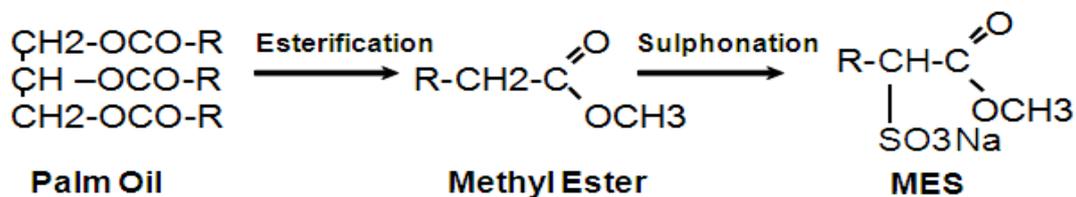


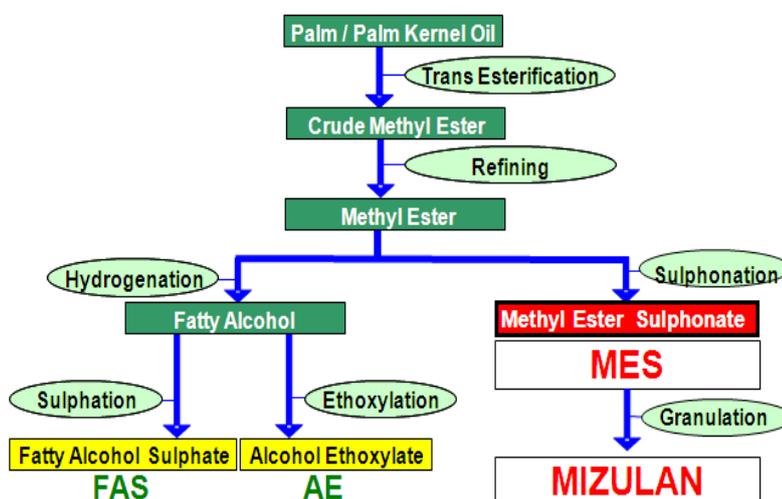
MIZULAN, Methyl Ester Sulphonate (MES) for Laundry Detergent



Methyl Ester Sulphonate (MES) is an anionic surfactant derived from vegetable oils, through esterification and sulphonation. MES is suitable as an ingredient of laundry detergent due to its properties and performances.

Production Process

MES is produced through the original technology developed by Lion Corporation, Japan which has more than 20 years of experience in using MES in its heavy duty detergent powder. The production process of MES is one step shorter than that of Fatty Alcohol Sulphate and Alcohol Ethoxylate. MIZULAN is MES produced by Lion Eco Chemicals.



MIZULAN P-82



MIZULAN P-82 is available in free-flow granules which can be easily incorporated into any powder detergents by post addition without any modification of the manufacturing process. It gives the flexibility of formulation to the detergent producers.

MIZULAN FL-80



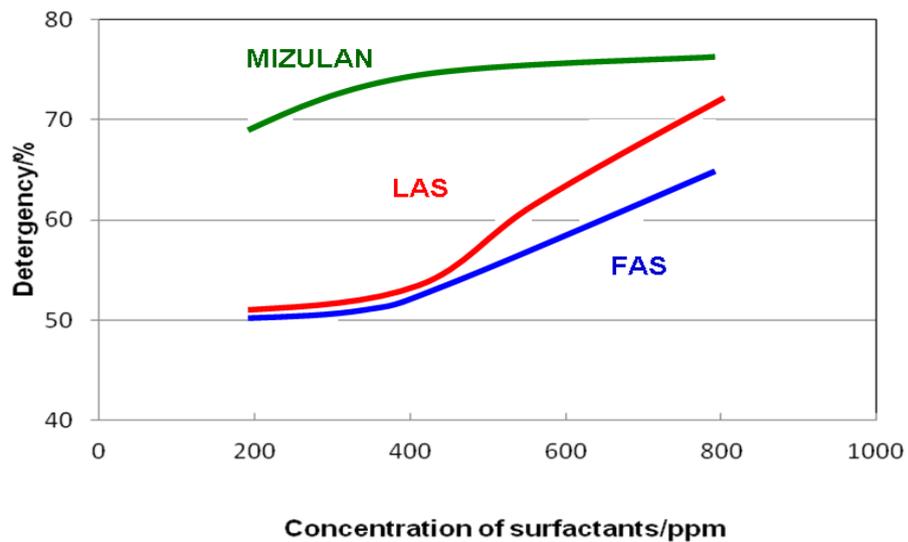
MIZULAN FL-80 is available in free-flow flakes which can be diluted in a pre-mix with water. The MIZULAN solution can then be easily substituted or partially substituted as an anionic surfactant for liquid detergent formulations.

