PRODUCTION TECHNOLOGY OF PALM-BASED MONOGLYCERIDES

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95

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Partial glycerides are commercially synthesized and used as emulsifying agents in a wide range of food products. Monoglycerides, in particular, which have better emulsifying property than diglycerides, account for over 70% of the total world consumption as food emulsifiers.

Monoglycerides have also been shown to be useful intermediates for the preparation of more lipophilic and more hydrophilic derivatives for other specific food applications. Both monoglycerides and their derivatives are also used in non-food applications as emulsifiers, texturing agents, lubricants, plasticizers, pharmaceuticals, cosmetics and textiles, *etc.*

Commercially, on an industrial scale monoglycerides are produced by glycerolysis of natural oils and fats with glycerol at temperature greater than 220°C in the presence of an inorganic catalyst. The reaction products are an equilibrium mixture consisting of monoglycerides, diglycerides and triglycerides (Sonntag, 1982). The yield of the conversion of triglycerides to monoglycerides is about 58%. Some studies using various solvents to improve the homogeneity of the reactants, *i.e.* glycerol and fats have also been carried out but in general, the yield is low.

In recent years, synthesis of monoglycerides using lipase enzymes has been actively pursued by several workers (Holumberg and Osterberg, 1988; Mc Niel *et al.*,1991; Mc Niel and Yamane, 1991). Studies using a wide variety of different enzymes and substrates as well as conditions to improve the yield of partial glycerides have been carried out (Mc Niel *et al.*, 1991). By controlling the reaction temperature, a yield of 90% of monoglycerides using lipase catalyzed glycerolysis of olive oil can be obtained.

PRODUCTION TECHNOLOGY OF MONOGLYCERIDES

PORIM has developed an efficient process for the production of monoglycerides and diglycerides (predominantly the former) from palm oil and palm oil products using sodium methoxide as catalyst under various reaction conditions (Choo, 1992). Optimum conditions for the production of mono- and diglycerides via glycerolysis of refined, bleached and deodorized (RBD) palm stearin catalyzed by sodium methoxide using suitable solvent, has been established. It was found that high yields of monoglycerides and diglycerides (predominantly the former) could be obtained in a much shorter reaction time (< 30 minutes) and at a lower temperature (< 110°C) as compared to the current technology which requires a much longer reaction time (> 4 hours) and a temperature of > 220°C. The critical determining factor of the PORIM process is the use of appropriate solvents. The results from the reactions of palm stearin with glycerol in three different solvent systems are shown in *Table 1*. This process has been successfully extended to other feedstocks such as RBD palm oil and hydrogenated palm oil. The reaction products were monitored qualitatively by thin layer chromatography (TLC) and quantitatively by gas chromatography (GC). The products obtained are white crystalline solid devoid of odour (*Figure 1*).

Figure 1.

ADVANTAGES OF THE PRESENT TECHNOLOGY

Typical compositions of the two types of commercial emulsifiers (namely mono-diglycerides and distilled monoglycerides) are shown in *Table 2*. The distilled monoglycerides (90-95%) are produced by molecular dis-

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TABLE 1. COMPARISON OF GLYCEROLYSIS OF REFINED, BLEACHED AND DEODORIZED PALM STEARIN BY PORIM PROCESS AND CURRENT TECHNOLOGY

Reaction Conditions Process	Reaction Time (minutes)	Temperature (°C)	Yield (%)	
			MG	DG
1. PORIM (1)	1	<100	95.2	1.4
PORIM (2)	5	<110	98.7	1.1
PORIM (3)	5	<120	90-92	2 - 6
2. Current Commercial Technology	>240	>220	40 - 50	35 - 40

Note: PORIM (1), (2) and (3) use different solvent systems.
MG - Monoglycerides
DG - Diglycerides

TABLE 2. TYPICAL COMPOSITION OF THE TWO TYPES OF COMMERCIAL EMULSIFIERS

Components	Commercial Emulsifiers	
	(1) Mono-diglycerides or Undistilled Mono-diglycerides	(2) Distilled Monoglycerides
Monoglycerides	40 - 50%	90 - 95%
Diglycerides	35 - 40%	3 - 8%
Triglycerides	5 - 12%	0.5 - 1%
Glycerol	0.5 - 1%	Trace
Fatty acids	0.5 - 1%	Trace

tillation of the mono-diglycerides mixture. On the contrary, our present process has been demonstrated to be capable of producing >90% of monoglycerides without having to go through the molecular distillation process. Thus, it is obvious that this novel process has a definite economic advantage over the current commercial process as the difference in the concentration of monoglycerides results in a substantial price difference in favour of the higher concentration of monoglycerides.

CONCLUSION

The process to produce high yield of monoglycerides described has been evaluated on its technical feasibility and proven to be viable. Thus, it is now ready for commercialization. This will increase the consumption and enhance the value of palm oil.

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REFERENCES

CHOO, Y M (1992). Synthesis of monoglycerides and diglycerides from palm oil, Malaysian patent No. P19201231.

HOLUMBERG, K and OSTERBERG, E (1988). Enzymatic Preparation of monoglycerides in microemulsion. *J. Am. Oil Chem. Soc. 68*: 1544-1548.

Mc NIEL, G P; SHIMIZU, S and YAMANE, T (1991). High – yield enzymatic glycerolysis of fats and oils. *J. Am. Oil Chem. Soc. 68*: 1-5.

Mc NIEL, G P and YAMANE, T (1991). Further improvements in the yield of monoglycerides during enzymatics glycerolysis of fats and oils. *J. Am. Oil Chem. Soc. 68*: 6-10.

SONNTAG, N O V (1982). Glycerolysis of fats and methyl esters-Status, review and critique. *J. Am. Oil Chem. Soc., 59*: 795A-802A.

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