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PURIFICATION OF NATURAL WATER FROM PHARMACEUTICALS BY OXIDATION METHOD

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Abstract. As a result of the development of the chemical industry in recent years, thousands of organic compounds have been synthesized, which, according to their ability to oxidize under the influence of natural processes, can be divided into stable, difficult to oxidize, and easily oxidized. Pharmaceuticals occupy a special place in this series. Currently, the ways in which pharmaceuticals, as well as personal hygiene products produced in significant quantities, enter underground and surface water sources and their detrimental effects on ecosystems, as well as the danger of these compounds for drinking water supply, are being widely studied. Possible aspects of the impact of these substances on human health are being actively analyzed. The relevance and necessity of studying the problem of dispersion of drugs in the planet's hydrosphere and the development of a regulatory framework for its regulation are noted. The main reason for the entry of drugs into water bodies is their entry together with treated and untreated wastewater.

Keywords: pharmacy, treatment, method, effect, health.

INTRODUCTION

In [1] it is noted that wastewater from hospitals contains pathogenic microflora, drugs, etc. A pilot experiment is reported, during which wastewater from a hospital was subjected to combined treatment: first, it was disinfected and then biologically treated using an irrigated biofilter (the mechanical treatment stage was preliminary). During disinfection, ozone and chlorine were used as oxidizing agents; during chlorination, the chlorine dose was 4.5 mg/l with a residence time of 1 hour, and 7 mg/l with a time of 1.5 hours; in the second case, almost complete inactivation of microflora was ensured. The BOD5 value of wastewater ranged from 5000 to 10000 mg/l, with a biofilter load of 1–5 m3/m2day, the removal efficiency was 85–95%, and with loads of 10–30 m3/m2day, it decreased to 75–90%.

MATERIALS AND METHODS

In [2] it is reported that currently a significant amount of drugs and compounds with hormonal activity enter wastewater; if they are not removed deeply enough, they enter water sources; their presence in drinking water has a negative impact on human health. Compounds with hormonal activity include, among others, the natural steroid 17-beta-estradiol, as well as synthetic estrogen-like compounds 17-alpha-ethinyl estradiol, nonylphenol and bisphenol A. It has been established that bisphenol A is highly stable and is ineffectively removed in treatment facilities; in laboratory experiments, the named components were most effectively removed using a combination of membrane and biological methods. The authors note that drugs can be destroyed using photocatalytic processes, as well as ozonation.

RESULTS AND DISCUSSION

Wastewater (WW) leaving municipal treatment plants[3] contained 5 types of antibiotics (0.34–0.63 mg/l), 5 beta-blockers (0.18–1.7 mg/l), 4 anti-inflammatory agents (0.1–1.3 mg/l), 2 lipid metabolism regulators (0.12–0.13 mg/l), the antiepileptic drug carbamazepine (2.1 mg/l), 4 contrast agents (CA) for fluoroscopy (1.1–5.2 mg/l), the natural estrogen estrone (0.015 mg/l), and 2 types of air coolers (0.1–0.73 mg/l). In a pilot experiment, these WW were subjected to ozonation, ozone dose 10-15 mg/l, contact time 18

min, as a result of which ozone-depleting agents and estrone were not detected, contrast and other drugs were contained in the treated WW in insignificant quantities, in particular, KS diatrizoate was removed by 86%. The inefficiency of additional use of UV radiation and hydrogen peroxide was also established.

Diclofenac is a well-known anti-inflammatory drug, which, being present in wastewater from many industries, enters natural waters and has a harmful effect on fish. The kinetics of decomposition of this drug and the nature of intermediate products during its oxidation were studied. The combined use of UV irradiation/H2O2 and ozonation leads to the complete conversion of chlorine to chloride; the degree of mineralization with ozonation is 32% and with H2O2/UV treatment 39% after treatment for 90 min [4]. The paper [2] presents the results of a study of paracetamol oxidation in water by ozonation and photolysis with hydrogen peroxide. Intermediate and final products were identified, kinetic parameters were determined. The degree of mineralization of paracetamol is 30% and 40% for ozonation and photolysis, respectively. In [4] it is noted that currently in groundwater (GW) in many cases there are persistent pollutants that are not destroyed in biological processes. In these studies, the model pollutants were sulfosalicylic acid (SSA) and propionic acid (PA). Under laboratory conditions, the possibility of oxidative destruction of SSA and PA during ozonation was studied, MnO2 was used as a catalyst. It was established that not all forms of MnO2 have catalytic activity, three types of MnO2 did not have this activity relative to PA. During ozonation of model GW including SSA, effective destruction was observed at a solution pH of 1.0, at pH 6.8 and 8.5, catalytic activity of the metal oxide was not observed.

CONCLUSION

1. Currently, the number of factors that negatively affect the quality of water, both surface and groundwater, has increased.

2. Much attention from foreign scientists in the field of water purification is paid to the study of new technologies for removing persistent organic pollutants, in particular pharmaceuticals, as evidenced by numerous publications

3. Modern treatment facilities based on biological methods of wastewater treatment cannot prevent persistent organic pollutants, including pharmaceuticals, from entering water bodies that receive wastewater.

4. The most promising, technically and economically effective methods for removing persistent organic impurities are oxidative methods.

5. The kinetics of the destruction of sodium diclofenac by catalytic oxidation with oxygen, catalytic oxidation with hydrogen peroxide and oxidation with ozone were studied.

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