EISENMANN

Waste Water Treatment · Water Purification

This is EISENMANN

Innovations and strategies for the optimization of production, process technology and in-house logistics are what we do best. EISENMANN builds facilities for surface finishing technology, material flow automation, environmental technology, ceramic firing lines and special facilities for coating, recycling, thermal processing and energy recovery.

Approximately 2400 employees worldwide, half of whom are engineers or technicians, develop new ideas for future fields of production, painting, assembly or distribution. Among them are experts and specialists with well-founded know-how in various areas of expertise and industry sectors. An advantage that is mirrored in tailored concepts with state-of-the-art technology and a high degree of economic efficiency.

Another result of our efficient production and assembly strategies: Our production centers are tailored to the requirements of individual customers. They allow the production of a system's configuration specially designed to your requirements at your own site.

EISENMANN technology center in Holzgerlingen

Our unique installation concept offers a significant contribution to increasing quality and on-time delivery performance. When delivering complete systems, we assemble the entire system at our facility pre-assembly building in order to conduct a thorough system check. The individual pre-assembled functional units are delivered to the customer. As a result, the customer saves time and money, and installation can proceed without production downtimes.

Needless to say, once the system has been put into operation, we are there to provide you continued support: Our after-sales service provides professional maintenance, speedy repairs, and immediate supply of spare parts.

Water treatment from a single source

EISENMANN develops, designs and installs custom-made systems for water purification, waste water treatment and water recycling systems for nearly all areas of production and service. This includes a large variety of industries such as surface treatment companies, disposal and cleaning plants, the chemical industry, power plants, the printing industry, metal processing plants, the food industry, the pharmaceutical industry and many others.

Depending on the desire of our customers, EISENMANN provides not only the planning, design and installation of water treatment systems, but also turnkey total solutions, including buildings or even build-operate-transfer models. For this, EISENMANN can utilise experience gathered over 25 years of system design and more than 800 reference installations for water treatment plants.

Complete waste water treatment for a car plant

Turnkey waste water treatment plant in the chemical industry

Desalination plant by ion-exchange for a power station

Contents

The best process for every individual case

Our engineers develop the best water purification or waste water treatment process for each individual application. EISENMANN is able to do this because we offer all of the important systems.

In accordance with our policy, "avoid – recycle – dispose", initially the overall situation of the production process is investigated. The best environmental protection is still to avoid or to reuse emissions. This policy is not only required by law, but the proper process design and resource management also reduces investment capital expenditure and associated operational costs. Also, when refitting existing plants, it is often possible to achieve considerable savings through the utilization of modern recycling technology.

EISENMANN offers a large number of processes and combinations of processes which are specifically adapted to the substances contained in the raw water or waste water. By means of such custom-made water purification and waste water treatment plants, the undesired substances are removed from the water so that the pure water properties required by the production or the corresponding consent limits for waste water can be fulfilled without difficulty.

★★★ highly recommended ★★ recommended ★ applicable	Suspended solids	Heavy metals	Oil / Grease	Sulphate Phosphate	CN, CrVI Nitrite, AsIII	Paint Ink	Organics COD	AOX	Micro-organisms	Ions
Decontamination / Oxidation					★★★		★★	★★		
Precipitation, Flocculation, Sedimentation	★★★	★★★	★★	★★★		★				
Flotation			★★★			★★★				
Filtration/Adsorption	★★★						★			
Microfiltration	★★★		★						★	
Ultrafiltration	★★★		★★★			★★★	★		★★	
Nanofiltration	★★	★		★		★	★★		★★★	★
Reverse osmosis	★	★★		★			★★★		★★★	★★★
Electrodialysis		★		★						★★★
Biology				★			★★★			
Evaporator	★★★	★★★	★★	★★★	★	★	★	★	★★	★★★
Ion exchanger		★★★		★	★		★			★★★

