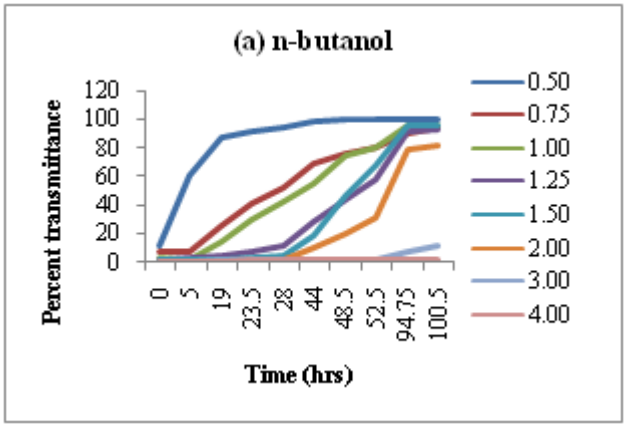
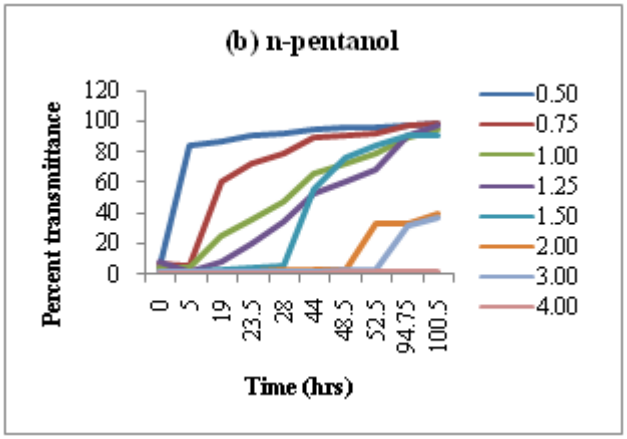
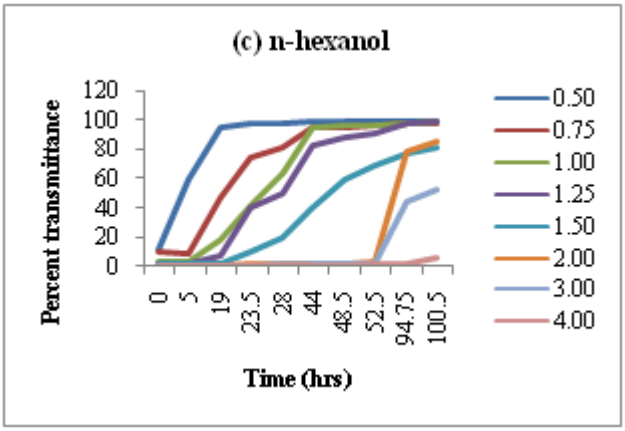
potassium oleate/hexanol/tween-80 are presented in Table 3. Table 3 shows that transparent or translucent emulsions were obtained for these two emulsifier systems over the HLB range of 14-16 and 13-18 respectively. On diluting with water, the dispersions formed at HLB 14 and 15 were translucent, had no tendency to cream and were bluish in appearance. These properties are those of micro-emulsions. This view is supported by observations from the centrifugal tests that no phase separation occurred after 5 minutes of centrifuge.

Fig. 1(a-d) shows transmittance plots as a function of time for toluene emulsions employing tween-80 and four alcohols: n-butanol (a), n-pentanol (b), n-hexanol, (c) and n-heptanol (d) as co-surfactants. The emulsifier mixtures were composed to give the HLB of toluene. In all cases, the transmittance of the dispersions increased with time. The higher the transmittance value, the more disperse the system and the more stable it is since unstable systems will segregate through creaming or coalescence. This is a strong evidence for presence of thermodynamically stable systems called micro-emulsions. The results also show that, while all the alcohols may be used, n-hexanol appears to be more effective over a wider range of concentrations (heptanol is the least) and it appears there might be little point in using alcohols of longer chain length.

The role of alcohols in these formulations has been explained as resulting from the interposition of their molecules between Teen-80 molecules enhancing the lateral attraction within the droplets of the emulsion thereby increasing film elasticity, strength and stability.







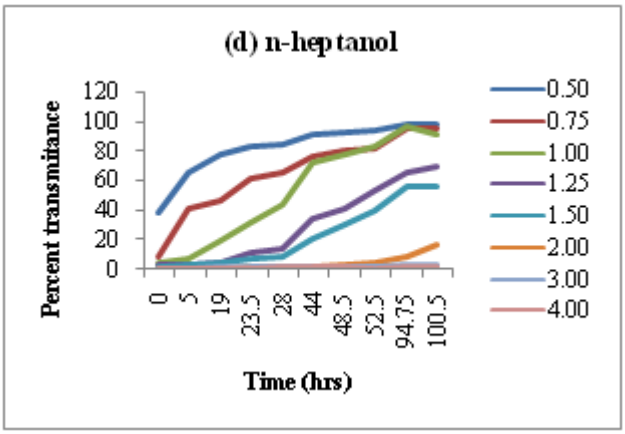


Figure 1: Tranmittance-time Graghs for Four Emulsifier Formulations Showing the Effect of Alcohol Chain Length on the Stabilization of Toluene-water Emulsions

Under this condition, the droplets form spontaneously giving rise to the thermodynamically stable micro-emulsions.