1. Detergency of MIZULAN

High Detergency at Low Dosage

The figure shows performance of detergents formulated with different surfactants at different dosage in hard water condition. MIZULAN shows higher detergency than other commonly used surfactants such as Linear Alkylbenzene Sulphonate Sodium Salt (LAS) and Fatty Alcohol Sulphate (FAS). The figures exhibit that 200 ppm of detergent with MIZULAN has almost 20% more detergency than a 200 ppm of detergent with LAS or FAS. It suggests the prospect of reducing the content of surfactants in detergent formulation when MIZULAN is applied.

Fig. 1 Detergency and Concentration of surfactants

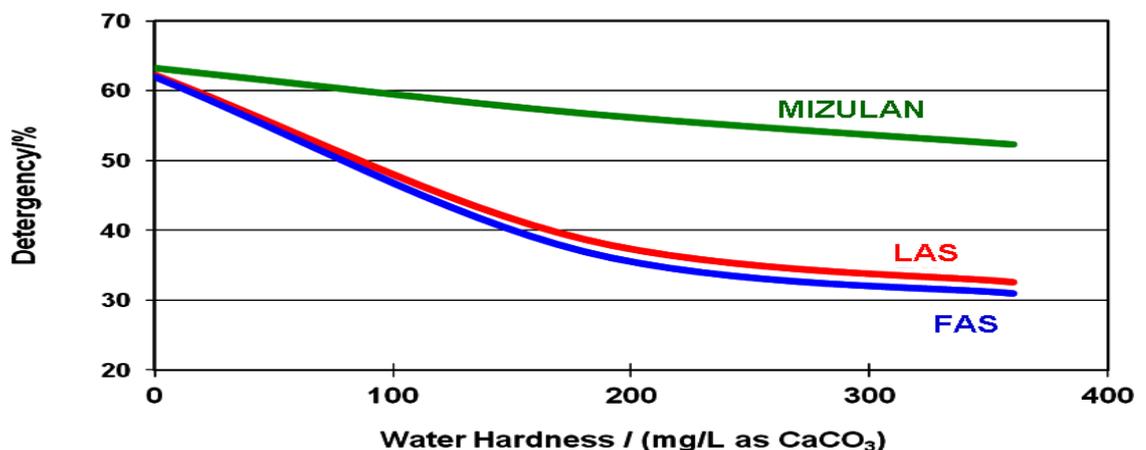


Conditions: Terg-O-Tometer 120 rpm 15 min., 35°C, 180mg/L as CaCO₃, Krefeld 10D (cotton), Na-Ash 250ppm, Zeolite 300ppm

High Detergency in Hard Water

Generally, detergency of surfactants decreases by increasing water hardness. Compared to other surfactants, MIZULAN maintains its detergency even at extreme water hardness. It suggests prospect of reducing the content of calcium chelating agent in the detergent formulation when MIZULAN is applied.