Decontamination · Oxidation

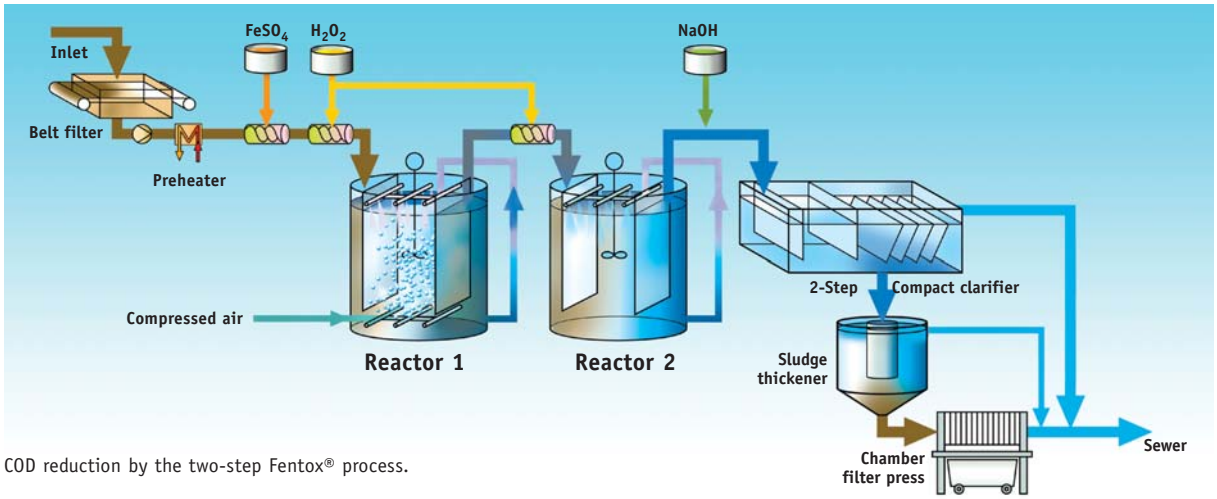
Waste water decontamination is the term for all those processes in which toxic substances in the water are transformed into harmless substances that can then be removed from the water flow.

These are, in particular, waste water flows containing cyanides, chromates, arsenic or nitrite as well as dissolved complex metal compounds.

Around the world, authorities pose increasingly high requirements on the biodegradability of undesired substances contained in water. In some cases very low COD values are demanded.

Industrial waste waters, in particular, are frequently contaminated with organic substances whose toxicity makes the biological treatment difficult or even impossible. In such cases, various oxidative treatment processes can solve the problem.

In particular, the Fentox process® patented by EISENMANN is very promising. It is based on the oxidation of organic substances by means of Fenton's reagent, and in addition to process technology advantages it is also distinguished by low consumption of the oxidation chemical and reduced sludge generation.

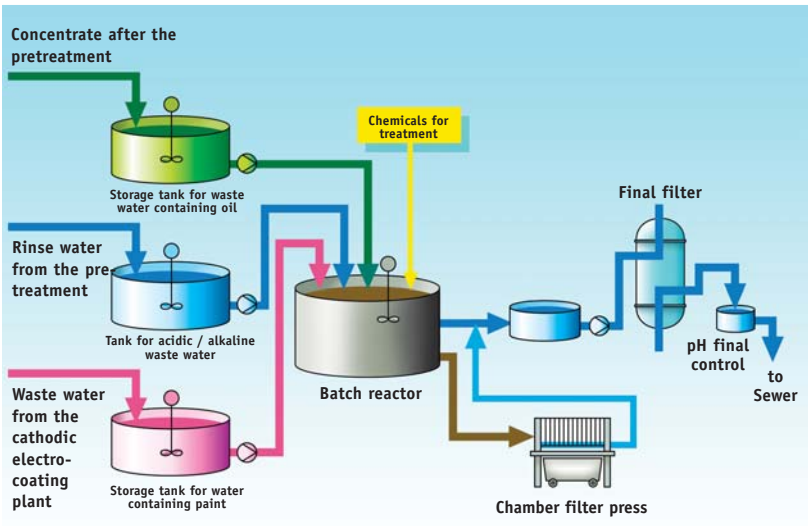


COD reduction by the two-step Fentox® process.

