OZONATION: Removal of Micropollutants

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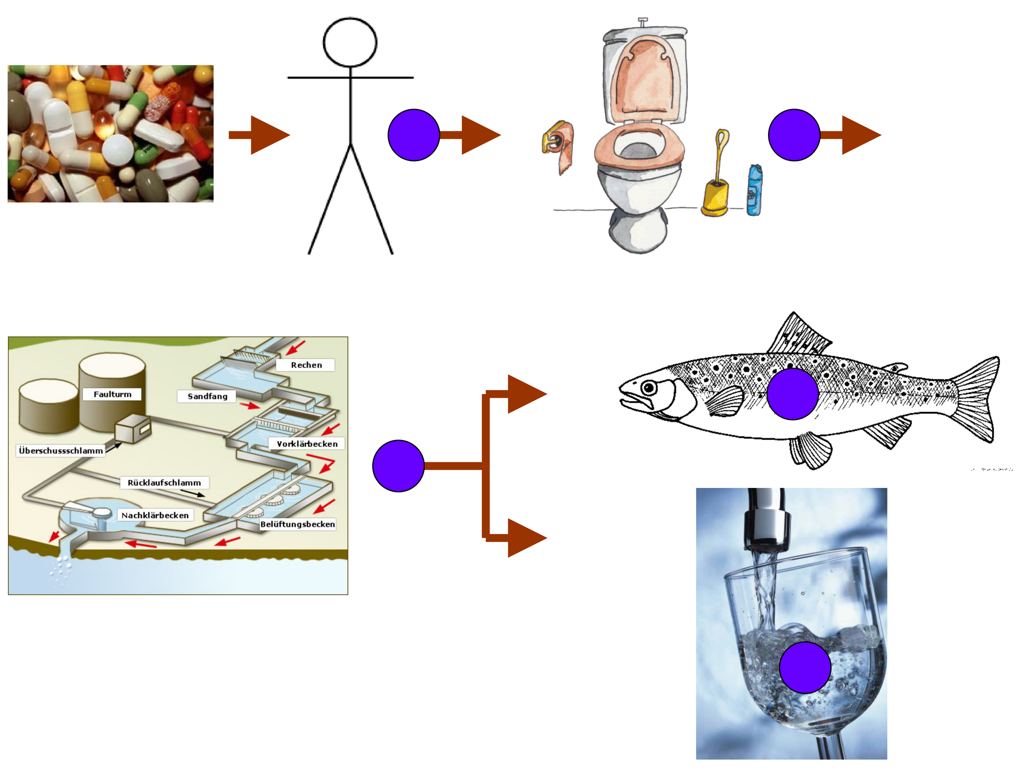
Effect of Micropollutants



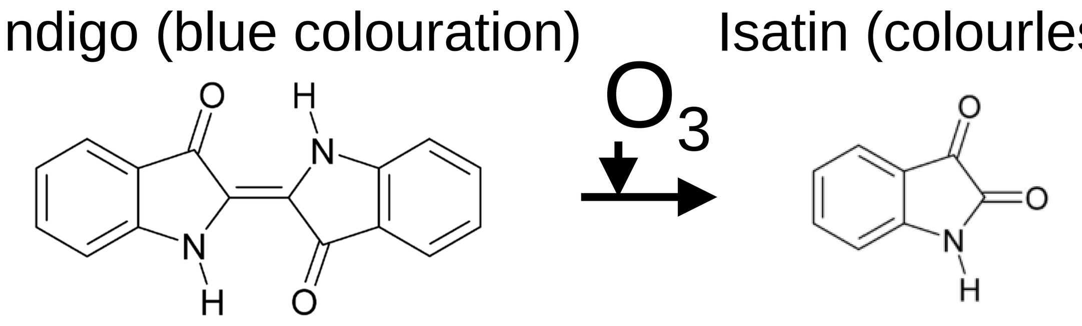
Micropollutants such as Antibiotics, Substances with hormone activity, painkillers etc. reach different water bodies, where they can have toxic effects on the ecosystem.

Ozonation – Decolourisation of Water

Ozone – Indigo

In presence of Ozone the intensely colouring (blue) Indigo-molecule is degraded into Isatin which is colourless. Thus if a water column is coloured with indigo and then fed with ozone the blue colour will disappear.

