TRANS FREE MARGARINE FORMULATION

by: MOHD SURIA AFFANDI, Y; NOOR LIDA HABI, M D; KAMAL AZMI, K and ROZI, M P

MAY 1996

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PORIM TT NO. 37

PORIM INFORMATION SERIES ISSN 0128-5726

INTRODUCTION

Margarine is a fatty food resembling butter in appearance, character and composition. It is used as a substitute for, or alternative to butter. It is an emulsion of a fatty phase (usually the continuous phase) and an aqueous phase. The fatty phase is a mixture of vegetable and/or animal oils and fats. It contains sufficient solid fat to ensure that the margarine is solid at prevailing atmospheric temperature. The aqueous phase is either specially prepared skim milk or water, or their mixture. Small quantities of other ingredients such as salt, flavouring substances and emulsifiers may be incorporated in one or other of the phases.

Margarine.

In the preparation of the margarine, usually the vegetable oils have to be modified through hydrogenation to achieve the required solid fat content. During hydrogenation positional and *trans* isomers are formed. Formation of *trans* isomers influences the chemical and physical characteristics of the final product. It was noted that trans isomers have higher melting point than the corresponding *cis* fatty acid.

TRANS FREE MARGARINES

The formulations for the various types of *trans* free margarines prepared by either direct blending or interesterification are shown in *Tables 1* and *2*. *Table 1* shows the formulations and some characteristics of table margarine. This type of margarine is categorised into packet and tub. These formulations have been tested and are found to be satisfactory. Interesterification of palm oil products, increase the percentage of palm oil products incorporated in these types of margarines. The interesterification reduces the solid content of the blend to a level suitable for margarine manufacture. The oral melting properties are correspondingly improved by interesterifying palm oil products, specially palm stearin, with non-lauric liquid vegetable oil.

Table 2 shows the formulations of industrial margarine. Direct blending of palm products with/without other liquid vegetable oil produces suitable industrial margarine. This type of margarine requires high solids at 20°C. Thus at this temperature, palm oil has about 23% solids and therefore is a valuable oil for industrial

TABLE 1. FORMULATION OF *TRANS* FREE TABLE MARGARINE

Type	Tub		Packet	
	1	2	1	2
Formulation	**IE(POs:PKO):RSO (60:40) 50:50**	**IE(POo:PKO):SBO (75:25) 80:20**	**IE(POS:PKOo):RSO (70:30) 60:40**	**IE(PKO:PO):SBO (30:70) 55:45**
SMP°C	33.2	31.5	35.8	33.2
SFC (%)				
5	33.4	43.2	–	–
10	27.8	33.3	–	–
15	19.9	21	22	22.8
20	13.5	14.2	15.8	15.8
25	9.5	6.5	–	–
30	6.4	2.5	6.7	5.8
35	1.7	t	2.6	2.7
37	1.6	t	–	–
40	–	–	–	–

ISSN 0128-5726

Palm Oil Research Institute of Malaysia, Ministry of Primary Industries, Malaysia
P. O. Box 10620, 50720 Kuala Lumpur, Malaysia. Tel: 03-8259155, 8259775, Telex: MA31609, Telefax: 03-8259446

TABLE 2. FORMULATIONS OF *TRANS* FREE INDUSTRIAL MARGARINE

Type	Industrial	
Formulation	**POs(50°C):PO:POo:SBO 10:40:30:20**	**PO:POs:PKO 60:20:20**
SMP°C	36.4	43.5
SFC (%)		
5	48.1	64.7
10	40.1	52.7
15	27.8	35.9
20	16	24.7
25	9	1 5.4
30	5.1	10.6
35	3.6	7.1
37	1.6	4.8
40	0.9	

margarines. Various levels of palm oil product can be used in this margarine, ranging from 50 to 100 percent. Palm kernel oil has good creaming properties due to its fast crystallisation behaviour, enhancing its use in these types of margarines and in cake margarine.

RAW MATERIALS

The raw materials used in the preparation of various types of *trans* free margarines are:

(i) Fat phase - palm oil and its products and liquid vegetable oil, *e.g.,* sunflower oil, canola oil, soya bean oil, *etc.*

(ii) Aqueous phase - water, emulsifier, colouring, flavour, salt.

TRANS FREE MARGARINE PREPARATION

The preparation of these *trans* free margarines was carried out using the Kombinator which is basically made up of two rotators and a blender. The whole unit is cooled by a refrigeration unit attached to it.

In the preparation of these margarines, the fat phase was heated in the emulsions tank. Then the aqueous phase consisting of water, emulsifier, flavour and colour was slowly added and properly homogenized (*Figure 1*). The homogenized solution was then pumped into the two votators. After passing through the two rotators, the products became semi-crystallized, this semi-crystallized solution was then passed through a blender. In the blender, the product was whipped for a few minutes and the finished margarine was filled in containers and stored.

TABLE 3. ESTIMATED PROFITABILITY PARAMETERS OF PROPOSED *TRANS* FREE MARGARINE PRODUCTION

Measurement	Value
NPV (RM million)	1.9
IRR (%)	40%
B/C Ratio	1:1
Payback Period (Year)	3 1/2

Notes: *Discount at 10% interest rate per year
*Processing capacity at 100 kg/hr @ 360 tonnes/year on a continuous basis.

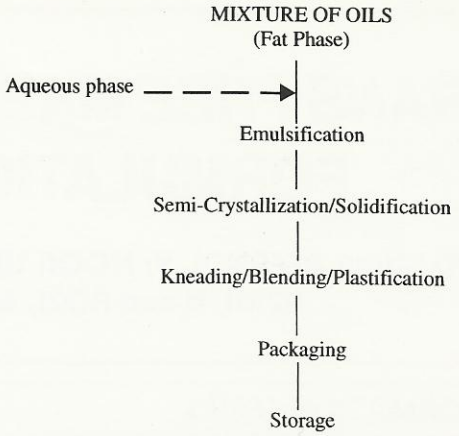

Figure 1.

ECONOMIC STUDY

The economic analysis in terms of Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio and Payback Period (PBP) are presented in *Table 3*. The preliminary analysis indicates that the investment is financially viable. At long term average price level of RM 7.00/kg (Table Margarine) and RM5.0 kg (Industrial Margarine), an NPV of RM 1.9 million can be generated at the assumed borrowing rate of 10.0%. A positive NPV suggests that the investment is financially viable. The IRR is computed to be 40%. This rate of return exceeds the cost of capital of 10% and thus reaffirms the findings that the investment is financially viable. The B/C ratio at 1:1 and payback period at approximately 3 1/2 years also indicates that the investment is a viable proposition.

It can be concluded that the investment on medium scale of *trans* free margarine production is found to be financially viable and is a profitable venture. The viability of the venture could be improved if the cost of capital can be further reduced.

CONCLUSION

Various types of *trans* free margarines were produced using palm oil and its products either with direct blending and/or interesterifying. The desired characteristics of these margarines could also be achieved with the addition of other liquid oils. Thus hydrogenation is not needed in the preparation of these margarine

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For more information kindly contact:

Director-General
PORIM
P. O. Box 10620
50720 Kuala Lumpur
Malaysia