CONVERSION OF METHYL ESTER SULPHONATES (MES) FROM PASTE TO POWDER USING CLOSED LOOP SPRAY DRYER

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MPOB INFORMATION SERIES • ISSN 1511-7871 • JUNE 2015 MPOB TT No. 579

THE TECHNOLOGY

Methyl ester sulphonates (MES) are anionic surfactants that had been extensively studied and formulated since 1950. MES type of anionic surfactants are used as the primary surfactants in powder and liquid laundry detergents as well as in dish washing liquids. MES can be produced from palm methyl ester which is subjected to sulphonation, bleaching, neutralisation, drying, flaking/needle and milling processes. The final product is in the form of flakes or the MES flakes grounded to powder. MES-based powder detergent is prepared either by mixing MES powder with builder-and-filler ingredients or by spray drying the MES slurry with builder-and-filler.

THE PROCESS

A new and improved method in converting MES from paste to powder using closed-loop spray dryer reduces the process from five to three steps as in *Figure 1* (Zulina *et al.*, 2014). The single spray drying step eliminates drying, flaking and milling steps of the conventional finishing process that will convert MES paste into fine, free flowing powder. The spray drying step is part of a closed-loop spray drying with dehumidifier. The 30%-50% of MES slurry in solvent is spray-dried via an atomiser at 100°C to 250°C and pressure of 50 psi (*Figure 2*).

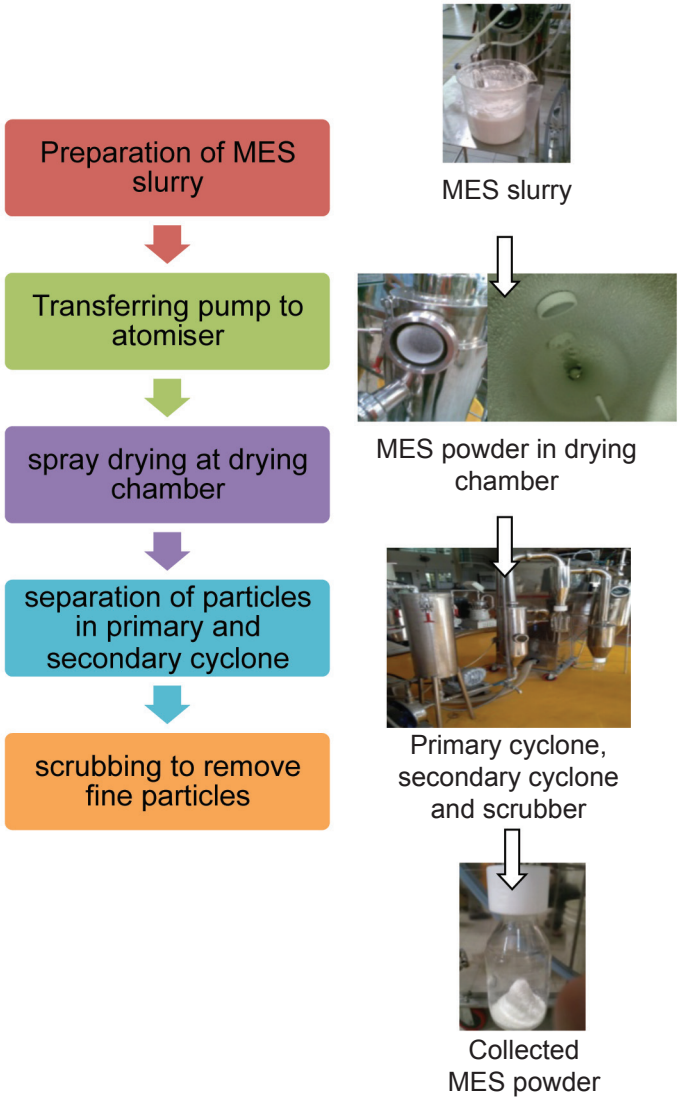

Figure 2. Flow diagram and facilities for spray drying process.

Figure 1. Flow diagrams for the preparation of MES powder comparing conventional with spray drying method.

ISSN 1511-7871
9 771511 787001

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THE PRODUCT: FREE FLOWING DRY MES POWDER

The resulting free flowing MES powder possesses high quality properties including high active content, low moisture content and minimal amount of methanol, suitable to be incorporated into detergent formulations (*Table 1*). The MES powder solution exhibits a surface tension of 33.35 to 34.56 mN m^{-1} and critical micelle concentration (CMC) of 0.158 to 0.279 ppm. The MES powder solution has the ability to lower water interfacial tension at 0.336 mN m^{-1} and exhibits good conductivity, which resulted in better solubility properties. Improved conductivity and solubility of the MES powder are attributed to the smaller particle size of the powder.

TABLE 1. PROPERTIES OF FREE FLOWING POWDER METHYL ESTER SULPHONATES (MES)

Parameter	Value
Active content	86% – 90%
Moisture content	< 3%
10% pH	5 - 6
Methanol	< 0.5%
Particle size at distribution (0.5)	50 – 90 μm
Fill density	185 - 351 kg m-3
Surface tension	33.35 - 34.56 dyn cm^{-2}
Conductivity at 24°C (0.8 ppm)	8.81 μs cm^{-1}
Interfacial tension	0.336 ± 0.008 mN m^{-1}
Critical micelle concentration(CMC)	0.158 - 0.279 mg $litre^{-1}$

MARKET ANALYSIS

The global market for biosurfactants is expected to reach USD 2308.8 million by 2020. Escalating consumer preference towards the use of bio-based products is expected to increase biosurfactant market penetration. In addition, stringent regulatory policies supporting environmental-friendly products are expected to boost the biosurfactant demand. MES was the largest consumed biosurfactant in 2013 accounting for 33.26% of the 344 000 t in global market. Its superior properties in terms of foaming and stability compared to other surfactants make it ideally suitable for use in household detergents (Grand View Research Inc, 2014).

ECONOMIC ANALYSIS

The estimated investment cost for the conversion of MES from paste to powder using closed-loop spray dryer is given below:

Item	Value
Cost of equipment	RM 500 000
Production of spray dried MES Production capacity = 100 kg hr^{-1}	384 000 kg yr^{-1}
Internal rate of return (IRR)	31%
Net present value (NPV)	RM 1 007 652
Payback period	3 years

ACKNOWLEDGEMENT

MPOB would like to acknowledge the contribution made by Sime Darby Research Sdn Bhd.

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