University of Stuttgart
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Institute for Sanitary Engineering, Water Quality and Solid Wastemanagement | **ISWA**

AWT

Application of granular activated carbon for the removal of persistent organic micropollutants (POPs) in continuously backwashed filters

In advanced wastewater treatment targeting micropollutants (persistent organic pollutants) the focus is amongst others on the adsorptive effect of activated carbon. The application of powdered activated carbon, which is directly added to the biologically treated wastewater in a dedicated process step (contact reactor), is favoured. After the adsorption process the carbon has to be removed from the wastewater, which is usually done by addition of precipitants and flocculants and subsequent sedimentation or filtration. Such adsorption stages are associated with relatively high costs, which constrain their realisation, especially on small and medium-sized sewage treatment plants.

As a process alternative, granular activated carbon (GAC) could be applied instead of the powdered one. It partly shows comparable adsorptive effects and is applied in a fixed bed, which is passed by biologically treated wastewater. The loaded activated carbon will be replaced by a new one and externally regenerated, e. g. no precipitation or flocculation is needed for this technique. The application of existing rapid sand filters, in which sand can be replaced by granular activated carbon as a filter material, is a promising method, which is efficient and inexpensive.

By applying a continuous filtration system, the functions of filtration (removal of suspended solids) and elimination of micropollutants (adsorption) could be fulfilled simultaneously in one tank. This is theoretically possible in the existing filter system of the sewage treatment plant Emmingen-Liptingen.

In order to investigate this alternative, a joint project in association with the community of Emmingen-Liptingen, the Institute for Sanitary Engineering of the University of Stuttgart (ISWA) and the engineering consultants Dr.-Ing. Jedele and Partner GmbH was initiated.

The main objective of the work carried out by ISWA is to define boundary conditions in laboratory and semi-scale experiments, for the selection of granular carbon, in order to apply them in a continuously backwashed Filter.

The laboratory tests include the selection of a suitable granular activated carbon based on selected sum parameters such as DOC (Dissolved Organic Carbon) and SAC (spectral adsorption coefficient). With these parameters it should be possible to estimate the adsorption rate and maximum load of the different investigated GACs. Further aspects are desorption behaviour of micropollutants as well as the maximum feed rate, flow velocity and abrasion resistance. These investigations will be carried out on small lab-scale columns filled with granular activated carbon.

Then, based on the results obtained from laboratory preliminary investigations, gained knowledge will be transferred to a semi-scale filter system in Büsnau at the Treatment Plant for Education and Research (LFKW) at which investigations for the operating method and the process optimisation are performed. For the implementation on large scale, the sand of one of the three continuously backwashed rapid sand filters on the wastewater treatment plant Emmingen-Liptingen will be replaced by granular activated carbon; afterwards the filter will be operated parallel to the two rapid sand filters. The coordination of the large scale implementation, including the laboratory and semi scale investigations, is scientifically accompanied by ISWA.

In case of a successful verification, that such a system could be implemented in practice under economically reasonable conditions, an efficient and inexpensive method for the removal of micropollutants on small and medium-sized sewage treatment plants would be available. A major advantage would be that a majority of the required equipment, such as various filter systems already exist on most sewage treatment plants and just have to be modified or supplemented by filter cells. This could reduce the necessary investment costs for an additional treatment step significantly.

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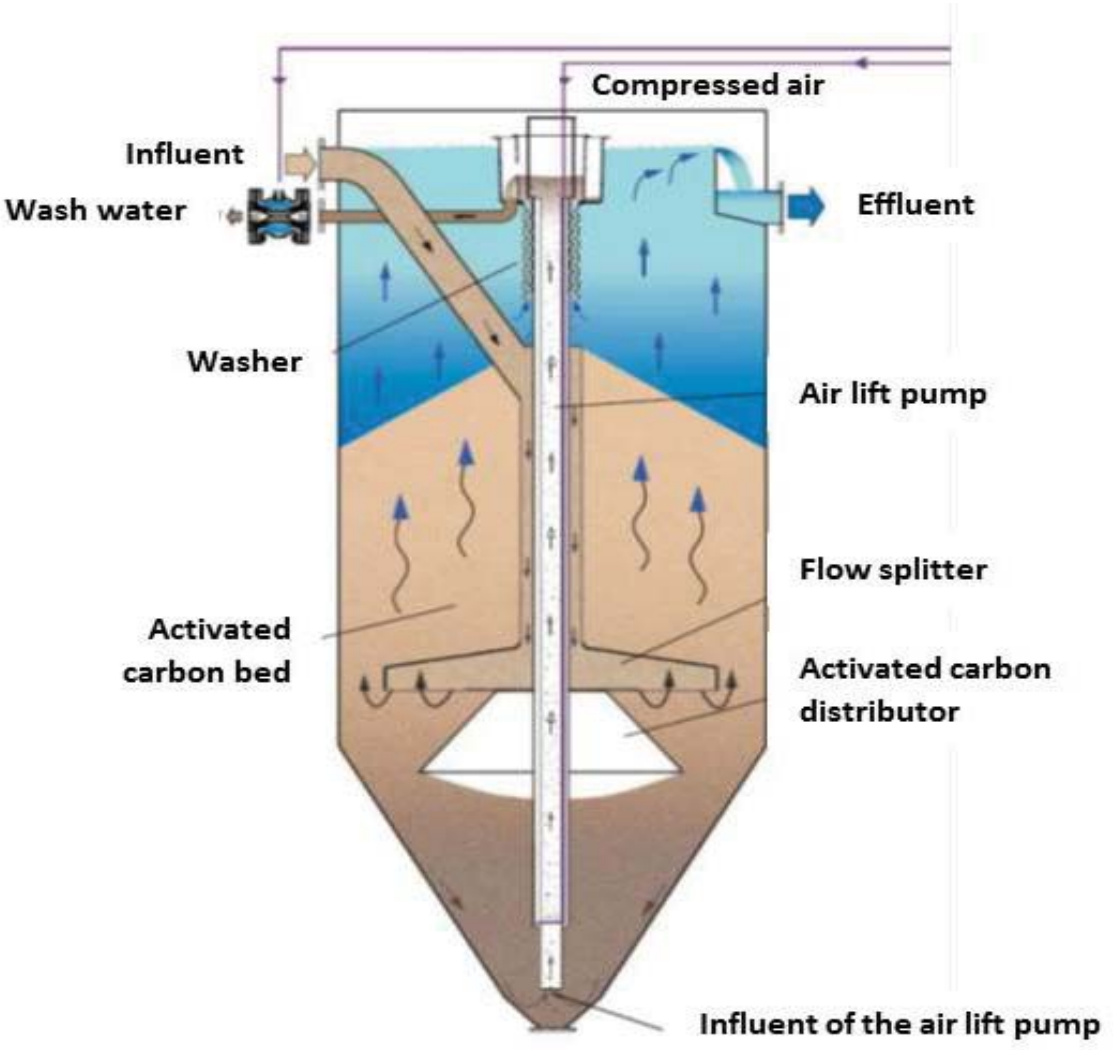

Figure: Schematic of a continuously backwashed filter