

Basic knowledge

Combined processes

Wastewater usually contains large numbers of substances with different properties. Consequently, a single unit operation is not usually sufficient to treat the water. That is why water treatment plants always combine several individual unit operations. The unit operations are selected primarily based on the properties of the raw water and the treated water quality requirements. One treatment target can often be achieved with different combinations. The question of which combination is most suitable must be investigated for each application. Economic factors are often the key to this decision.

Areas of application for water treatment plants:

- drinking water purification
- treatment of communal and industrial wastewater
- production of process water within industry
- treatment of contaminated ground water (remediation of contaminated sites)

For many industrial processes water with specific properties is required (e.g. hardness, pH value, salt content). At the same time heavily contaminated wastewater is produced in many production processes which cannot be discharged directly into a wastewater treatment plant. Therefore, a water treatment plant is integrated into many production processes. The treated wastewater can then either be discharged into the sewer or reused for the production process.

Such production processes occur, for example, in the following industries:

- food industry
- textile industry
- paper industry

The figure shows by way of example a multi-stage water treatment plant (A) integrated into an industrial production process (B). First the wastewater is treated mechanically. This protects the downstream plant components (e.g. pumps and pipes) against potential damage and clogging. Coarse solids are removed in a lamella separator (2) by sedimentation. Next, non-sedimentable solids are separated in a sand filter (4) by depth filtration. The thus mechanically cleaned wastewater contains no more solids and is then treated using physical/chemical processes.

Dissolved organic substances (e.g. chlorinated hydrocarbons) are removed by adsorption in activated carbon in an adsorber (5). In the final stage an ion exchange takes place (6). This can e.g. be used to remove heavy metals from the wastewater or desalinate the wastewater.

The treated water is collected in a collector tank (7). The treated water can now either be discharged into the sewer (8) or returned to the production process (9). This creates a closed water circuit within the production process reducing the costs of wastewater disposal.



Example of an industrial water treatment plant:

- 1 wastewater
 - 2 lamella separator (sedimentation)
 - 3 collecting tank
 - 4 sand filter
 - 5 adsorber (activated carbon)
 - 6 ion exchanger
 - 7 collecting tank for treated water
 - 8 discharge of the treated water into the sewer
 - 9 reuse of the treated water;
- A water treatment plant
B production