

PALM-BASED INSECTICIDE FORMULATIONS

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Pesticides play an important role in agriculture sectors. Pesticides in Malaysia are mainly in the form of aqueous concentrates (AC) for herbicides, emulsifiable concentrates (EC) for insecticides and as wettable powders (WP) for fungicides. These formulations comprised more than 80% of the total pesticides marketed in Malaysia (MCPA, 1998; Abdullah, 1993). However, customers increasingly require safer and more convenient pesticides formulations such as suspension concentrates (SC), water dispersible granules (WDG) and oil-in-water emulsions concentrates (ECs) instead of WP, dusts and powders (D&P), and EC respectively.

Recently, many agrochemicals have been formulated as oil-in-water emulsions concentrates (ECs). ECs offer many advantages over the conventional EC formulations. ECs is an aqueous-based formulation, therefore, they may produce less hazards to the operators, e.g., they may cause less skin and eye irritation. They may also be less phytotoxic to plants and allow adding of water-soluble adjuvants to the formulations. The systems can also be less expensive to produce since mainly water is used instead of oil for the preparation of ECs.



At present, there is a shift from petroleum-based oils to natural-based oleochemicals such as palm-based surfactants and solvents as inert ingredients in pesticides formulations. The advantages of the natural-based oleochemicals are that they are renewable, biodegradable, non-flammable and cause fewer medical problems and allergies to the operators. This paper therefore discusses the potential use of palm-based surfactants and solvents as inert ingredients in ECs of pyrethroid-insecticide formulations.

RAW MATERIALS

The basic raw materials for making ECs pyrethroid-insecticides formulations are as follows:

- Palm-based solvents.
- Palm-based surfactants.
- Synthetic pyrethroid insecticides (i.e. es-fenvalerate, α -cypermethrin, cypermethrin and 1-cyhalothrin).

EMULSIFICATION PROCESS

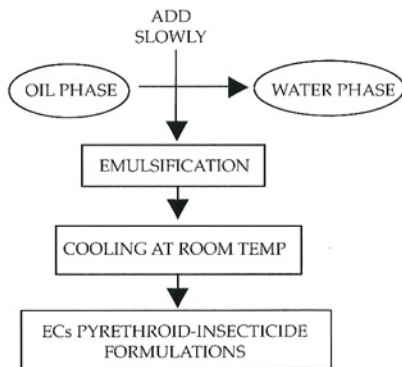


Figure 1. Emulsification process for ECs pyrethroid-insecticide formulations.

ECs of pyrethroid-insecticide formulations were produced through the **emulsification process**. The insecticide was solubilised homogeneously in the **oil phase** and poured slowly into the jacketed beaker that contained the surfactant/blended surfactants in **water phase**. The water phase was heated at the desired temperature. The mixture was emulsified using a homogeniser with a speed which gradually increased from 1000 to 8000rpm for about 10 minutes. Then, the homogeniser speed was decreased gradually and the ECs formulation was cooled at room temperature (RT). The whole process is illustrated in **Figure 1**.

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PHYSICAL CHARACTERISTICS OF PALM-BASED INSECTICIDE FORMULATIONS

The physical properties of palm-based solvents were compared with the petroleum-based oils (also called mineral oils). The viscosity and surface tension of palm-based solvents are comparable to the mineral oils, but their flash point values indicate that they are much less flammable than the mineral oils (Table 1) (Ismail et. al., 1998).

TABLE 1. PHYSICAL PROPERTIES OF PALM-BASED SOLVENTS AND MINERAL OILS

Palm-based solvents/ mineral oils.	Physical properties		
	Viscosity (cP), 25°C	Surface tension (mNm ⁻¹), 25°C	Flash points (°C)
Solvent 1 ^a	9.7	29.7	170
Solvent 2 ^b	5.3	32.0	170
Solvent 3 ^c	5.6	31.8	170
Solvent 4 ^d	3.4	30.6	130
Solvesso 150 ^e	1.5	31.5	66
Xylene ^f	0.74	29.7	28

a, b, c, d are palm-based solvents, and e, f are mineral oils. The solubility studies of some synthetic pyrethroid insecticides were carried out in palm-based solvents and mineral oils (Ismail et. al., 1998). The studies found that palm-based solvents have good solvency properties for pyrethroid insecticides. (Durban, 2000)

TABLE 2. THE EFFICACY TESTS OF ECs-PYRETHROID INSECTICIDE FORMULATIONS

Formulations	% Mortality
Formula 1a	80
Formula 1b	64
Formula 2a	68
Formula 2b	52
Formula 3a	84
Formula 3b	72
Sumi-alpha 2.5EC	68

Note: 1, 2 and 3 represent three types of palm-based solvents, and a and b indicate two different concentrations of those palm-based solvents. Sumi-alpha 2.5EC is a commercial conventional EC of es-fenvalerate-insecticide formulation.

CONCLUSION

- The oil-in-water emulsions concentrates (ECs) offer many advantages over the conventional emulsifiable concentrates (EC), e.g., they may cause less hazards to the operators and less phytotoxic to plants. They can also be less expensive than the EC because they replace about 65 to 80% of the oil (solvent) with water.

- The palm-based surfactants and solvents have better environmentally friendly properties than the petroleum-based surfactants and mineral oils.
- Palm-based solvents have comparable physical characteristics and good solvency properties to the mineral oils.
- The ECs of pyrethroid-insecticide formulations have comparable potential to the conventional EC of pyrethroid-insecticide formulations in killing insects (*Helopeltis theivora*, a cocoa mirid).

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