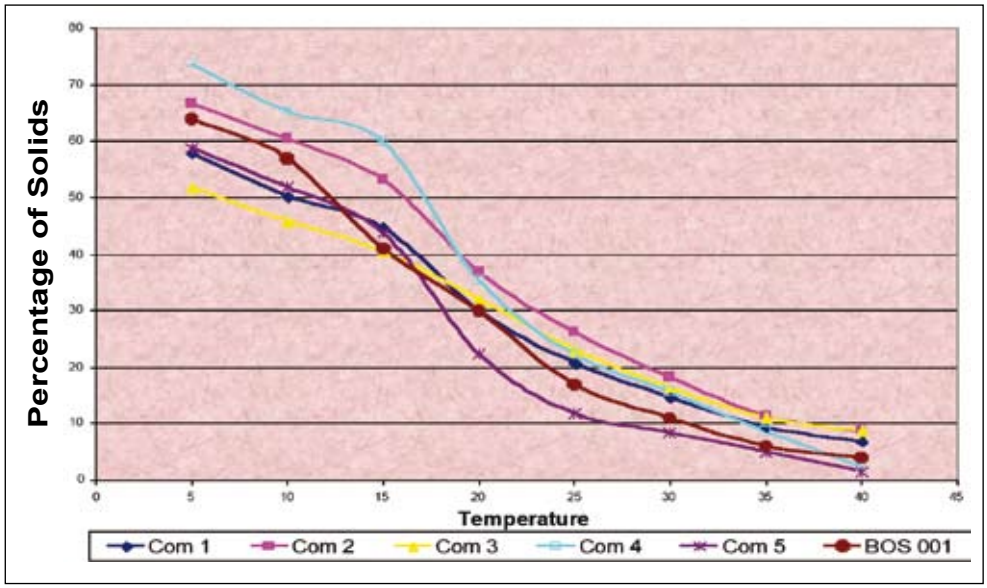

Figure 3. Solid fat content of commercial BOS samples and BOS 001.

TABLE 4. CREAMING ABILITY OF COMMERCIAL BOS AND BOS 001

Butter oil substitute (Specific volume)	Creaming value ($cm^3\ g^{-1}$)
Com 1	3.3 $cm^3\ g^{-1}$
Com 2	2.3 $cm^3\ g^{-1}$
Com 3	2.9 $cm^3\ g^{-1}$
Com 4	3.0 $cm^3\ g^{-1}$
Com 5	3.4 $cm^3\ g^{-1}$
BOS 001	3.3 $cm^3\ g^{-1}$

CONCLUSION

The palm-based BOS produced was able to match the physical properties and functionalities of the commercial BOS from China. Hence, natural palm-based fractions can successfully replace animal and partially hydrogenated fats in the production of BOS and thus provide a healthier fat ingredient for the bakery industry.

REFERENCES

MOZAFFARIAN, D; KATAN, M B; ASCHERIO, A; STAMPFER, M J and WILLETT, W C (2006). *Trans* fatty acids and cardiovascular disease. *New England Journal of Medicine, 354*: 1601-1613.

O'BRIEN, R D (1996). Shortening type and formulations. *Bailey's Industrial Oil and Fats Products Volume 3. Edible Oils and Fat Products and Application Technology* (Hui, Y H ed.).

JEE, M (2002). Milk fats and other animal fats. *Oils and Fats Authentication* (Jee, M ed.). Blackwell Publishing. p. 115-142.

For more information kindly contact:

Director-General
MPOB
P. O. Box 10620
50720 Kuala Lumpur, Malaysia.
Tel: 03-87694400
Website: www.mpob.gov.my
Telefax: 03-89259446