Fig. 2 Detergency and Hard Water

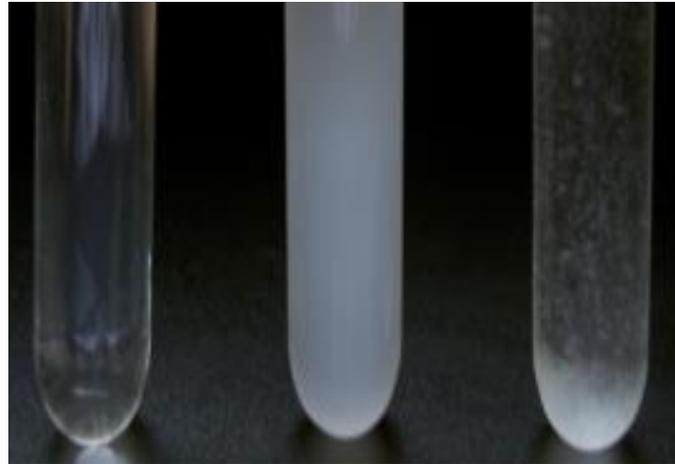


Conditions: Terg-O-Tometer 120rpm 15min, Krefeld10D (cotton), Surfactant 270ppm, Na-Ash 270ppm 25°C

Water Hardness Tolerance

MIZULAN shows higher tolerance against water hardness. This picture shows the appearance of surfactant solution right after the addition of calcium ion. MIZULAN solution remains clear while other surfactants soon form water insoluble complex with calcium. It suggests that MIZULAN would be effective even in hard water.

Fig.3 Appearance of Calcium solution



MIZULAN

LAS

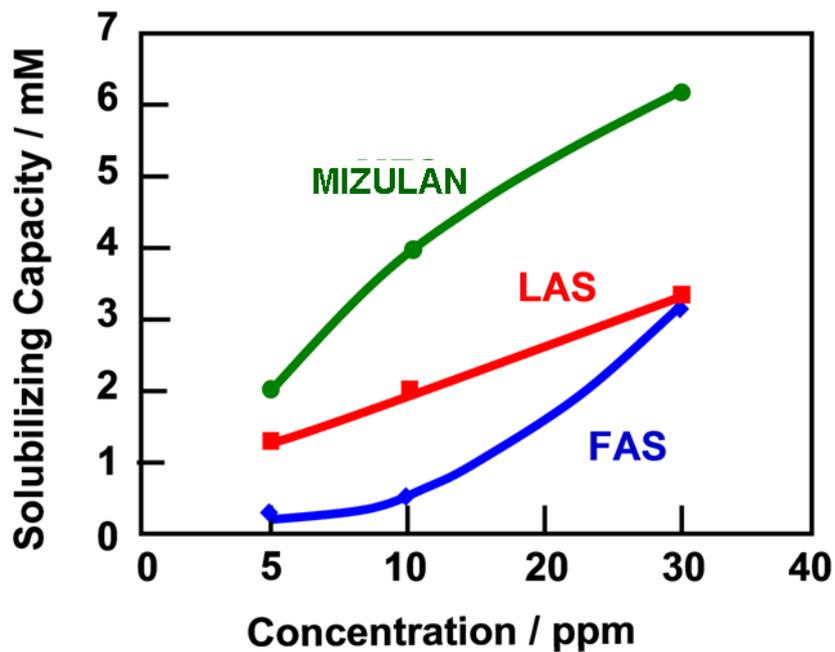
FAS

Conditions: Surfactants 270ppm, Calcium 180ppm as CaCO₃, 20°C

Oleic acid solubility

MIZULAN's capability to solubilize in aqueous oleic acid is much higher than of LAS and FAS. This is one of the reasons for high detergency of MIZULAN.

