PALM-BASED METHYL ESTER SULPHONATES

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MAY 2002
160
MPOB TT No. 143

MPOB INFORMATION SERIES ISSN 1511-7871

Through its R&D activities, MPOB now has a technology to produce an active ingredient (technically known as anionic surfactant) from palm oil and the active ingredient can be used to formulate cleaning products, such as liquid and powder detergents. The active ingredient is called methyl ester sulphonates or in short MES.

MES was found to have good cleaning power. It does not pollute the environment and is suitable to be used in hard water. Preliminary calculation indicates that MES can be produced at a cost cheaper than the current active ingredient used in detergent formulation, which is linear alkyl benzene sulphonates or in short LAS (*Table 1*).

LAS is an active ingredient commonly used in the detergent industry and because of its popularity has been nicknamed the *workhorse of the detergent industry*. LAS is derived from petrochemicals. It has good cleaning power, good foaming characteristic and does not pollute the environment. However, potential pollution to the environment is normally measured in terms of biodegradation characteristics and when the biodegradability of MES is compared to LAS, MES is found to be better.

Data gathered from Statistics Department of Malaysia revealed that the imports of alkyl benzene sulphonates (ABS) into Malaysia have been increasing, with the exception of 1998 and 1999, probably due to the financial crisis (*Figure 1*). The average growth rate for the import of ABS is 24% per year. Majority (greater than 80%) of the imports are consumed (*Figure 1*). Besides alkyl benzene sulphonates, Malaysia also imports other anionics and majority of this are also consumed (*Figure 2*). In 2000, Malaysia imported 3885 t of alkyl benzene sulphonates valued at RM 13.5 million, and 10 740 t of other anionics valued at RM 44 million (*Figures 1, 2* and *3*), a total imports of RM 57.5 million per year. During the last five years the average prices (RM kg^{-1}) of the imported ABS and other anionics were RM 2.790 kg^{-1} and RM 4.032 kg^{-1} (*Figure 4*) respectively.

In the same year, Malaysia consumed 12 540 t of active ingredients. If it is assumed that the actives are used to

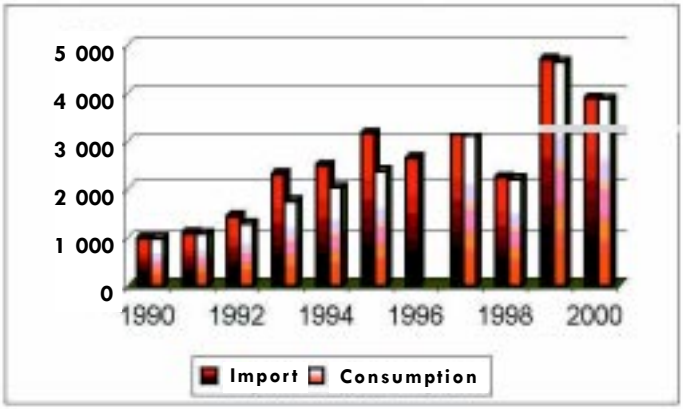

Figure 1. Imports and consumption of ABS (t)

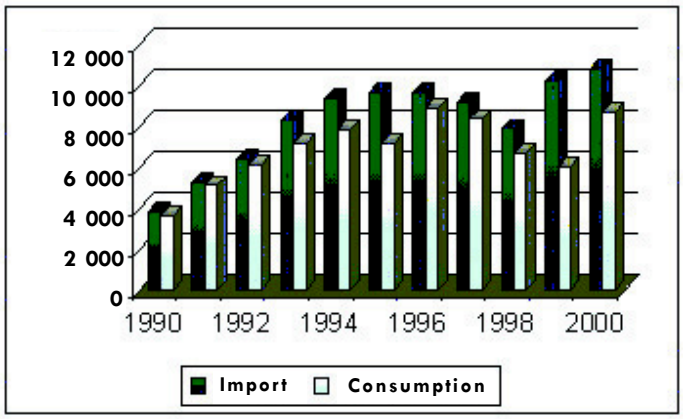

Figure 2. Imports and consumption of other anionics (t)