Two concentrates were prepared using this formulation. The transmittance measurements for these concentrates are presented in Table 4 for Bu_2SnSa_2 (a) and Bu_2SnAs_2.(b). Their dilutions were also monitored through transmittance measurements and the data is presented in Fig. 2 (a) and (b).

Table 4: Transmittance/Time Variation for Bu_2SnSa_2 and Bu_2SnAs_2 Concentrates in Toluene Stabilized with Potassium oleate/Hexanol Emulsifier Mixture

		Time (hrs)			
		0	**96**	**216**	**1320**
Transmittance	Bu_2SnSa_2	76	76	73	66
	Bu_2SnAs_2	67	75	64	62

The data of Table 4 shows that over the period of 55 days monitored, a significant change in transmittance of the formula was observed. However, this leveled up after about 10 days. These formulae are indeed solutions hence are a convenient basis for agricultural applications.

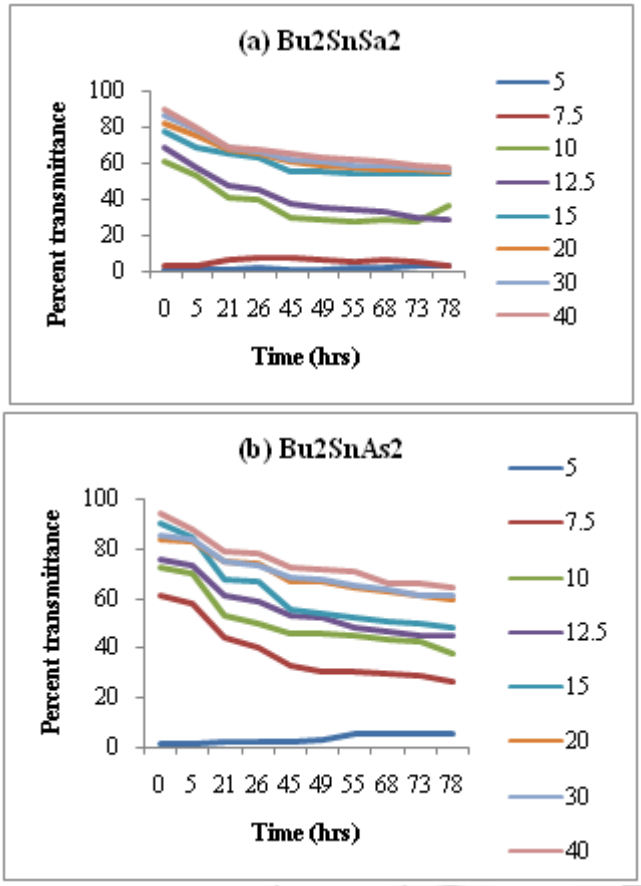


Figure 2: Variation of Transmittance with Time for Eight Dilutions of Bu_2SnSa_2 (a) and Bu_2SnAs_2 (b) Concentrates with Water

The dilutions of the formulae gave transmittance values shown in Fig. 2a and 2b for the salicylate and acetylsalicylate respectively. These figures show a marked deviation from the profiles expected on the basis of Fig.1 and indicate the ability of the organotin compounds to alter the surface tension of toluene and therefore its required HLB. However, considering that formulae are applied immediately after dilution, this is not expected to adversely affect the formulae. In addition, the decrease in transmittance with time levels up after about 40 hrs and within the period of observation, no precipitation occurred. These thermodynamically unstable dispersions may thus be used for this purpose as earlier defined.

4. Conclusion

The organotin compounds tested are known to possess antifungal activity and are commonly adopted for treatment of fungal infections where oral and mammalian non-toxicities are not critical requirements. Among the formulae based on polar media, mixed solvent systems containing bis-(2-methoxyethyl) ether were found suitable for phenyltin compounds since they yielded un-coagulated dispersions.

Dispersions in the non-polar media required emulsification. The role of the alcohol and soap in the stabilization of emulsions indicates that alcohols of medium chain length (4-7 carbon atoms) may be used with n-hexanol having the best co-surfactant property. It was observed that while the media were stable, the introduction of the active ingredient required consideration in order to arrive at thermodynamically stable systems. Dispersions of Bu_2SnSa_2 and Bu_2SnAs_2 in toluene were found to be thermodynamically unstable but did not precipitate within the period studied. These can thus be used for field applications of the test agents. The formulae may therefore be used to protect non-consumable agricultural products, such as seed yams and wood.

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