Fig.4 Oleic Acid Solubility

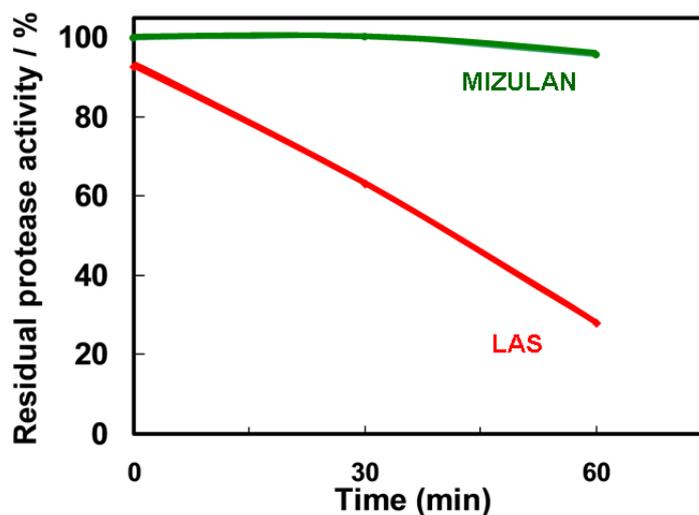


2. Other Characteristics of MIZULAN

Effect on Stability of Enzyme

Enzyme is one of the important ingredients of detergents influencing its detergency. Generally, protease, the typical enzyme for laundry detergents, gradually loses its activity during washing under coexistence of surfactants like as shown in the figure. But MIZULAN has good compatibility with protease and gives no effect to enzyme activity in washing water. It suggests that detergents with MIZULAN would maintain its detergency during washing time.

Fig.5 Enzyme Activity in Washing Time

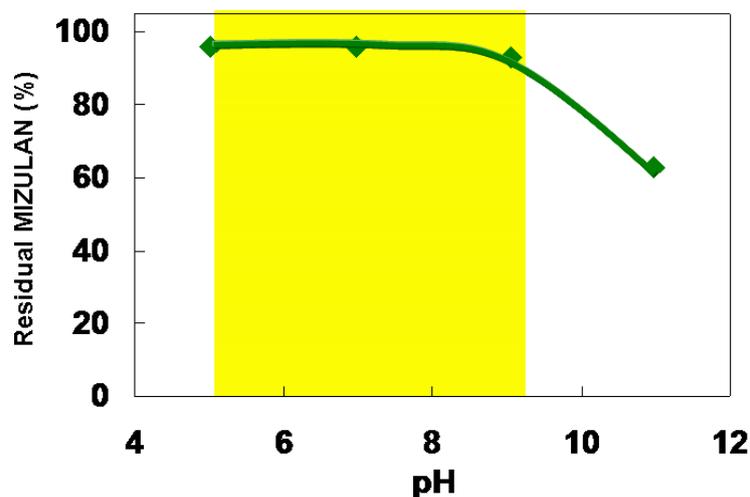


Evaluation conditions : Surfactant 800ppm, Protease 50ppm, Zeolite 1000ppm, Ash

MES stability in Liquid Detergent

MIZULAN FL-80 has good stability between pH 5 and pH 9 in liquid formula.

Fig. 6 Stability of MIZULAN in Liquid detergent Formula



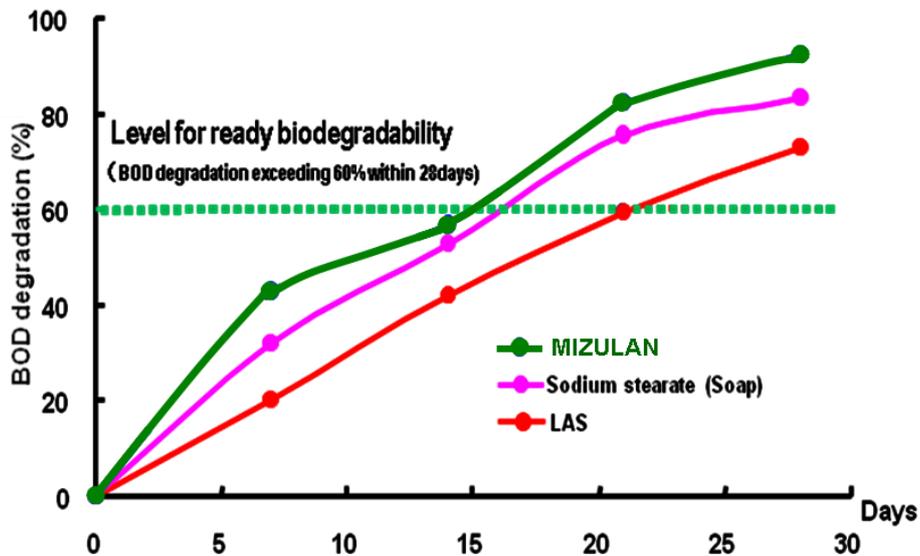
Stability condition: Storage for 1 month at 50C

3. Environmental Features of MIZULAN

Ready Biodegradability

MIZULAN is easily and rapidly biodegraded in the environment. Biodegradation of MIZULAN proceeds faster than that of Linear Alkylbenzene Sulphonate (LAS) and Sodium Stearate (Soap) as shown in the figure below. Biodegradability of MIZULAN is faster due to its low protein denaturalizing property.

