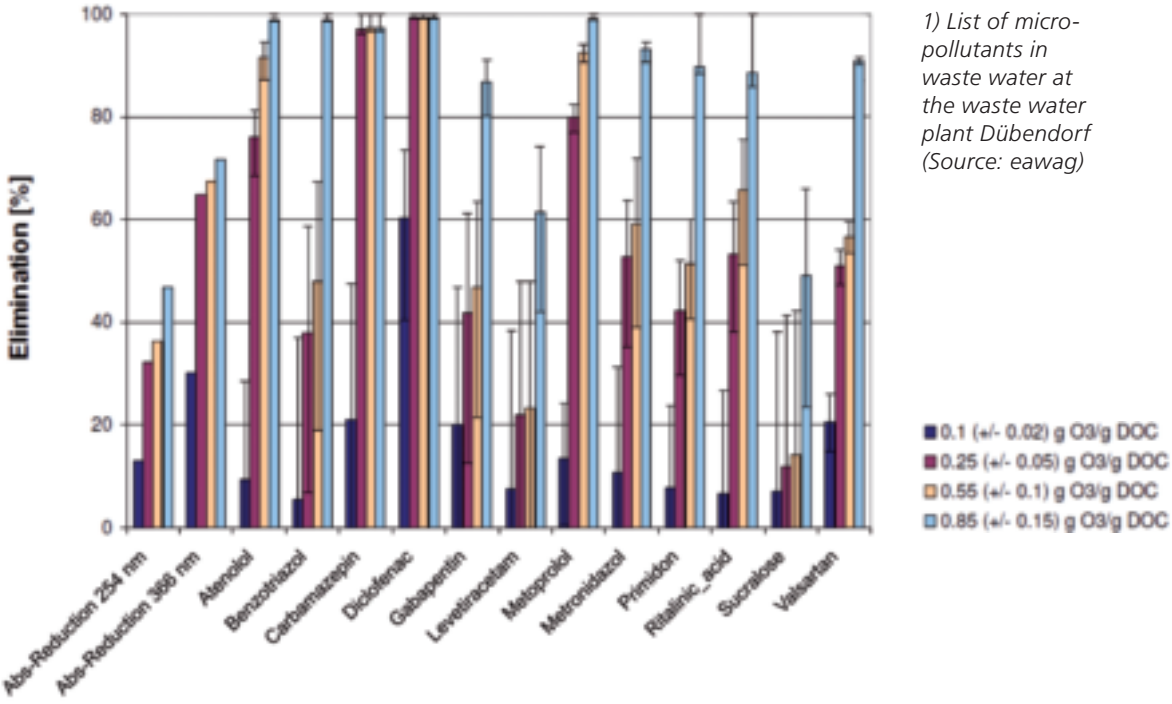
Elimination of micro pollutants

The consumption and use of various pharmaceuticals, detergents, pesticides and cosmetics such as shower gel, shampoo etc., has greatly increased over the past decades. These substances, termed micropollutants, cannot, or only partly are biodegraded in waste water treatment plants and sorption onto the sewage sludge is only partially effective. The elimination performance or the retention of these trace substances, respectively, is therefore only slight or insufficient. As a result, corresponding contaminants reach the surface water where they can have a negative influence on the ecosystem. The best-known phenomenon is the feminization of fish as a result of endocrine disruptors used in contraceptive pills or in plastics as softeners.



1) List of micro-pollutants in waste water at the waste water plant Dübendorf (Source: eawag)

The list of micropollutants in waste water is extensive. The fact that their compositions differ in each waste water aggravates this situation. There is a classification in categories in European countries, from which a Switzerland-specific list of micropollutants is derived.

These substances can be eliminated with two methods: the use of ozone to oxidize the substances and the use of powdered activated carbon (PAC) treatment for adsorbing and subsequently filtering out the substances. Both methods have advantages and disadvantages.

