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1 *Biological purification (Source: Sewage Treatment Plant Dresden-Kaditz).*

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OXYGEN CONTROL FOR MUNICIPAL SEWAGE TREATMENT PLANTS

Efficient sewage treatment plants are an important precondition to maintaining the quality of life in urban and rural areas without excessively burdening the quality of the elixir water in an irresponsible manner. Laws and regulations provide the legal framework for the observation of limit values in purified sewage water.

The biological removal of harmful substances from sewage water requires certain metabolic processes of the microorganisms in the aeration basins. Due to great fluctuations in the constitution of the sewage water and complex biological interaction, it is difficult to supply the microorganisms with vital oxygen.

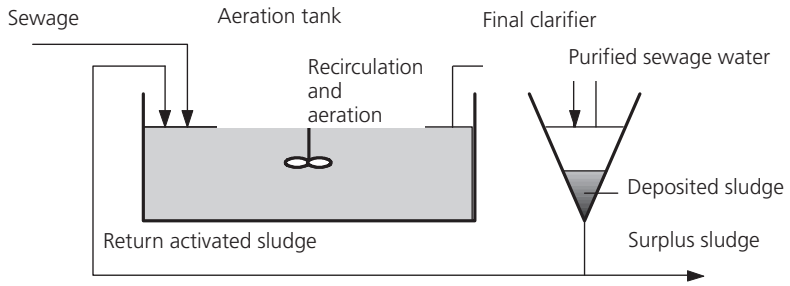
Oxygen Supply of Large Sewage Treatment Plants

The Fraunhofer-Institute for Transportation and Infrastructure Systems IVI has developed novel control methods which stabilize the required oxygen at optimal values for one of the most important large sewage treatment plants in Saxony. This solution contributes towards the improvement of the plants' discharge values whilst considerably lowering its operating costs by minimizing the energy input. Implementation of this method in the treatment plant in Kaditz constitutes a perfect pilot project. Other operating plants with a similar design can be equipped using this innovative technology.

Sewage Treatment Plant in Dresden-Kaditz

Dresden's drainage system is a masterpiece of city planning. Over 1300 km of sewer tunnels transport untreated wastewater and rainwater to the Dresden-Kaditz treatment plant which was built in 1910 and was one of Europe's most modern mechanical treatment plants in its time.

After several expansions it still operates reliably to date and will produce top values once it has been equipped with the latest



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technology. The idea is to preserve the famous technical monument and to advance the historically proven basic functional principle of several treatment stages. The wastewater is first treated mechanically and the partially treated sewage is then transferred to the high-performance biofiltration basin. Microorganisms degrade the dissolved organic pollutants. A precondition for this process is a stable supply of oxygen. By means of compressed aeration the oxygen is transported into 20 parallel purification lines, a common feature in large treatment plants.

Due to their parallel alignment in large sewage treatment plants, conventional aeration control systems for the individual basins do not operate in a reactionless manner, which means that the oxygen supply is often destabilized. Therefore, the plants are operated at an overaerated state for safety reasons, thus unnecessarily increasing energy consumption and reducing the quality of the sludge and therefore also the cleaning capacity.

Process Analysis

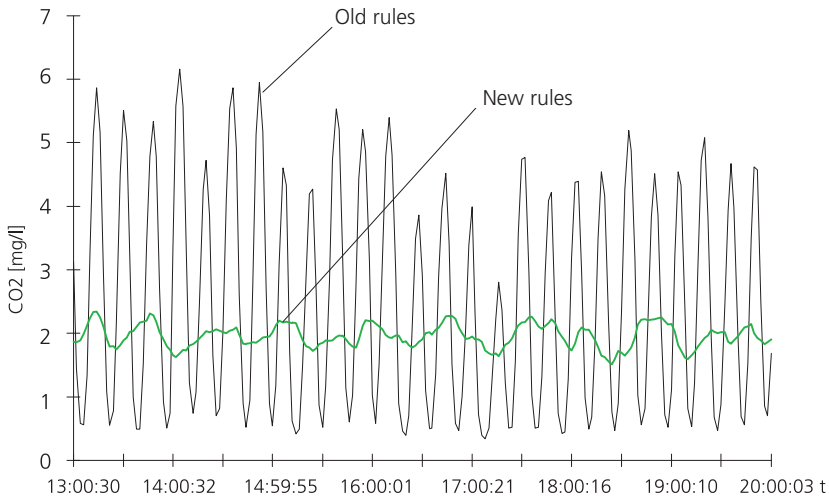
A model reflecting the retroactive effects among the process factors of the aeration system and largely taking the realities into account by means of simulations is available to examine oxygenation in parallel operated activation basins. The actual simulation model is used as a basis for the analysis of the current structure of automatization and to test a novel control technique.

Control Techniques

The aeration of a basin has a retroactive effect on all other basins. The strong interconnections of the process factors are therefore given detailed consideration in a multivariable control unit which is based on the structural information of all interconnections. The strong nonlinear behavior of the oxygenation capacity into the liquid phase is intercepted by adaptive controllers which stand out due to their robustness and stability in many areas of work. The automatization solution permits the steady operation of aeration tanks with 2 mg/l dissolved oxygen, thus minimizing energy consumption by optimizing the pressure and flow ratios. A reduction of the oxygen concentration by 1 mg/l, for instance, can save up to 1.75 MWh annually. Further potential areas of application of the control method are water purification cascades for biological nitrogen elimination.

Cooperation

The novel automatization solution is being developed in close cooperation with the Stadtentwässerung Dresden, and was funded by the Saxon State Ministry of the Environment and Agriculture, State Office for the Environment and Geology.



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2 *Treatment stages.*

3 *Oxygen concentration in aeration basin 2.*