Fig. 7 MIZULAN Biodegradability



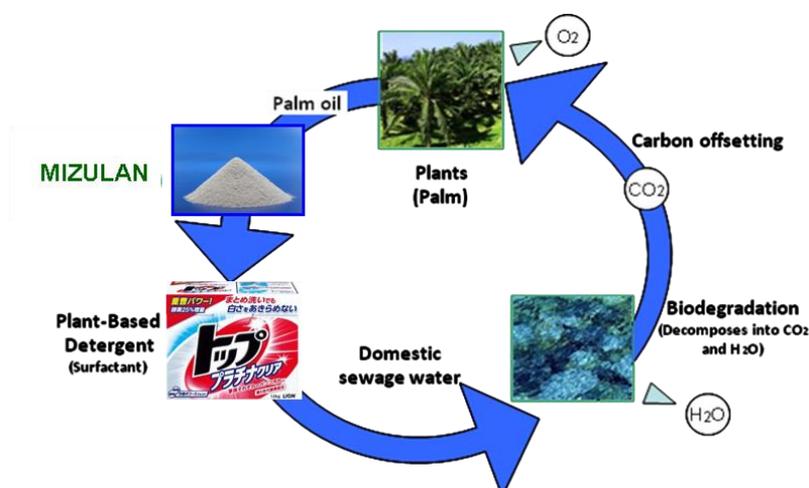
Test method: OECD 301C – Aerobic biodegradability testing method using activated sludge in a darkened, enclosed respirometer at $25 \pm 1^\circ \text{C}$

Source: Ministry of International Trade and Industry in Japan

Carbon Neutral

The nature of MIZULAN is carbon neutral because it is derived from plants. As shown in the figure, Carbon Dioxide (CO_2) released by MIZULAN during biodegradation had originally existed in the air. So CO_2 in the air does not increase in this cycle.