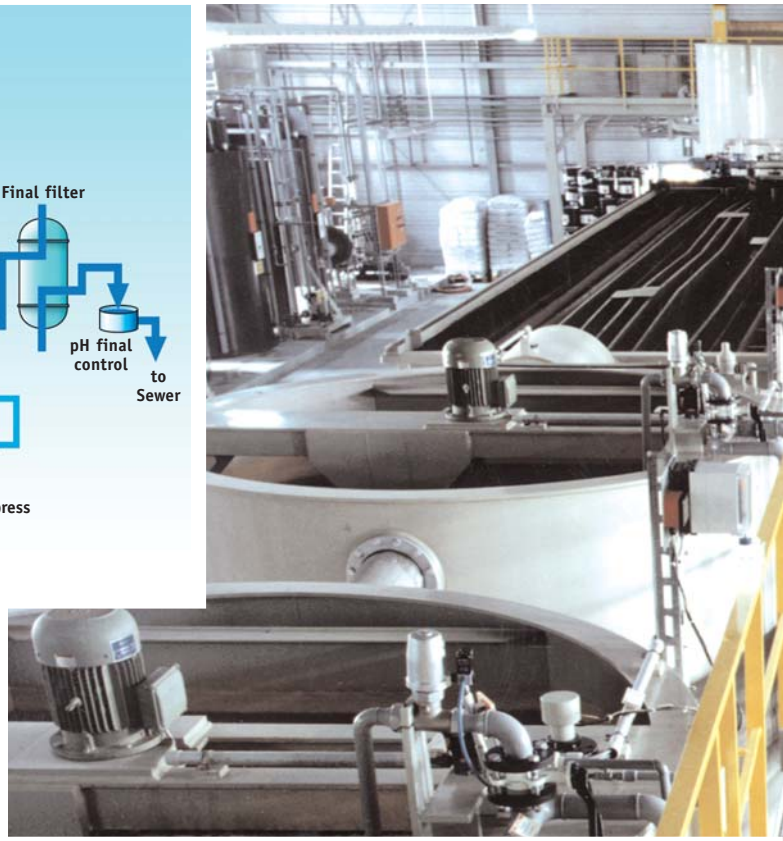
Waste water decontamination for a battery manufacturer

Landfill leachate treatment by the Fentox® process in an industrial park

Precipitation · Flocculation · Sedimentation



Waste water treatment using a batch process



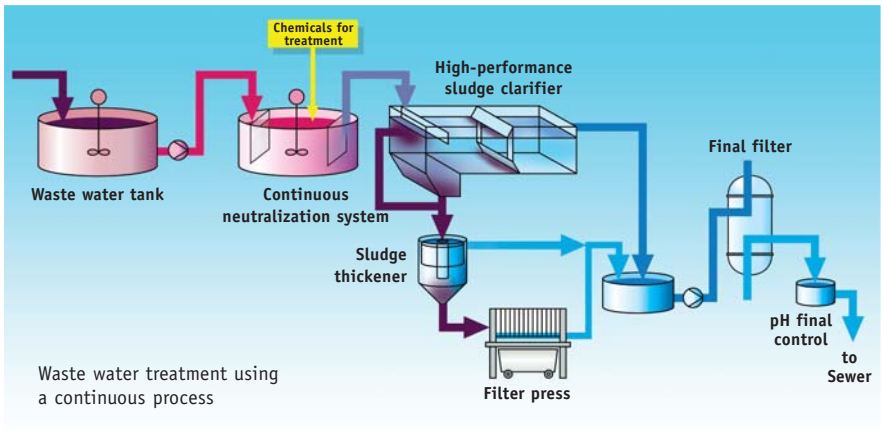
Precipitation is a classic waste water treatment method used for the removal of dissolved heavy metal ions, fluorides, phosphates and similar substances. By raising the pH with neutralization media the harmful substances are transformed into an insoluble form.

By adding flocculant and polyelectrolyte, large flakes are created, which can be separated from the water by sedimentation through suitable settling installations. Therefore, EISENMANN developed the two-step compact clarifier and the high-performance sludge clarifier that are proven technologies in several reference plants.

The separated slurry is concentrated in a sludge thickener and drained in a filter press until it contains approximately 35% dry substance. The water phase from the clarifier is run through sand filters to remove small impurities. Depending on the quantity of waste water, the process is either designed for batch- or continuous operation.

Continuous waste water treatment plant for fluorid removal, preinstalled and commissioned at EISENMANN

Figure, left: Chemical storage, continuous neutralization with a clarifier, batch reactor and DI water circulation system for an aluminium processor



Waste water treatment using a continuous process

Waste water treatment for direct discharge in a river: Phosphate precipitation with contact sludge recirculation and a high-performance sludge clarifier for a chemical production plant

