Effect of Surfactants on the Electro-oxidation of Benzhydrol in Emulsion Systems

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Summary The yield of benzophenone obtained in the electro-oxidation of benzhydrol can be increased from $< 1\%$ to 90% and the current efficiency can be increased from 1% to 326% by the use of emulsions and cationic surfactants.

ALTHOUGH emulsions[1,2] and emulsifying agents[1,3] have been used in electro-organic systems, few of these studies have involved electro-oxidation. It has been observed that the yield can be markedly improved in the electro-oxidation of benzhydrol to benzophenone by using emulsions and certain types of surfactants.

Benzhydrol was oxidized at room temperature at platinum electrodes. The emulsion was prepared using an organic solvent and aqueous 2 M NaOH solution. The anolyte and catholyte were separated by a porous porcelain cup. The anolyte inside the cup was stirred to maintain the emulsion. The potential was controlled at 1·90 V *vs.* SCE using a Wenking Model 66 TA1 potentiostat. The yield of the product was determined by use of a model ALC–202 liquid chromatograph.

The Table shows results of electrolyses performed for 1 h in an emulsion containing 50 ml of 2 M NaOH, 50 ml of the organic solvent, 0·4 ml of the commercial surfactant, and 0·005 mol of benzhydrol. A variety of surfactants were used and a number of runs were made with each of them. The results reported here are the averages of all runs.

TABLE

Organic solvent	Type of surfactant	Yield of benzophenone %	Current efficiency %
Benzene	None	0·2	1
Benzene	Neutral	4·0	20
Benzene	Anionic	2·8	14
Benzene	Cationic	23·4	87
Acetonitrile	Cationic	90·0	326

NaOH solution alone is not suitable as a solvent since benzhydrol is insoluble in it. However, if the concentration of cationic surfactant is increased till the solution contains 4 ml of surfactant, the benzhydrol is solubilized forming micelles. In the micelle system the yield of benzophenone was 41% and the current efficiency was 200%.

By changing the solvent system and the surfactant the yield can be increased from $< 1\%$ to almost 100%, based on benzhydrol. The addition of cationic surfactants improved the yield while anionic and neutral surfactants did not.

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[1] L. Eberson and B. Helgee, *Chemica Scripta*, 1974, **5**, 47.
[2] A. L. Underwood, R. A. Day, Jr., and P. A. Westmoreland, *Analyt. Chem.*, 1972, **44**, 737.
[3] D. Price and T. N. Hartley, *J. Electrochem. Soc.*, 1970, **117**, 448.