Indigo (blue colouration) Isatin (colourless)

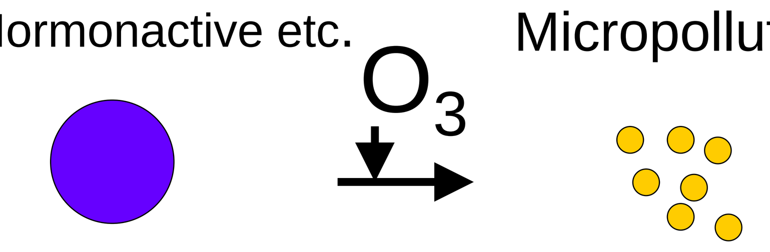


Ozone – Micropollutant

Similar to the decolourisation of Indigo blue water Ozone reacts with different micropollutants. They are degraded into transformation products which are either biologically degradable or exhibit reduced ecotoxicological effects.

Micropollutants: Toxicity, Hormonactive etc.

Transformed Micropollutants:



biol. Degradable transformation products with a finally reduced ecotoxicological effect.

Ozone Dosage – Decrease in Absorbance – Removal of Micropollutants

Δ Absorbance

As described above with the example of indigo, wastewater is decolourised in presence of ozone. In order to find a control- and monitoring-parameter the absorbance was measured at 254 and 366 nm in the influent and effluent of the ozone reactor.

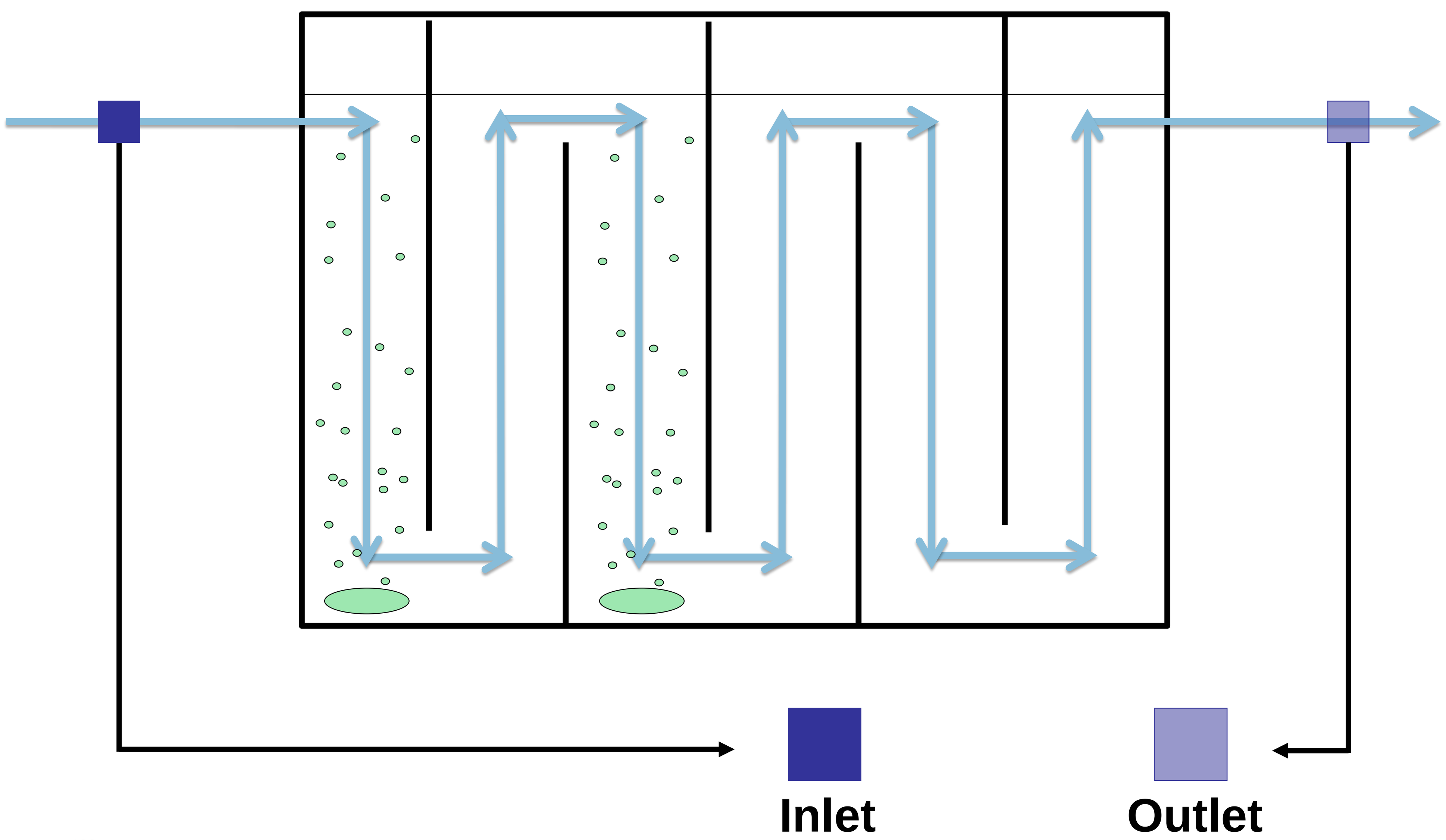
In Figure-1 the decrease of absorbance is shown in relation to different ozone dosages.

