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PHOTOOXIDATION OF HYDROCARBONS BY CHROMIUM(VI) OXO COMPOUNDS

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Chromium(VI) oxo complexes efficiently oxidize hydrocarbons, in particular, alkanes usually only at elevated temepratures [1-3]. On the other hand, the photoactivity of such complexes has been reported in reactions with some organic compounds [4, 5]. Irradiation using the unfiltered emission of a 500-W high-pressure mercury lamp in a glass vessel significantly accelerates the oxidation of hydrocarbons both in homogeneous solution (CrO_3 in acetic acid) and, especially, in a two phase system (aqueous $Cr_2O_7^{2-}$ solution and hydrocarbon) in the presence of $(C_4H_9)_4NBr$ and H_2SO_4. Benzene, toluene, ethylbenzene, and cyclohexane are oxidized to quinone, benzaldehyde, acetophenone, and adipic acid, respectively. Adamantane give 1-adamantanol and adamantanone in ~7:1 ratio. The reaction rate is linearly dependent on the light intensity. The experimental results at 20°C are given in Table 1.

Thus, photoirradiation permits a sharp increase in the efficiency of the oxidation of hydrocarbons by Cr(VI) oxo complexes without increasing the temperature and carrying out this oxidation in aqueous solution.

TABLE 1

Hydrocarbon	Solvent	Time, h	Product yield, %	
			in the dark	upon irradiation
Benzene	CH_3COOH	2	0.9	18
Toluene	CH_3COOH	2	5.3	25
	H_2O	1	2.4	56
Ethylbenzene	CH_3COOH	1.5	46	50
	H_2O	2	4	60
Adamantane	CH_3COOH	5	0.8	6.5
	H_2O –dichloroethane	0.5	19	52

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