

**M**icroemulsions are normally isotropic (clear), have very small droplets (~8-100 nm), low in viscosity and thermodynamically stable solutions. In contrast, the ordinary emulsions are milky white dispersions with higher viscosity, with droplets of  $>0.5 \mu\text{m}$  and only kinetically stable. Thus, the unique properties of microemulsions have generated great interest for use in high value products.

Microemulsions containing low molecular weight aliphatic or aromatic hydrocarbons have been investigated extensively, and there is growing interest to replace hydrocarbon oils with natural oils, such as long and medium chain alkyl triglycerides and alkyl esters. This is due to the many advantages of natural oils such as being renewable, biodegradable, non-flammable, harmless to the environment, and less toxic to end-users. This invention is on using palm oil derivatives (palm-based solvents and emulsifiers) and non-toxic co-surfactants (*e.g.*: 1,2 alkane diols) in the formation of microemulsions for practical applications.

### **USES AND PROPERTIES OF PALM- $\mu$ E SPRAY LIQUID CLEANERS**

There are numerous applications for microemulsions, for example, in detergents. The most important property of microemulsions for detergency is high solubilization capacity for both polar and non-polar soil compounds. This has very low interfacial tension between the aqueous and oil phases and spontaneous formation when the components are brought into contact. Other examples of detergent products formulated using the microemulsions are all-purpose spray liquid cleaners for hard household surfaces, all-purpose spray liquid cleaners containing natural insect repellent (*Figure 1*) and other industrial cleaning applications.



*Figure 1. Palm- $\mu$ E spray liquid cleaners with natural insect repellent.*

The physical properties of Palm- $\mu$ E spray liquid cleaners for hard surfaces are shown in *Table 1*. Their particle sizes, viscosity and pH are approximately similar. However, the conductivity varies from 109  $\mu\text{S/m}$  to 919  $\mu\text{S/m}$  and 136  $\mu\text{S/m}$  to 976  $\mu\text{S/m}$  for 15% and 20% (w/w) surfactants, respectively. With their very small droplet sizes (~7.5 nm to 9.5 nm) and low viscosity, the solutions can be applied on hard surfaces in diluted or concentrated form. Thus Palm- $\mu$ E can be used in spray cleaners with potentially superior grease and oily soil removal over powdered cleaning compositions.

### **CLEANING PERFORMANCE OF PALM- $\mu$ E AS ALL-PURPOSE SPRAY LIQUID CLEANER**

Cleaning tests (*Figure 2*) on a detergent cleaning tester 10 (DCT 10) found that Palm- $\mu$ E spray liquid cleaners performed better in cleaning and gave a better shine than a conventional liquid cleaner (*Figure 3*).

All formulae (F1, F2 and F3) showed good performance as cleaning solutions even after several dilutions (*Figure 4*). The products also gave a lasting shine to the cleaned hard surfaces. Adding a natural insect repellent will enhance the usefulness of the liquid cleaners by being able to confer health benefits as well.

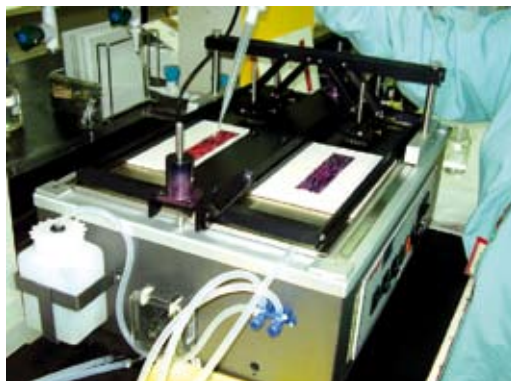


Figure 2. Detergent cleaning tester 10 (DCT 10).

