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RoDisc® pilot plant with upstream flocculation reactor on STW Mannheim

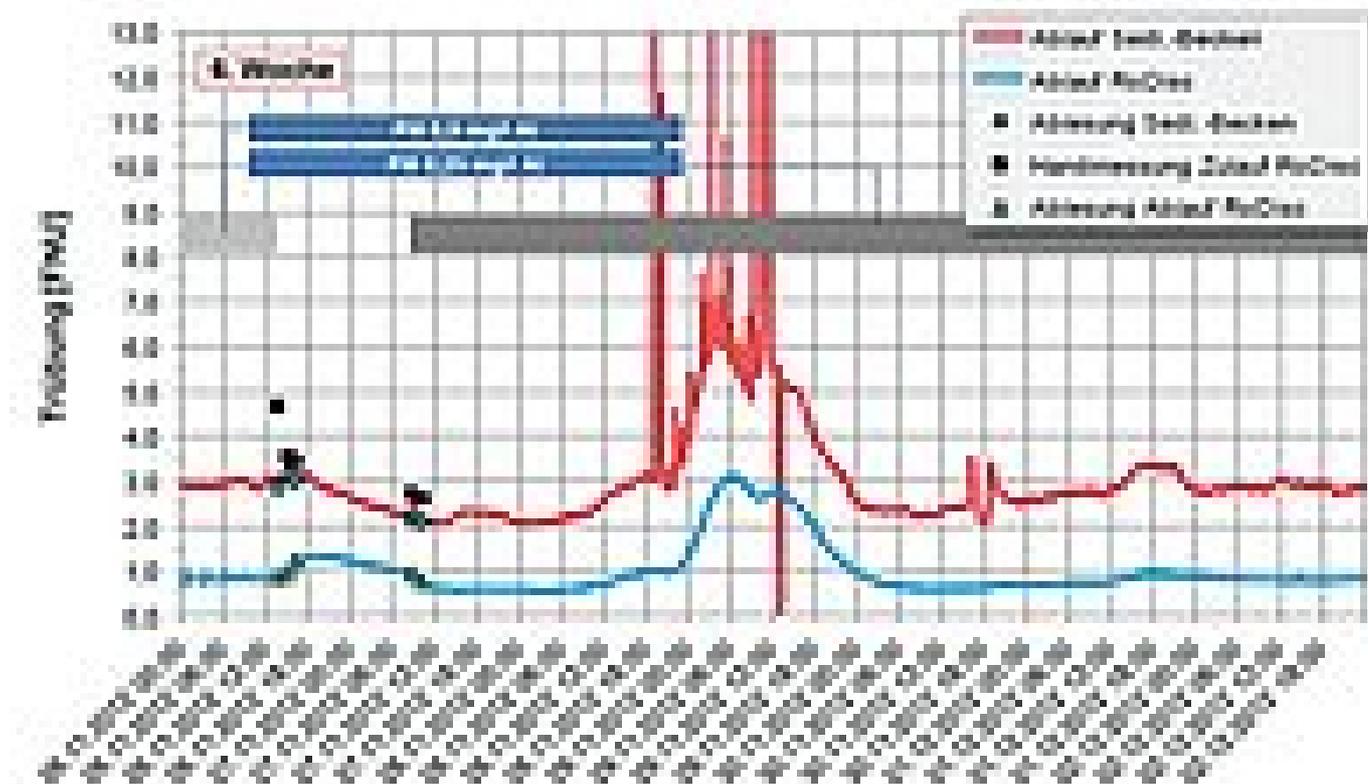
Increasing loads of pharmaceutical residues, industrial chemicals and hormones are discharged to our waters. To counteract this development, these substances must be removed from the wastewater as effectively as possible. The combined use of powdered active carbon and the HUBER RoDisc® Rotary Mesh Screen provides a solution which ensures that the substances to be eliminated are absorbed on the surface of the powdered active carbon and reliably separated from the wastewater flow by the downstream RoDisc® screen.

Pharmaceutical residues are increasingly found in water and soil in Germany. Due to improved methods of analysis a great number of pharmaceuticals can be detected in the concentration range of nanogram to microgram per litre.

The effects these substances have on the ecosystems in our waters have not yet been fully clarified. It is however certain that some of these substances have a high damaging effect on the environment, such as the very commonly used analgesic Diclofenac which can cause kidney damage in fish and has meanwhile been detected in a lot of waters.