In Figure-2 the relation between micropollutant removal and decrease of absorbance.

Depending on the quality goals for micropollutant removal a certain decrease in absorbance can be defined that indicates a good performance of the ozone reactor.

This parameter could not only be used for Monitoring but also for Feedback control.

An optimized ozone process is reached when the quality goal is reached with a minimum ozone dosage.



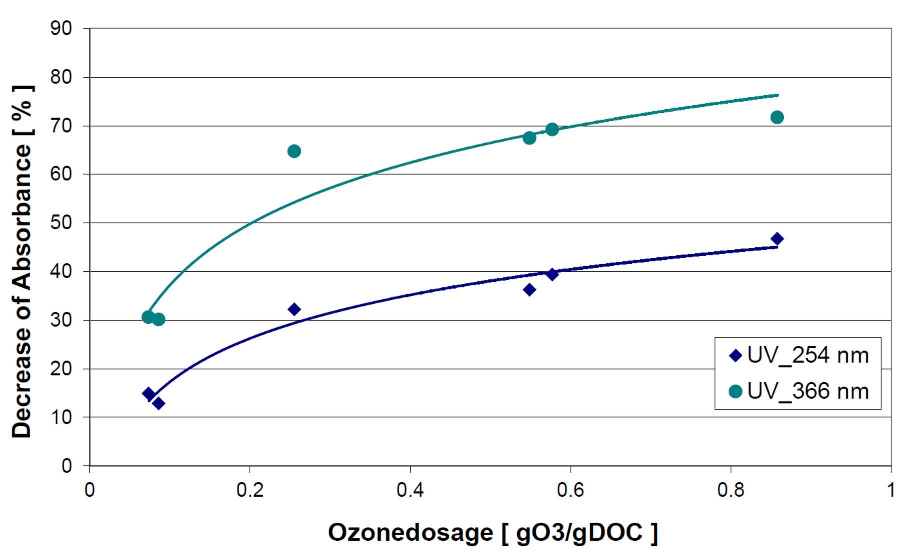


Figure-1: Decrease of absorbance of 254 and 366 nm in relation to ozone dosage

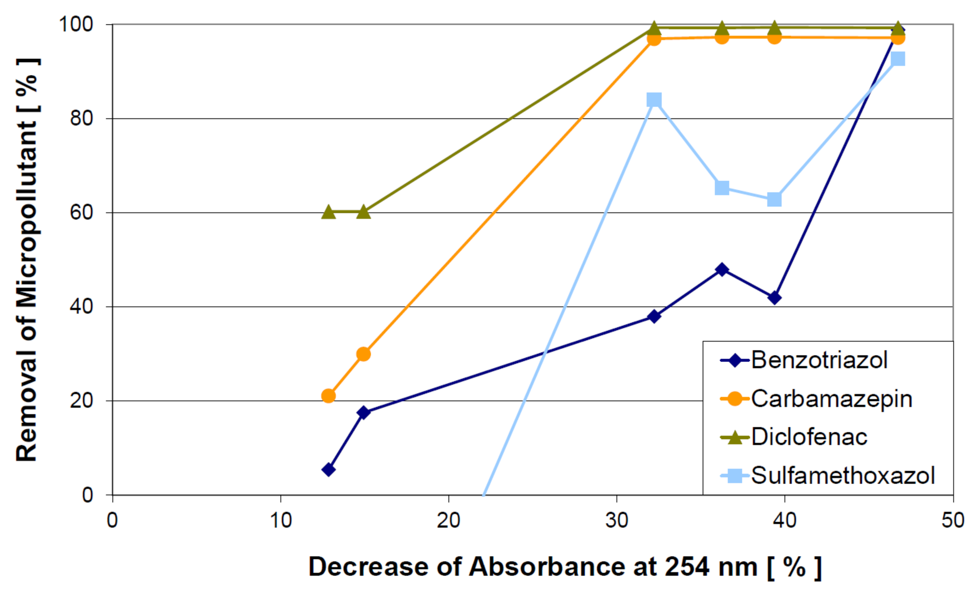


Figure-2: Decrease of absorbance of 254 and 366 nm in relation to the removal of micropollutants

Ozone Dosage – Control Strategy:

Feedforward control

A feed-forward control portion provides a control action (ozone mass flow rate, uff_id) based on a hydraulic flow proportional (Q) or mass flow proportional (Q*DOC) scheme (Figure-3, orange boxes).