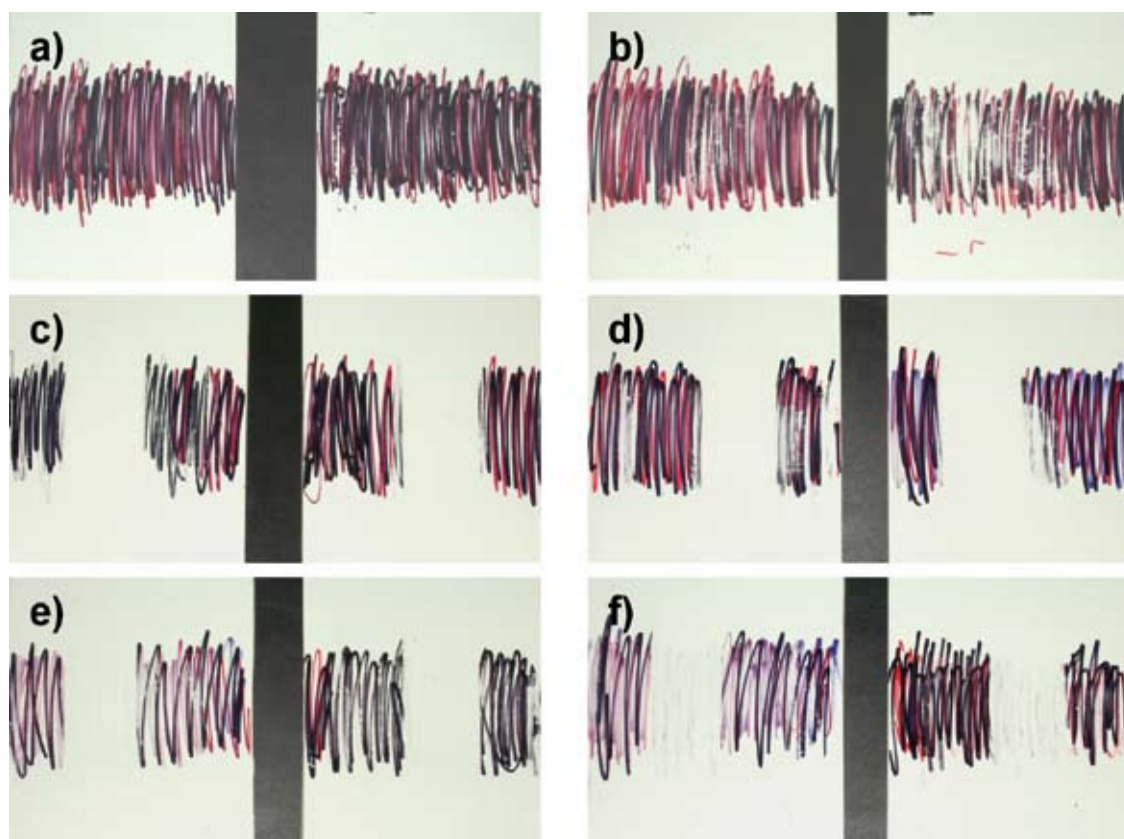


Figure 3. Appearance of glazed white tiles after washing with (a) distilled  $H_2O$ , (b) laboratory liquid cleaner, and Palm- $\mu E$  spray liquid cleaners at (c) 1:0, (d) 1:3, (e) 1:5, and (f) 1:9 ratios of dilution.

**TABLE 1. PROPERTIES OF PALM- $\mu$ E SPRAY LIQUID CLEANERS**

| Formula   | Conductivity ( $\mu$ Sm) | Particle size (nm) | Viscosity (cP) | pH  |
|---|--------------------------|--------------------|----------------|-----|
| F1<br>(15% S <sub>A</sub> )                                 | 109                      | 8.8                | 13.1           | 5.0 |
| F2<br>(15% S <sub>A</sub> +S <sub>B</sub> )                 | 137                      | 9.5                | 12.6           | 5.0 |
| F3<br>(15% S <sub>A</sub> +S <sub>B</sub> +S <sub>C</sub> ) | 919                      | 8.8                | 12.7           | 4.8 |
| F1<br>(20% S <sub>A</sub> )                                 | 136                      | 7.9                | 17.0           | 5.2 |
| F2<br>(20% S <sub>A</sub> +S <sub>B</sub> )                 | 141                      | 9.0                | 15.4           | 5.4 |
| F3<br>(20% S <sub>A</sub> +S <sub>B</sub> +S <sub>C</sub> ) | 976                      | 7.5                | 15.1           | 5.1 |

Note: S<sub>A</sub> and S<sub>B</sub> are ethoxylated non-ionic surfactants, and S<sub>C</sub> a sulphonated anionic surfactant.

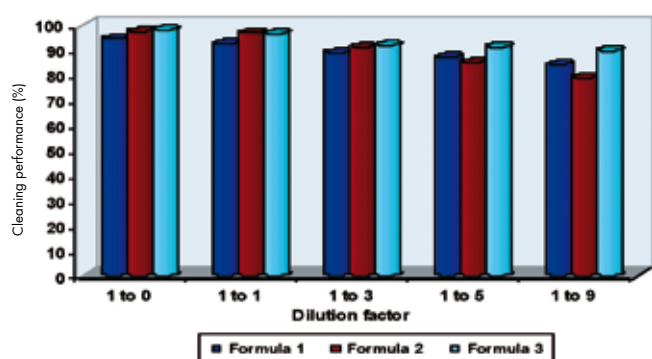


Figure 4. Cleaning performance of Palm- $\mu$ E spray liquid cleaners at various ratios of dilution.

### ADVANTAGES OF PALM- $\mu$ E AS ALL-PURPOSE SPRAY LIQUID CLEANER

- The palm-based derivatives are renewable, environment-friendly, less flammable (due to their higher flash points) and less allergenic to the users;

- Palm- $\mu$ E cleaning compositions can be better grease and oily soil removers than powdered cleaning compositions;
- Palm- $\mu$ E spray liquid cleaners are terpene-free, and with their good cleaning performance and longer shine are viable options for cleaning hard surfaces; and
- Palm- $\mu$ E spray liquid cleaners can be incorporated with oil-soluble active ingredients, such as natural insect repellents, disinfectants and fragrances, to enhance the value of products.

### CONCLUSION

Being a renewable resource with ready availability in the country, palm-based materials can be formulated into terpene-free Palm- $\mu$ E as all-purpose spray liquid cleaners.

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