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Ozonation-based processes for removal of Aminoglycoside antibiotic from wastewaters

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Global consumption of active medicinal substances represents an ever-increasing environmental problem due to the continuous introduction of low concentrations of active compounds into the environment and the indirect negative impact on non-target organisms. Established conventional wastewater treatment methods are ineffective in removing pharmaceutical micropollutants, so the use and implementation of advanced oxidation processes (AOPs) is crucial. Global human consumption of medicinal substances is estimated at between 100,000 and 300,000 tons with an average consumption of 15 grams per person per year. Due to incomplete metabolic processes, active substances can be excreted as parent compounds, main metabolites or a group of various metabolites. A certain proportion (30-90%) of antibiotics remains active after excretion, so the active substances can enter the environment indirectly and directly. The aim of the study was to use ozonation and ozonation in combination with hydrogen peroxide, Fe^{2+} and UV for pretreatment of wastewater, containing gentamycin sulphate. Gentamycin is persistent antibiotic with low metabolic rate in human applications. Model municipal wastewater was prepared by spiking gentamycin in different concentrations (50- 400 mg L^{-1}). Batch experiments were carried out at room temperature in a laboratory bubble column (300 mL). Ozone (4.5 g h^{-1}) was produced from oxygen p.a. in the Wedeco Ozone Modular HC8 ozone generator and fed into the reactor via a glass frit. The UV light source was a 6 W/42 V lamp (436.0 ± 9.6 lux). A set of three experiments was conducted and reduction of pH, COD, TOC, and BOD_5 were measured up to 120 min. It was confirmed that ozone and the combination of ozone/UV effectively remove chemical oxygen demand (COD) and total organic carbon (TOC) leading to increased biodegradation. The addition of hydrogen peroxide to ozonation did not improve the process, at most a similar removal efficiency was maintainedBy performing ozonation in combination with Fenton oxidation, the process was accelerated and the removal efficiency improved.