Flotation

Purification of laundry waste water by flotation

Chamber filter press for filtering of slurry

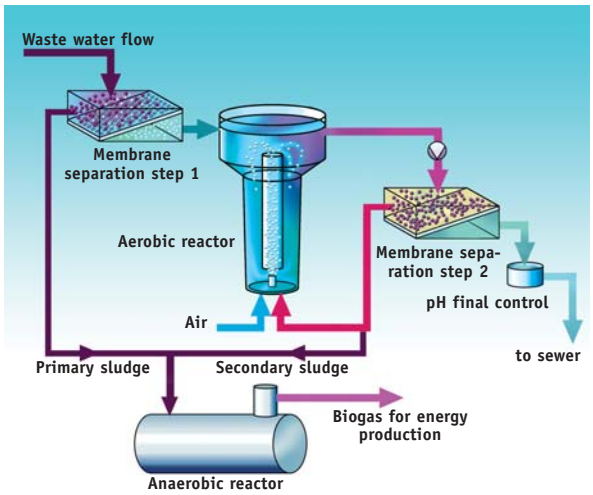
Substances that tend to float because of their low density can be removed from the waste water by flotation technology. These are, for instance, substances that contain oil, grease and carbohydrates, which are used in all branches of industry (e.g. the textile industry, laundries, the food processing industry) and waste water containing paint.

The flotation of the substances contained in the waste water is supported by the addition of chemicals and the injection of dispersed air (expansion flotation). The EISENMANN flotation system enables the optimum separation of the water and the sludge phase. Using the scraper system at the surface of the flotater, the sludge is separated and drained in subsequent process steps, such as the drainage container, chamber filter press or decanter.

Paint sludge flotation in an EISENMANN flotator in an automotive plant

Biology

Cross-flow membrane filtration in the bypass to the bioreactor for biomass concentration and separation



Combination of anaerobic and aerobic techniques with membrane filtration

Biological processes use the ability of microorganisms to transform and remove contaminants in the waste water. Many organic contaminants can only be econo-mically eliminated using biological methods. Therefore, various anaerobic and aerobic techniques are available. EISEN-MANN is your competent partner for industrial and com-munal waste water treatment in this field, too.

The strength of anaerobic technology is the acidification and fermentation of organic carbon compounds into the end products methane and carbon dioxide. Anaerobic processes do not require any oxygen, and the quantity of excess sludge produced is low. The anaerobic process is particularly suitable for waste water with a high organic load (COD, BOD).

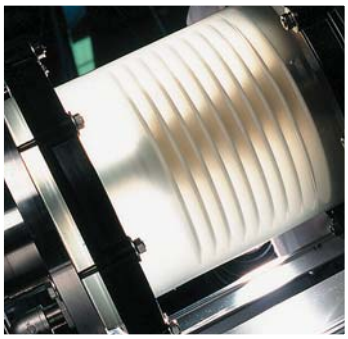
In aerobic biological processes the effluent is supplied with oxygen to grow biomass that degrades the organic substances in the waste water. This oxidation process converts the organics into biomass and mineralized products. Aerobic systems are particularly suitable for achieving very low discharge values of, e.g., COD, BOD, P and N.

Anaerobic and aerobic techniques can be used as single processes or in combination. For example the main reduction of COD is achieved in an anaerobic reactor by production of a high-energy biogas followed by an aerobic purification process in order to reach the low discharge values required. By the additional integration of membrane techniques, the efficiency of biological installations can be increased and the space required for them decreased. Here EISENMANN can make use of considerable know-how accumulated in this product area.

Anaerobic fermentation with production of biogas

Filtration · Membrane separation processes

Sand filter installation for suspended solids removal



Rotor filter for concentrating biomass in highly loaded waste water

Reverse osmosis plant for water desalination

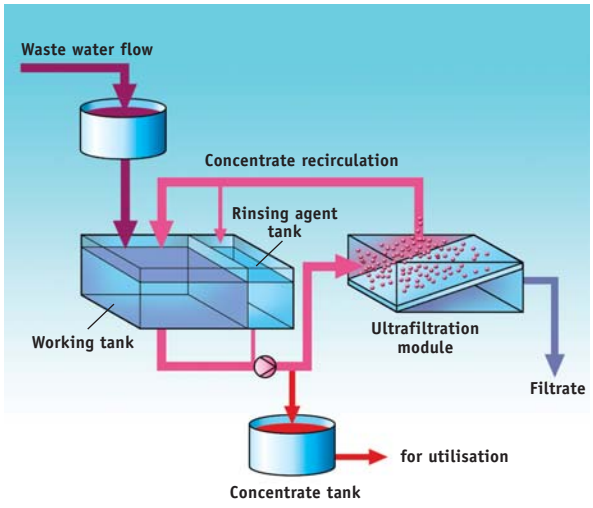
Filtration processes are used to remove fine dispersions or mechanically suspended particles from the water. The product range covers simple candle filters, bag filters or sand filters to more complex filtration layers. In addition to the pore size of these filtration layers, adsorption effects are important for the filtration.

