

G. B. Shul'pin, P. Lederer,
and E. Mácová

UDC 541.145:542.943.7:547.53

Chromium(VI) oxo complexes efficiently oxidize hydrocarbons, in particular, alkanes usually only at elevated temperatures [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 $\text{Cr}_2\text{O}_7^{2-}$ solution and hydrocarbon) in the presence of $(\text{C}_4\text{H}_9)_4\text{NBr}$ 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 $\sim 7:1$ 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

Hydro-carbon	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

LITERATURE CITED

1. A. E. Shilov, Activation of Saturated Hydrocarbons by Transition Metal Complexes, Dordrecht (1984).
2. E. S. Rudakov, Reactions of Alkanes with Oxidizing Agents, Metal Complexes, and Radicals in Solution [in Russian], Izd. Naukova Dumka, Kiev (1985).
3. G. Cainelli and G. Cardillo, Chromium Oxidations in Organic Chemistry, Springer, Berlin (1984).
4. P. V. Rusev, M. I. Mitewa, P. R. Bantchev, and A. P. Malinovski, Dokl. Bolg. Akad. Nauk **33**, 519 (1980).
5. D. Rehorek, W. Winkler, R. Wagener, and H. Hennig, Z. Chem., **22**, 112 (1982).

Institute of Chemical Physics, Academy of Sciences of the USSR, Moscow. Institute of Inorganic Chemistry, Academy of Sciences of Czechoslovakia, Prague. Translated from Izvestiya Akademii Nauk SSSR, Seriya Khimicheskaya, No. 11, pp. 2638-2639, November, 1986. Original article submitted July 9, 1986.