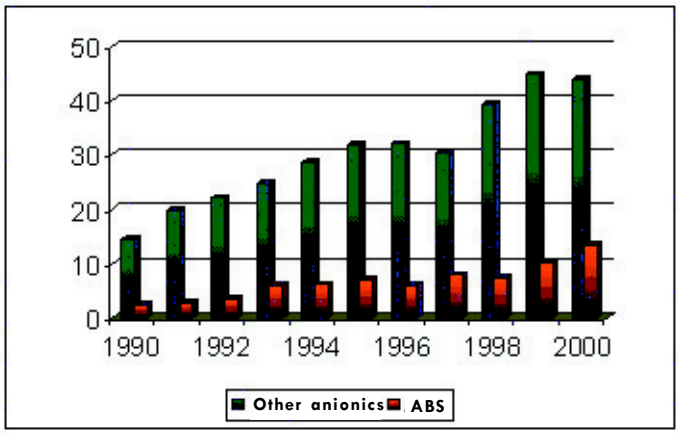

Figure 3. Imports of ABS and other anionics (RM million)

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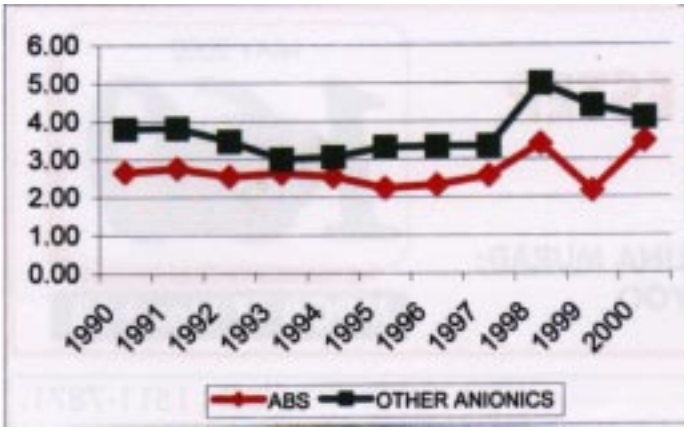

Figure 4. Prices of imported ABS and other anionics (RM kg^{-1})

formulate detergent containing 20% actives then 63 000 t of detergent was consumed implying that the average per capita consumption of detergent in Malaysia is 2.73 kg capita^{-1}.

Thus, if MES were to be produced commercially in Malaysia, the following advantages could be realized:

1. Cheaper active ingredient for detergent manufacturers: Federation of Malaysian Manufacturers (FMM) website indicates that there are at least 60 companies producing detergent and other cleaning products in Malaysia. Since these companies do not have facilities to produce the actives it is assumed that the actives are imported. If MES were sold in Malaysia then these manufacturers could enjoy a cheaper active ingredient to manufacture their products.

2. Saving on foreign exchange. As indicated above Malaysia imports about RM 13 million worth of ABS. If MES were to be produced, then there could be a saving on foreign exchange worth at least RM 13 million per year. The saving is of course greater if substitutes for other imports are taken into consideration.

3. Promote the use of more environmentally friendly ingredient. Since MES has better biodegradation characteristics than LAS, the use of MES will help to improve the environment.

4. Helping towards the development of palm oil downstream activities. Malaysian Industrial Master Plan has been promoting the development of palm oil downstream activities since the downstream activities will help to diversify the end-uses of palm oil making Malaysia less dependence on commodity prices. Downstream product also fetches higher value per weight. The technology required to produce downstream product is usually capital intensive and therefore, if promoted will make Malaysia less dependence on labour.

5. ASEAN Market with the coming of AFTA, the potential market for MES is not only in Malaysia but also the whole ASEAN population of 510 million. If it is assumed that the average per capita consumption of detergent for ASEAN is 1 kg capita^{-1} then at least 510 000 t of detergent need to be produced and this will require at least 100 000 t of MES. Since the price of MES is expected to be cheaper than ABS, penetrating the ASEAN market should be easy.

TECHNOLOGY TO PRODUCE MES

Starting from palm oil, the technology to produce MES involves converting palm oil to methyl ester followed by hydrogenation to reduce the degree of unsaturation and then sulphonating the ester to produce MES (*Figure 5*). The technologies required for each stage of the process are available.

If the proposed palm diesel project between Petronas, MPOB and plantation companies are successfully implemented, generous quantities of the right type of methyl ester will be available, and much cheaper too. Thus, this project will also benefit greatly from the success of the palm diesel project which will supply the raw material.

ECONOMIC VIABILITY

The economic viability of a project will of course depends on the project strategy and *Figure 5* lists the stages for the production, uses of MES and the major factors to be taken into consideration when deciding on a strategy. MPOB has also purchased a 20 kg hr^{-1} pilot plant capable of producing MES with high active. Besides MES, the pilot plant can also be used to produce fatty alcohol sulphates and fatty ether sulphates. The pilot plant may be used by industry members to study the technology to produce MES in greater detail, use the surfactant(s) produced from the pilot plant to formulate finished detergents and evaluate the performance and evaluate scale up cost and efficiencies.