Feedback control

A feed-back control portion based on the decrease of absorbance can be used to optimize the ozone dosage and Monitoring of the ozone-process (Figure-3, yellow boxes).

Combination: Feedforward and Feedback

The retention time in the reactor is much higher than the reaction time of ozone. Therefore a combination of feedback and feedforward control can provide a optimal ozone dosage and behaviour of the process.

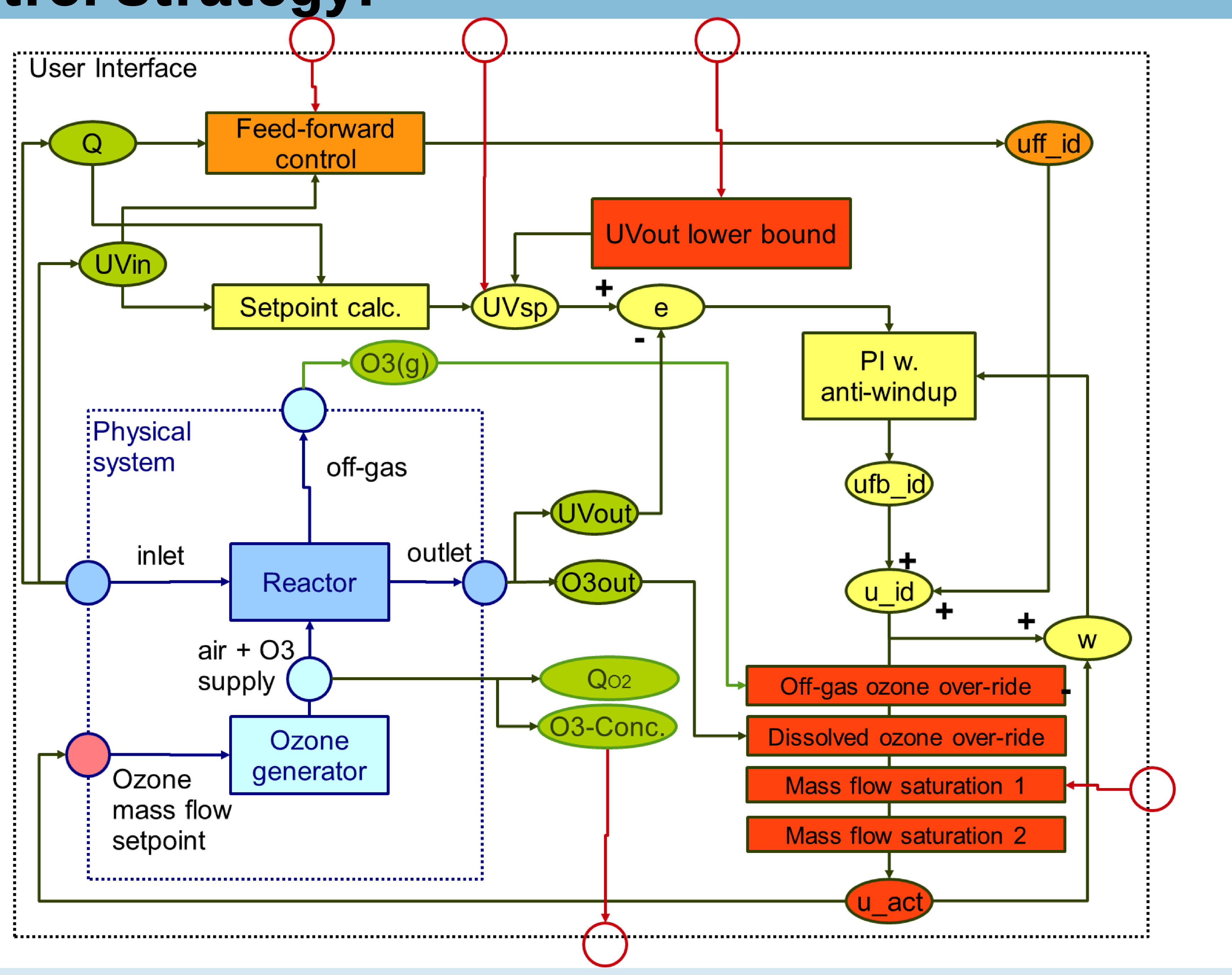


Figure-3: Control scheme of a combination of Feed-Forward and Feed-Back Control based on the Measured UV-Signal (254 nm) in the Influent and the Effluent of the ozonation reactor.

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