Asian Journal of Chemistry Vol. 6, No. 3 (1994), 670–672

NOTES

Physico-Chemical Studies of Oil/Water Emulsions Stabilised by Different Surfactants

I.P. PANDEY,
Department of Chemistry,
D.A.V. College, Dehradun-248 001, India

Emulsions of a large varieties have been prepared and studied by taking two immiscible liquids as internal and external phases with a number of surface active materials naturally occurring substances and finely divided solids as emulsifying agents. The results shown by cetyl alcohol which reduces the rate of coalescence significantly, and very stable emulsions were produced. The enhanced stability is due to the formation of a coherent strong interfacial film which works as a *barrier* preventing coalescence by virtue of its rheological properties.

INTRODUCTION

The survey of literature reveals that oil/water emulsions of kerosene and turpentine oils stabilised by different surfactants[1] have not been much investigated. It was, therefore, considered worthwhile to prepare kerosene oil/water and turpentine oil/water emulsions employing different surfactants and the study of various conditions which favour the emulsification and make the emulsions more stable. In this paper, the author reports some results on the effects of oil/water emulsions stabilised by the three surfactants *i.e.*, cetyl alcohol, Super-N-Dedenol and Acifix by studying viscosity and interficial-tension by preparing a good deal of emulsions of different concentrations.

Oil/water emulsions of a number of concentrations have been prepared by using water as external phase, kerosene and turpentine oils as internal phases. The oil/water emulsions have been prepared by agent-in-water method[2] by taking fixed ratio of oils and varying ratios of water and secondly fixed ratio of oils and varying ratios of water and thirdly fixed ratio of oil/water and different concentrations of surfactants with constant stirring. The emulsions, thus made were homogenized by agitation with the help of Braun Emulsifier.

Double distilled kerosene oil (specific gravity 0.7937), turpentine oil (specific gravity 0.8745) and water (conductance-1×1^{-6} ohm^{-1} cm^{-1}) have been employed. Cetyl alcohol, Super-N-Dedenol and Acifix (CSAN) (Hico-Products, Bombay) were the surfactants used. A number of emulsions have been prepared with the help of Braun emulsifier (German made). Following sets of different emulsions have been prepared and studies. These different sets are as follows:

1. The variation of oil/water ratios such as 1 : 1, 1 : 2, 1 : 3, 1 : 4, 1 : 5, 1 : 6, 1 : 7, 1 : 8 and 1 : 9 while the concentration remains 3% constant.

2. The variation of surfactant concentrations *viz.* 0.1, 0.2, 0.4, 0.6, 0.8 and 1.0 gm. by using oil/water ratio 1 : 2 constant. The viscosity and interficial tensions of these emulsions have been studied at 30 ± 1°C. The results are summerised in the Table 1–3.

TABLE 1
SURFACTANT CONCENTRATION = 3%; TEMP. = 30°C; KEROSENE OIL

Oil-water ratio	Cetyl Alcohol		Super-N-Dedenol		Acifix (CSAN)	
	Viscosity millipoise	Interfacial tension. Dynes/Cm.	Viscosity millipoise	Interfacial tension. Dynes/Cm.	Viscosity millipoise	Interfacial tension. Dynes/Cm.
1 : 1	40.224	20.13	25.412	21.14	30.442	25.46
1 : 2	29.123	21.15	18.450	22.18	20.846	26.81
1 : 3	25.111	22.45	15.100	23.41	17.544	28.01
1 : 4	22.401	24.01	13.550	24.51	15.116	29.41
1 : 5	20.541	25.54	11.880	25.86	14.018	30.61
1 : 6	18.000	26.90	10.850	26.04	13.221	31.71
1 : 7	16.522	28.01	09.800	27.75	12.210	32.85
1 : 8	15.650	29.41	08.950	28.80	11.250	33.75
1 : 9	14.450	30.65	07.500	30.00	10.100	35.11

TABLE 2
SURFACTANT CONCENTRATION = 3%; TEMP. 30°C; TUPRENTINE OIL

Oil-water ratio	Cetyl Alcohol		Super-N-Dedenol		Acifix (CSAN)	
	Viscosity millipoise	Interfacial tension Dynes/cm.	Viscosity millipoise	Interfacial tension Dynes/Cm.	viscosity millipoise	Interfacial tension Dynes/Cm.
1 : 1	35.341	19.42	22.437	19.54	25.223	35.46
1 : 2	25.433	20.47	18.448	21.08	20.814	36.61
1 : 3	22.112	21.75	15.475	22.41	18.225	37.85
1 : 4	18.950	22.86	13.501	23.70	16.001	38.95
1 : 5	16.010	24.41	12.050	24.85	14.850	40.41
1 : 6	14.110	25.50	10.010	26.15	12.050	41.65
1 : 7	12.250	26.65	09.111	27.75	10.110	42.75
1 : 8	10.090	28.05	08.150	29.25	09.150	14.15
1 : 9	09.110	29.25	07.250	30.34	08.110	45.25

TABLE 3
OIL WATER RATIO: 1 : 2; TEMP. = 30°C; KEROSENE OIL

Surfactant concentration in gms	Cetyl Alcohol		Super-N-Dedenal		Acifix (CSAN)	
	Viscosity millipoise	Interfacial tension Dynes/Cm.	Viscosity millipoise	Interfacial tension Dynes/Cm.	Viscosity millipoise	Interfacial tension Dynes/Cm.
0.1	10.250	25.25	08.444	35.35	13.222	34.48
0.2	10.110	25.01	09.450	33.85	11.425	31.85
0.4	09.855	24.90	10.100	32.75	10.446	30.75
0.6	09.015	24.01	10.950	31.85	09.650	30.15
0.8	08.255	23.25	11.650	30.76	08.250	29.40
1.0	07.855	22.11	12.250	29.25	07.155	28.55

The results presented in the Tables depict the interfacial tension decreases with a decrease in the concentration of the continuous phase (water) or an increase in the concentration of emulsifying agents; the lower the value of interfacial-tension of emulsions, the greater the stability. Interfacial-tension has been emphasised as a factor in forming emulsions as well as in maintaining stability. The emulsifiers reduce interfacial tension between the two phases, it decrease the free surface energy of the emulsion formed and tends to yield a stable emulsification.

In the present data, it is very much clear that in all the three surfactants such as cetyl alcohol, super-N-dedenol and acifix. Cetyl alcohol lowers interfacial tension more in comparison to super-N-dedenol acifix.

Thus there is a relationship between interfacial-tension and emulsifier efficiency of the surfactants. Thus from these discussions the mechanism for the enhanced stability of oil/water emulsions due to addition of cetyl alcohol favours more. As it lowers the interfacial tension of the oil/water emulsions and favours the emulsification with lower viscosities. Cetyl alcohal is good emulsifier in comparision to other two *i.e.* super-N-dedenol and acifix.

REFERENCES

1. R.K. Neogy and B.N. Ghosh, *J. Indian Chem. Soc.*, **30**, 113 (1953).
2. Paul Becher, Emulsion Theory and Practice, reinhold publishing corp., New York, p. 267 (1966).

[*Received:* 1 January 1993; *Accepted:* 4 October 1993] AJC-711