Miro Gämperli

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Subject Area	Water treatment
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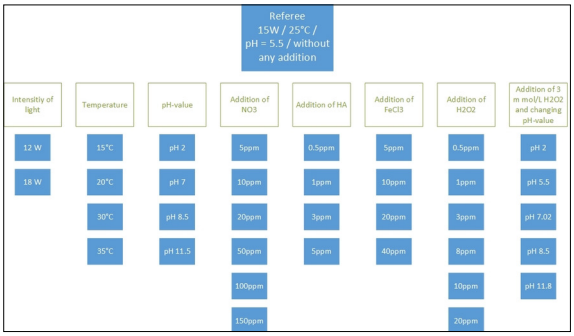
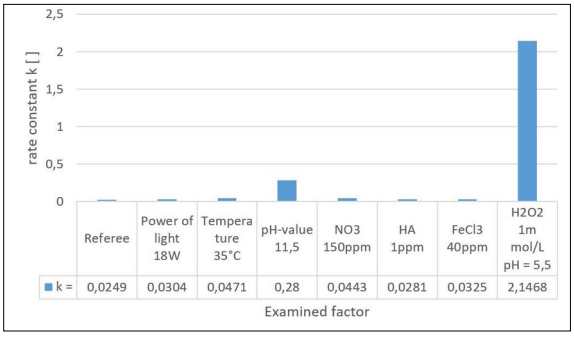
Removal of Trace Antibiotic Substances from Wastewater

Picture of photochemical reactor



Experimental setup



Comparison of the rate constants of the different series of experiments

Introduction:

Most micropollutants cause adverse ecological and human health effects. This includes pharmaceuticals and personal care products (PPCPs), and especially antibiotics.
Conventional wastewater treatment plants (WWTPs) are working with various biological treatment stages. Those systems are mostly inefficient in removing antibiotics. Thus, most of the antibiotics in waste water are eventually released into surface waters. Improving the efficiency of the WWTPs for the removal of antibiotics would reduce a serious environmental problem.
In this thesis, the influence of various factors on the removal by photolysis of traces of antibiotics (OTC) from wastewater were examined.

Objective:

Evaluations and interpretations were made based on the rate of reaction. First, it was investigated which influence the temperature, the pH value and the light intensity have on OTC photolysis. It was then investigated which substances have an influence on the photolysis. Substances found in natural waters such as nitrate, humic acid and iron (III) chloride were tested. Furthermore, oxidants such as H_2O_2 were also tested.

Result:

The results show that each investigated factor has an influence on OTC photolysis. When the temperature, light intensity or pH were increased, the reaction was faster. By adding one of the additional substances, the reaction rate usually increased. Adding nitrate however, caused the reaction to initially slow down. Surprisingly, at higher concentrations, the reaction rate increased. With humic acid, the results were inverse. At low concentration, the reaction rate increased somewhat, but at a higher concentration, the reaction rate decreased massively.
Our laboratory tests have shown that the rate constant of OTC photolysis can be increased by various factors. By addition of, e.g. H_2O_2, it can even be increased quite considerably. Also, the use of ozone and addition of powdered activated carbon have shown good results. Our findings indicate, that future WWTPs should be equipped with an additional clarification stage for removing micropollutants such as antibiotics.