Besides the figures given, *Table 1* may be useful for companies to make a preliminary evaluation on the economic viability of producing palm-based MES commercially.

Interested parties may contact either of the personnel listed below for more information or further discussions.

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TABLE 1. COST OF PRODUCTION: COMPARISON BETWEEN MES/LAS

1. Approximate cost of a commercial plant to produce MES from hydrogenated, distilled methyl ester at				
1.1	3.5 t hr^{-1} capacity			US$ 8 million**
1.2	5.0 t hr^{-1} capacity			US$ 9 million**
2. Typical qualities of methyl ester required are:				
2.1	Iodine value			- 0.6
2.2	Water (Karl Fischer) (wt %)			- 0.1
2.3	Unsulphonated Matter (wt %)			- 0.5
3. Based on C16-C18 methyl ester, the expected quality of MES to be produced are:				
			Typical value	Guaranteed Value
3.1	Surfactant content (wt %)		87	85
3.2	Volatile oil component (%)		2.0	- 2.5
3.3	Disalt content (%)		4.0	- 6.0
3.4	Moisture (%)		2.0	- 4.0
3.5	Methanol (as is) (%)		0.2	- 0.4
3.6	Colour, Klett		30 to 70	- 100
4. Comparison on cost to produce 1 t of MES versus 1 t of LAS in US$				
			MES	LAS
4.1	Sulphur		12.1	11.22
4.2	Linear alkyl benzene		-	808.96
4.3	Methyl ester		374.33	-
4.4	Sodium hydroxide		34.76	57.20
4.5	Methanol		12.00	-
4.6	Hydrogen peroxide		15.65	-
4.7	Sodium sulphate		2.00	-
4.8	Nitrogen		2.63	-
4.9	TOTAL RAW MATERIALS		453.47	877.38
4.10	Electricity		21.35	18.36
4.11	Steam		17.83	1.22
4.12	Cooling Water		1.20	1.20
4.13	TOTAL UTILITIES		40.38	20.78
4.14	Operating labour		12.00	12.00
4.15	Maintenance		10.65	10.65
4.16	General overhead (50% operating cost)		6.63	6.63
4.17	Tax and insurance (1% capital)		1.96	0.88
4.18	TOTAL OPERATING COST		21.24	30.16
4.19	TOTAL Cost t^{-1}	US$	525.09	928.32
		RM	1995.34	3527.62***

Note:

** . The exact cost will depend on the number and types of surfactants to be produced.

***. Data indicates that average imported prices of alkyl benzene sulphonic acids or alkyl benzene sulphonate (Custom code 3402.11.100 or 554-211-100) into Malaysia is RM 2790 t^{-1} and other anionics (Custom code 3402.11.900 or 554-211-900) is RM 4032 t^{-1}. The cost to produce MES is less than RM 2000 t^{-1}.

Source: INFORM (December 2001).

PROJECT STAGES		FACTORS TO CONSIDER
STAGE 1	PALM OIL ↓ CRUDE METHYL ESTER ↓ DISTILLED METHYL ESTER	• There are at least three companies producing methyl ester in Malaysia. • Interested party may make arrangement to purchase the methyl ester from these companies, however the party will be dependent on the supplier of the ester. • If interested party decides to produce methyl ester then the approximated capital required is US$ 6 million.
STAGE 2	↓ HYDROGENATED METHYL ESTER ↓ METHYL ESTER SULPHONATES	• A commercial plant for 3.5 t hr^{-1} and 5 t hr^{-1} cost approximately US$ 8 million and US$ 9 million respectively. • Cost for hydrogenation plant is approximately US$ 3 million. • An interested party may decide to produce MES and sell it to detergent manufacturers. There are at least 60 detergent manufacturers in Malaysia. • Exporting MES within ASEAN is easy.
STAGE 3	↓ FORMULATED DETERGENT ↓ CONSUMER PRODUCTS	• An interested party may decide to use the MES to produce detergent and sell to consumers. • The cost of a detergent finishing line is approximated at US$ 3 million. • If interested party decides to market finished detergents then packaging and BRAND need to be seriously considered since the party need to compete with established brands from P&G, Unilever and C-P.

Figure 5. Project stages and factors that need to be taken into considerations when formulating project strategy.

For more information kindly contact:

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