Beside diffuse sources and leakage, municipal sewage treatment plants are considered to be the main inlet port for micropollutants. The micropollutants contained in residential wastewater are usually not completely biodegradable and can therefore only insufficiently be removed by conventional wastewater treatment systems. In the present state of knowledge, it is indispensable to integrate additional treatment stages to ensure an as wide as possible spectrum of pollutants are removed.

Absorption of substances with the use of powdered active carbon is a well known method which is frequently applied especially in processing drinking water. It is a physical-chemical separation process in which the substances to be eliminated from the wastewater are absorbed on the surface of the active carbon. A prerequisite for the use of powdered active carbon in industrial scale applications is however the virtually complete retention of the added carbon by means of a filtration system to avoid that some of the carbon passes into the waters. The RoDisc® Rotary Mesh Screen is a cost-effective solution which can easily be integrated into existing wastewater treatment plants. Usually, the quaternary treatment stage downstream of the secondary clarification tank consists of a contact reactor, a sedimentation tank and a downstream filter.



Results of the RoDisc® pilot plant on STW Mannheim

The powdered active carbon is added into the effluent from the secondary clarification tank, directly before the flow enters the contact reactor in which the carbon gets in contact with the STP effluent. After a certain absorption time micropollutants stick to the large (inner) surface of the powdered active carbon. Precipitants and flocculants are dosed into the downstream sedimentation tank to separate the powdered active carbon and return most part of it into the inlet to the contact reactor (PAC circulation). Most of the added powdered active carbon settles in the sedimentation tank due to the addition of precipitants and polymers so that only a small rest is contained in the effluent. A filtration system is necessary to remove this rest of fine carbon after sedimentation. The RoDisc® Rotary Mesh Screen is vitally important in this concept as it prevents the ingress of contaminated powdered active carbon into the water.

Pilot tests were carried out on STW Mannheim from July 2011 to December 2012 to prove that the RoDisc® Rotary Mesh Screen is suitable to remove finest powdered active carbon particles from the sedimentation tank effluent. The pilot tests were conducted with the support from "Kompetenzzentrum Spurenstoffe Baden-Württemberg". The RoDisc® pilot plant was installed in parallel to the existing sandfilters.

The RoDisc® screen is a filtration plant for the removal of very fine suspended matter from wastewater. The screen consists of horizontally arranged rotating filter discs installed on a central shaft and submerged by up to 65 %. The wastewater to be treated flows through the filter discs from inside to outside. The filtrate is discharged via a weir at the front side of the screen. The disc segments are covered with needle felt material to ensure the high requirements for the retention of powdered active carbon particles are met. The fibre composite of the needle felt provides sort of a drainage system which effects the separation of particles when loaded with the suspension. Due to its three-dimensional design the separation effects are virtually the same as those of a conventional deep-bed filter and these are the effects which are necessary to reliably remove the powdered active carbon particles.

To verify separation efficiency, the turbidity was measured and continuously recorded in the effluent from the sedimentation tank and in the effluent from the RoDisc® screen. The tests proved that the RoDisc® screen is able to achieve effluent turbidity values in the range of 1 FNU! The separation efficiency achieved by the RoDisc® screen is similar to the high efficiency of the present two-layer filter.

In addition to the turbidity tests the solids retention efficiency on STW Mannheim was evaluated through visual comparison of the blinded membrane filters with 0.45 µm pore width. The membrane filters were visually inspected to compare how black they were. This is an easy method of evaluating the degree of retention. Also this visual inspection tests showed that the RoDisc® screen retains the powdered active carbon virtually completely.

For reasons of preventive health and environment protection the ingress of micropollutants and trace substances must urgently be limited. In view of the fact that municipal sewage treatment plants have been identified as main emission sources, it should be considered to gradually extend our sewage treatment plants with a quaternary treatment stage. In the present stage of knowledge, wastewater treatment with the use of active carbon represents a technically feasible solution.

The quaternary treatment stage has meanwhile been implemented on most of the sewage treatment plants (particularly in Baden-Württemberg) which until then were equipped with an adsorptive treatment stage. The following equipment components were retrofitted in these plants: powder active carbon dosing system, contact reactor to ensure the required residence time is achieved, sedimentation system, filtration system. The tests on STW Mannheim have shown that the use of a HUBER RoDisc® Rotary Mesh Screen for the retention of powdered active carbon can be considered a reasonable alternative to a two-layer filtration system after an adsorption stage (consisting of contact and sedimentation tank). When planning such plants it must be ensured that the coarse powdered active

carbon particles are already removed in the upstream sedimentation tank and the RoDisc® screen is used to separate only the rest of very fine particles.

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