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Heterogeneous ozonation kinetics of 4-phenoxyphenol in the presence of photosensitizer

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Abstract. In this work we have quantitatively measured the degradation of 4-phenoxyphenol adsorbed on silica particles following oxidative processing by gas-phase ozone. This was performed under dark conditions and in the presence of 4-carboxybenzophenone under simulated sunlight irradiation of the particles surface.

At the mixing ratio of 60 ppb which corresponds to strongly polluted ozone areas, the first order of decay of 4-phenoxyphenol is $k_1 = 9.95 \times 10^{-6}$ s^{-1}. At a very high ozone mixing ratio of 6 ppm the first order rate constants for 4-phenoxyphenol degradation were the following: $k_1 = 2.86 \times 10^{-5}$ s^{-1} under dark conditions and $k_1 = 5.58 \times 10^{-5}$ s^{-1} in the presence of photosensitizer (4-carboxybenzophenone) under light illumination of the particles surface. In both cases, the experimental data follow the modified Langmuir-Hinshelwood equation for surface reactions. The Langmuir-Hinshelwood and Langmuir-Rideal mechanisms for bimolecular surface reactions are also discussed along with the experimental results.

Most importantly, the quantities of the oligomers such as 2-(4-Phenoxyphenoxy)-4-phenoxyphenol and 4-[4-(4-Phenoxyphenoxy) phenoxy]phenol formed during the heterogeneous ozonolysis of adsorbed 4-phenoxyphenol were much higher under solar light irradiation of the surface in comparison to the dark conditions.

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