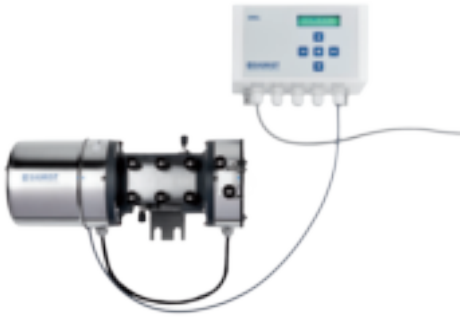
Based on the numerous experiences and examinations of recent years, a practical test was carried out using ozone with a pilot plant at the eawag in Dübendorf. The proof of the elimination was to be made online and a control strategy was simultaneously researched which guarantees optimum ozonation. A reliable control is desirable for keeping the energy consumption as low as possible.
The basic idea: measuring the difference in absorbance before and after ozonation with various light sources. All considerable and undesirable influences such as existing nitrite, nitrate, DOC were examined. In addition, the available measuring technology was tested as to its suitability.

Functions of the SIGRIST absorptionmeter ColorPlus

Two ColorPlus instruments (Pict. 2) were used with identical light sources 254nm, 366nm & 700nm.

One special feature of the measuring cell used is the function of compensating window soiling. For this, the measuring beam is once directed through the medium and once through an additional glass (Pict. 3). From this, the influence of window soiling is calculated within the instrument and compensated correspondingly.

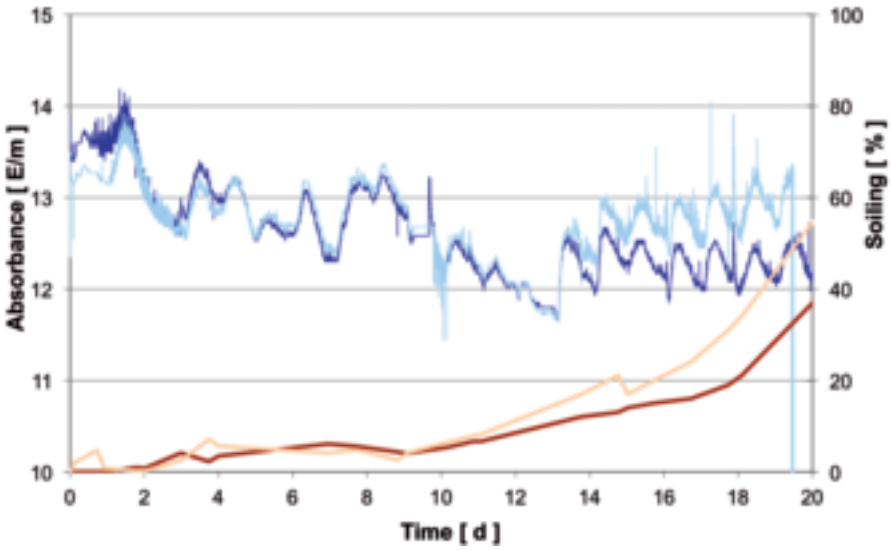
As a result, the user is provided with accurate measurements all of the time. In addition, the instrument will activate an alarm as soon as window soiling becomes too intense. The alarm is used to initialize cleaning of the measuring cell. Consequently, no fixed cleaning interval is necessary which contributes to reducing maintenance costs.



2) Absorptionmeter ColorPlus

3) Measuring cell with compensation glass

In Picture 4, the function of window soiling compensation is illustrated using the light source 254 nm. The left scale shows the absorbance/m and the right scale the degree of soiling (%). Two instruments (S1&S2) were compared and the sample water was filtered differently (5µm resp. 20µm). After about 13 days of operation, soiling at the windows begins to accelerate. It seems that the water can be compensated to a lesser degree with the 20 µm filter. Cleaning has to be carried out at a degree of soiling of 40% in the case of this waste water.