Fig.8 Carbon Neutral

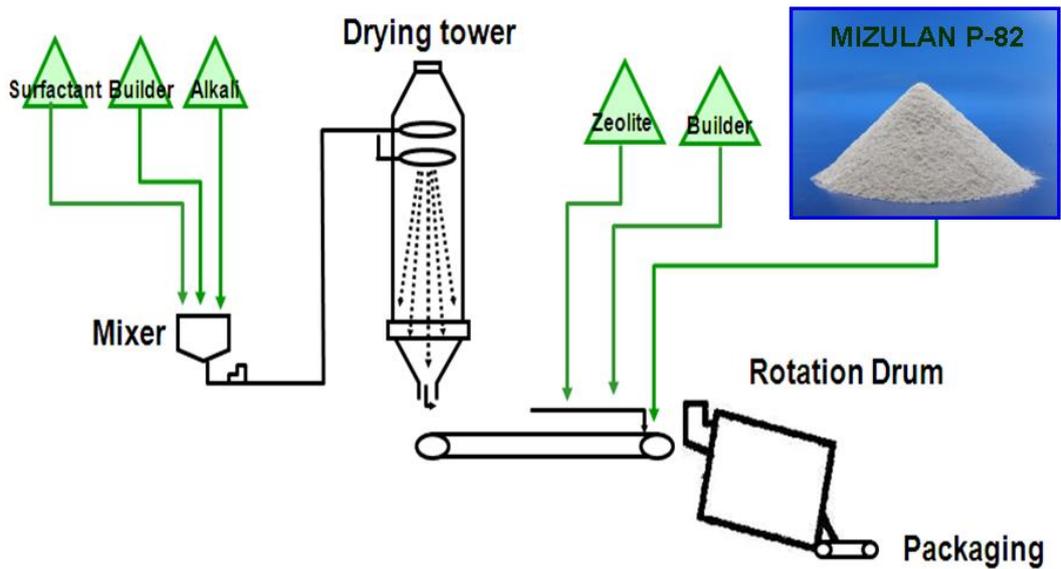


4. MIZULAN Advantages in Detergent Manufacturing Process

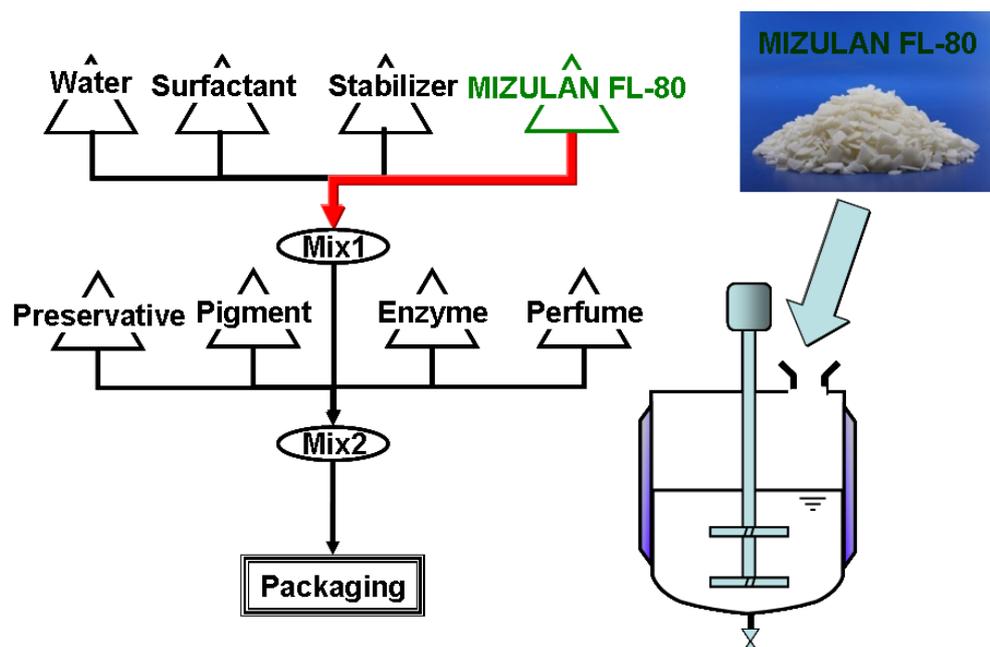
Application of MIZULAN in Detergents

MIZULAN P-82 only requires dry blending for the application as surfactant in detergents. This means MIZULAN can be post added after the spray drying process together with ingredients such as enzymes, fragrance, etc. On the other hand, MIZULAN FL-80 is dropped into mixing tank directly, which is more beneficial in terms of convenient.

Powder detergent (Spray Drying Process)



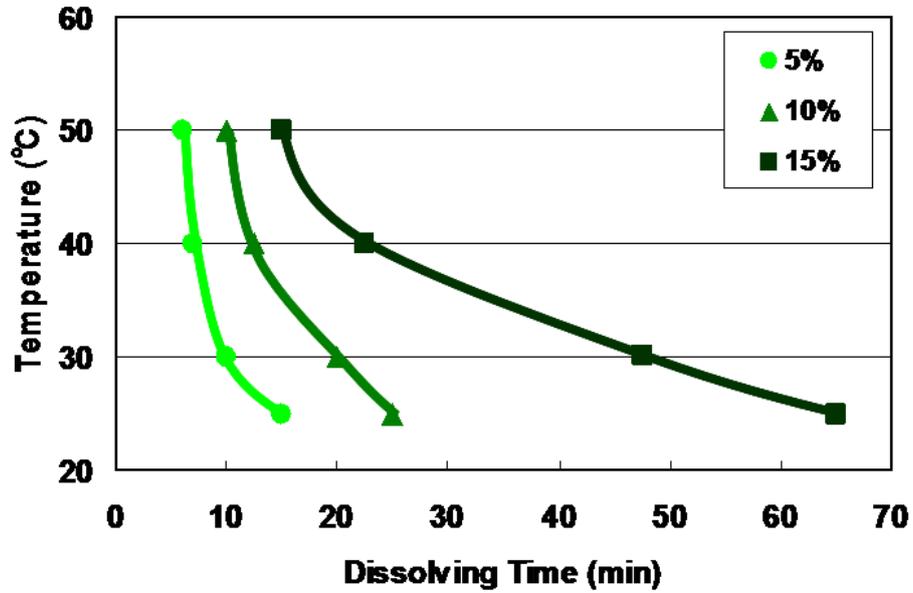
Liquid detergent (Direct Mixing Process)