The efficiency of these processes can be combined and increased with appropriate chemicals.

Top: Ultrafiltration system for emulsion splitting at a liquid waste disposal company.

Left: The modular construction of the membrane filtration system ensures high filtration performance and availability.

Membrane process	Cut-off	Example
Microfiltration	**0,1 - 0,9 µm**	**Microorganisms**
Ultrafiltration	**0,1 - 0,01 µm**	**Emulsified oil droplets**
Nanofiltration	**0,01 - 0,001 µm**	**Sugar molecules**
Reverse Osmosis	**0,001 - 0,0001 µm**	**Ions**

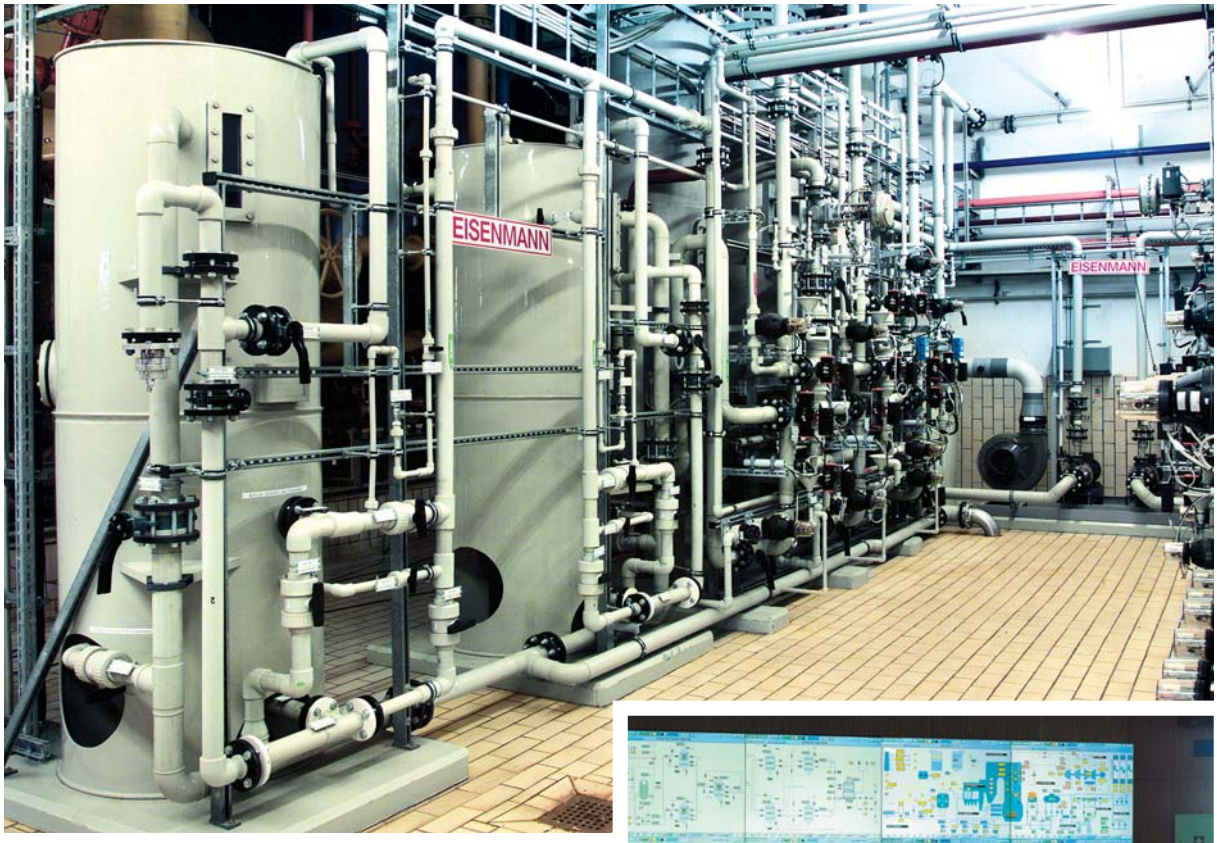


Process diagram of the cross-flow filtration

Membrane filtration is the selective separation and concentration of dissolved as well as non-dissolved substances from the aqueous phase under pressure. The size of the particles to be separated determines the pore size (cut-off) of the membrane which has to be chosen for the optimal process. For example, ultrafiltration is suitable for retaining paint pigments and/-or oil droplets, but ultrafiltration can't retain ions. Consequently, the conductivity of the treated water remains the same. For desalination of water, reverse osmosis membranes are required, which are gaining an increased market share in competition with the established ion exchange processes.

