



Fluorescence analysis of polyaromatic hydrocarbons photodegradation

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Introduction

Annual discharges of pollutants from industrial sources exceed the permissible standards established by the governments. Researchers are working to create a membrane bioreactor that would effectively purify waste water and then turn into a source of fuel. There are still no reports on the creation of a biocomposite plant to remove a wide class of stable toxic substances. A disadvantage of such a reactor is that such installations can not operate at low temperatures. This serves as an argument in favor of physico-chemical reactors. Studies of the dependencies of the structure of pollutants and the parameters of existing reactors are needed.

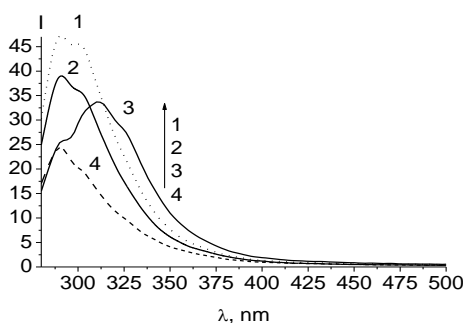
Methods

The choice of the most suitable source of radiation for a given photochemical reaction begins with a study of the absorption spectra of the reagents. Then, a radiation source is selected which gives the maximum energy at the wavelength of the detected absorption band. The wavelengths of the emission bands of the source and the absorption of the reagents must coincide. As sources of radiation, excilamps are used, under the influence of which both direct photolysis of the pollutant molecule and indirect, due to the interaction of the contaminant with the photosensitizers, takes place. The test solution was analyzed by a chromato-mass spectrometer. Express analysis was performed using fluorescence spectra.

Results and Discussion

When studying the phototransformation of phenol and naphthalene in water under UV irradiation, the samples were left for 5 days. An increase in the intensity from the absorption spectra of water in the visible spectral range was recorded, which indicates the appearance of inhomogeneities in the solution. The best fixation showed a polypropylene microfibre material (PMM) with TiO₂. After irradiation, the PMM samples were squeezed out and placed in hexane. Then systems were placed in an ultrasonic mixer. The obtained absorption and fluorescence spectra of hexane was observed formation of phenol phototransformation products which are adsorbed on the surface of PMM (Fig.1). Presumably these are quinones, pyrocatechol, 4-hydroxybenzoic acid, 1,4-benzoquinone, 4-hydroxybenzaldehyde. In the presence of PMM only after the XeBr excilamp irradiation, an increase in the efficiency of photoconversion of phenol was observed in comparison with the aqueous solution. The best fixation was shown by a PMM sample with a pH of 2.38.

Figure 1: Fluorescence spectra of phenol photoproducts in hexane obtained after irradiating 60 minutes of an aqueous phenol solution in the presence of PMM: KrCl (1), XeCl (2), Solar (3), and XeBr (4)



Conclusion

An array of data on the photochemical properties of polyaromatic hydrocarbons (anthracene and naphthalene) when exposed to UV radiation in photoreactors was obtained. The phototransformation products as a function of the irradiation wavelength were established. There is relationship between the structure of pollutants, their initial concentration, oxidizer concentration, etc., with the efficiency of utilization. Schemes for photochemical processes were constructed. The conditions for the degradation of molecules in photoreactors were optimized. Kinetic models for predicting photodegradation of molecules was constructed. The radiation source for the minireactor was selected.