Dissolving time of MIZULAN in water

MIZULAN FL-80 is dissolved in warm water easily.

Fig. 9 MIZULAN Dissolving Rate

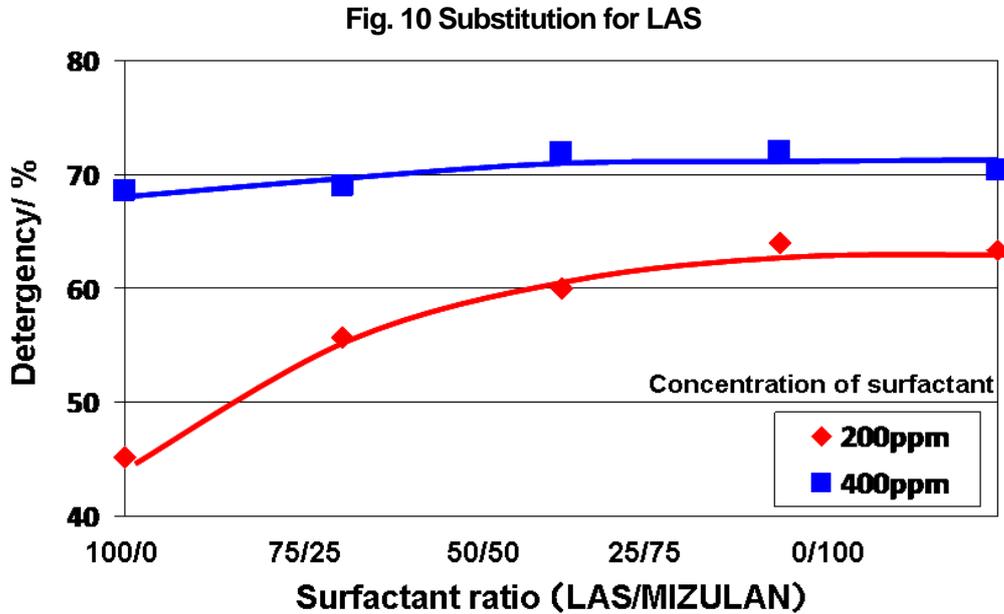


Evaluation condition: 500g (MIZULAN FL-80 and water) stirring in 1L flask

5. Application of MIZULAN

Partial substitution of MIZULAN for conventional surfactants

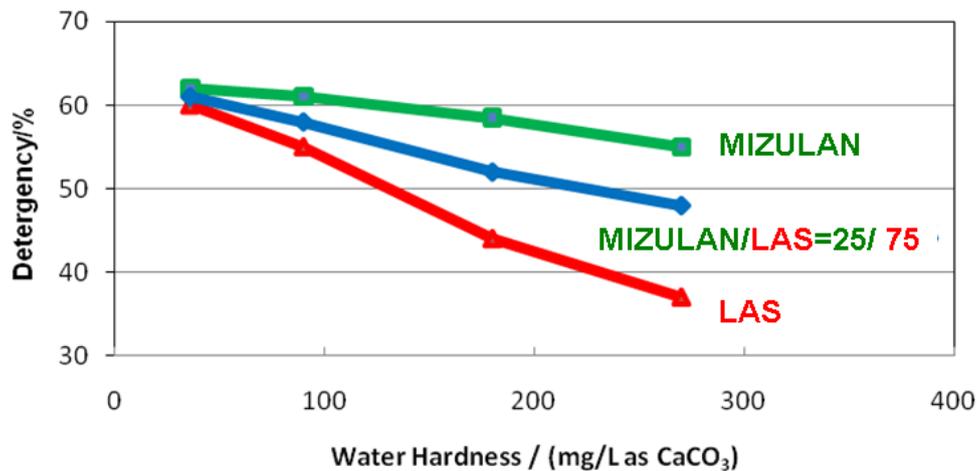
25% substitution of MIZULAN into LAS improves the overall detergency, especially at lower surfactant dosage. It suggests that MIZULAN can reduce the content of surfactant in detergent upon formulation with LAS.



