The Enhanced Effect of Anthracene on the Polarographic Maximum of Methyl-p-benzoquinone

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The author has been interested in the polarographic behavior of certain quinones in the presence of some polycyclic aromatic hydrocarbons. It is generally known that some polycyclic aromatic hydrocarbons have a suppressing effect on the polarographic maxima of some electroreducible substances[1]. It has been found in the present investigation that, on the other hand, these hydrocarbons are effective in inducing the maxima on the

1) C. E. Searle, *Nature*, **184**, 1716 (1959).

polarograms of some quinones. The results obtained with the methyl-*p*-benzoquinone (MQ)-anthracene (A) system are presented here.

As is shown in Fig. 1, a single wave having a typical maximum was obtained with 1.6×10^{-3} M of MQ in 2-methoxyethanol containing 0.25 M of lithium chloride at 25°C, but this maximum was suppressed by the addition of 0.004% methyl red. Contrary to this, the maximum was enhanced by the addition of A to the original solution. When A was added to the solution containing methyl red as a maximum suppressor, a pronounced maximum was observed to reappear.

The heights of the maxima were measured at varied concentrations of A with or without methyl red, keeping the concentration of MQ constant. In Fig. 2, the results obtained at 25°C are plotted against the concentration of A. Figure 2 shows that the maximum height increases with the increasing A concentration, but it seems gradually to reach to a limiting value. The maximum height obtained at given concentrations of MQ and A was observed to be lowered at higher temperatures and almost to disappear at 45°C.

Although the complete interpretation of the maximum is a very difficult problem, it may

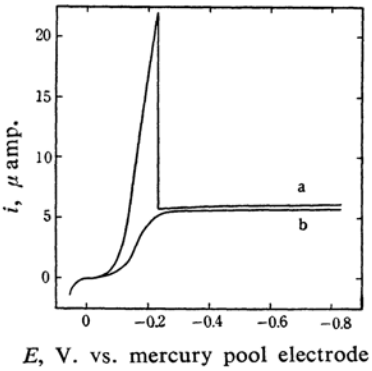

Fig. 1. Polarograms of 1.6×10^{-3} M of MQ obtained in 2-methoxyethanol solutions at 25°C in the absence (curve a) and in the presence of 0.004% methyl red (curve b).

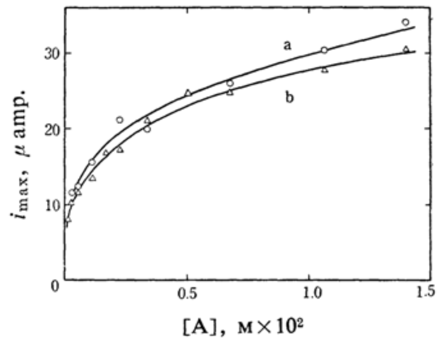

Fig. 2. Relation between maximum current (i_{max}) of MQ and concentration of A in 2-methoxyethanol solutions at 25°C in the absence (curve a) and in the presence of 0.004% methyl red (curve b).
Concentration of MQ is 1.3×10^{-3} M.

be suggested on the basis of the obtained results that the maximum may be attributed to the adsorption of MQ and A on the surface of the dropping mercury electrode. It can be considered that the maximum suppressing action of A is due to the preferential adsorption on the electrode surface. The adsorbed A molecules may prevent the adsorption of electroreducible substances. On the contrary, they should attract MQ and allow it to approach the electrode surface. It is possible that A reacts with MQ to form a charge-transfer complex[2]. Actually, some considerable changes were observed in the infrared spectrum of the mixture of A and MQ (KBr disk). On the assumptions that the complex formed between A and MQ is adsorbed on the electrode surface and that Langmuir's equation is applicable to this system, a consideration of the probable mechanism of the maximum is now in progress. The details will be published later.

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2) M. Chowdhury, *Trans. Faraday Soc.*, **57**, 1482 (1961).