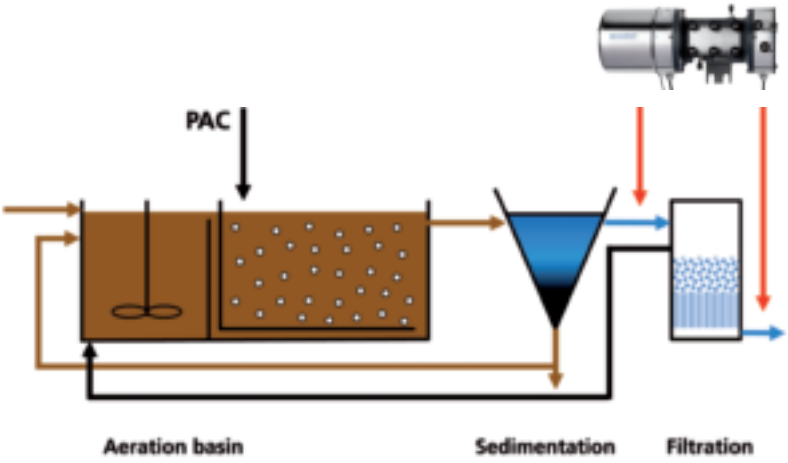
4) Examination of soiling compensation in two instruments (source: eawag)

Reference:
Eawag project No. 85341: A. Wittmer (2013), «UV-Messung zur Regelung der Ozondosis und Überwachung der Reinigungsleistung» («UV measurement for controlling ozone dosage and monitoring the cleaning performance»)
Eawag: Ch. Götz, J.Hollender, R.Kase (2011). «Mikroverunreinigungen. Studie im Auftrag des Bundesamtes für Umwelt (BAFU)» («Micropollutants. Study commissioned by the Swiss Federal Office for the Environment (BAFU)»)

Use of powdered activated carbon (PAC)

With PAC, a wide range of micropollutants, and their effects, can largely be removed from municipal waste water. One idea of a project of the UMTEC involves the dosing of the PAC directly into the biological treatment basin. The subsequent Dynasand filter ensures that no PAC can reach the environment (Pict. 5).

It is under evaluation if the ColorPlus could be used before or after the Dynafilter for measuring the elimination performance online. The absorbance measurement is a sum signal which does not allow identification of individual substances. This demands correlating the measured absorbance at 254nm with a number of predetermined reference substances to finally optimize the PAC dosage.



5) Direct dosage of PAC into the biological treatment stage

Reference: Topic Micropollutants, JM Stoll (2012): Institute UMTEC of the University of Rapperswil

Online turbidity measurement with SIGRIST AquaScat

6) AquaScat WTM

7) Free-fall concept

The product family AquaScat offers a permanently precise turbidity measurement based on the concept that the sample water passes the measuring area in free fall.

The inlet tube and a correct flow rate guarantee permanent maximum precision of measurement in the range mFNU without drift. There is no soiling and metal ions such as iron, manganese etc. have no influence. Virtually no maintenance is necessary except recalibration which is even fully automated depending on the model.

8) Manual recalibration with secondary standard

Manual recalibration

To spare the user from buying, storing and handling formazin, the AquaScat is equipped with a glass body as secondary standard, which creates a predefined turbidity.

Picture 8 shows this calibration unit mounted inside the instrument. Recalibration is initiated via the touch screen. Thus the instrument will provide reliable measurements for many years without any consumables.

SIGRIST AquaMaster – The compact multi-parameter measuring system

9) AquaMaster

With a minimum footprint of 60x100x40cm (WxHxD), the SIGRIST AquaMaster is mounted on a wall. Based on a completely modular design, the following parameters can be measured: turbidity with all AquaScat models, pH, conductivity, Redox/ORP, dissolved oxygen and temperature. The various parameters can be combined at random.

The measuring system is completely premounted. After supplying electricity, only the water inlet (right) and the water outlet (bottom) have to be connected. Connect – adjust flow rate – measure!

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