Conditions :Krefeld10D (Pigment, sebum/cotton), Terg-O-Tometer, 25°C,
 Dosage:2g/L Water hardness 90mg/L as CaCO₃ ,
 Formula (%):Surfactant 10 or 20, Na₂CO₃ 12.5, Zeolite 15, Na₂SO₄ 30

The substitution of LAS with 25% MIZULAN improves the detergency of LAS in hard water conditions. It suggests that a detergent with LAS/ MIZULAN combination is suitable for high hard water areas.

Fig. 11 Effect of Partial Substitution for LAS in Hard Water



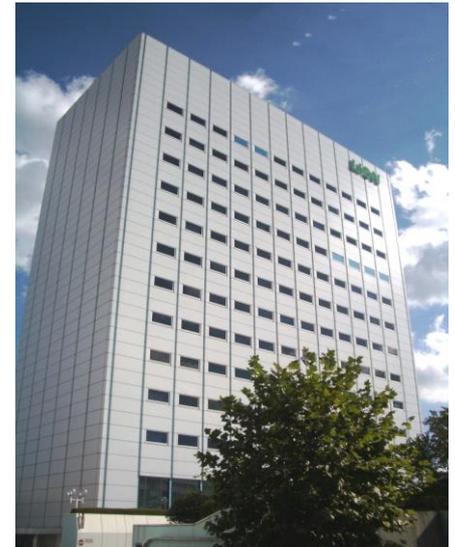
Conditions :Krefeld10D (Pigment, sebum/cotton), Terg-O-Tometer, 25°C, dosage:2g/L
 Formula (%):Surfactant 20, Na-Ash 12.5, Zeolite 15, Na₂SO₄ 30

6. Development of MES

History of Lion Corporation

Since 1891, Lion Corporation has been producing and supplying many kinds of home care products such as laundry detergents, dishwashing detergents, toothpastes, toothbrushes, body showers and pharmaceutical products. Now it is one of the largest home care products manufacturers in Japan and has many affiliate companies in the Asian countries.

Lion has been leading home care industry also in environmentally friendly products. In 1967, Lion developed a highly biodegradable surfactant, alpha-olefin sulphonates, and in 1980, developed phosphate-free detergents.



Headquarters of Lion Corporation
(Tokyo, Japan)

Technology on MES

Lion started its research and development activity on MES in 1970s, and began to produce MES and launched the first laundry detergent formulated with MES in 1991. Though MES was well known to the world's major detergent manufactures as a surfactant with high detergency and good biodegradability, no one had succeeded in commercial production of MES. Since then, Lion has been producing and marketing laundry detergents applying MES for 20 years in Japan. With such a long term experience, lots of technologies have been developed for manufacturing and applying MES.

Production of MES in Malaysia by Lion Eco Chemicals

Taking the opportunity that environmental concerns become so crucial worldwide, Lion established its subsidiary in Malaysia to supply MES to other detergent manufacturers in the world. Lion Eco Chemicals, started manufacturing and marketing MES in 2009 under the technologies of Lion Corporation.



"TOP", Detergent with MES
(Lion Corporation)



Lion Eco Chemicals Sdn. Bhd. (Malaysia)

LION ECO CHEMICALS SDN. BHD.

(Wholly owned subsidiary of Lion Corporation Japan)

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