Most important for the efficiency of the membrane separation process is among the cut-off and the individual design, the choice of membrane material (ceramic or organic), and module design (hollow fiber, tubular, spiral wound, rotor or plate).

Ion exchanger



Top: Ion exchanger fluidized bed system for water purification in a power station

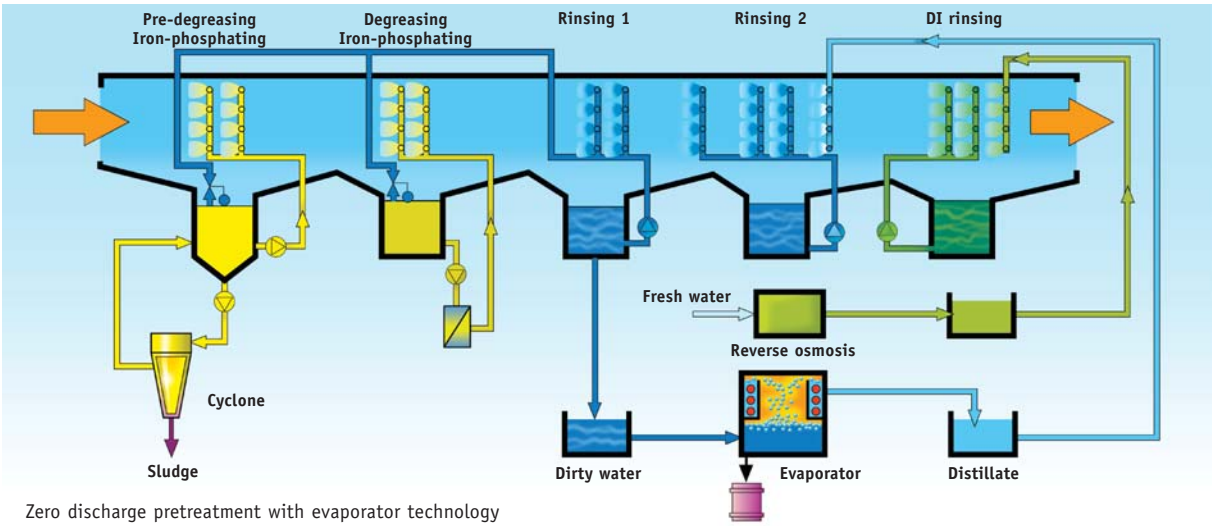
Right: Control panel of a power station equipped by EISENMANN

Bottom right: Ion exchanger system for a water circulation system using new modular EISENMANN design

Ion exchange is the most versatile and proven separation process for water purification and recycling. With this technique, it is possible to desalinate fresh water to the point that it can be used as boiler water in a power station or in combination with membrane separation processes for chip production.

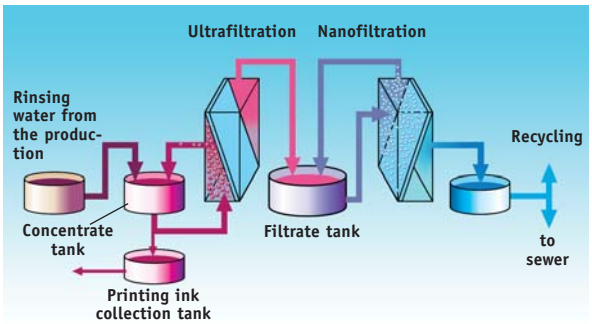
Ion exchangers are often used for the circulation of rinsing water because of their robustness and economical advantages for desalination of low salt-containing water. For the waste water treatment, selective ion exchangers are used for the removal or recovery of metals.

Recycling



Zero discharge pretreatment with evaporator technology

Because of the EISENMANN policy, reduction and recycling are preferred to disposal, and circulation techniques have priority over waste water treatment. With EISENMANN's experience in production processes,



Two-step membrane separation process for printing ink recycling

all options for water saving and water recycling are checked and already incorporated in the design phase.

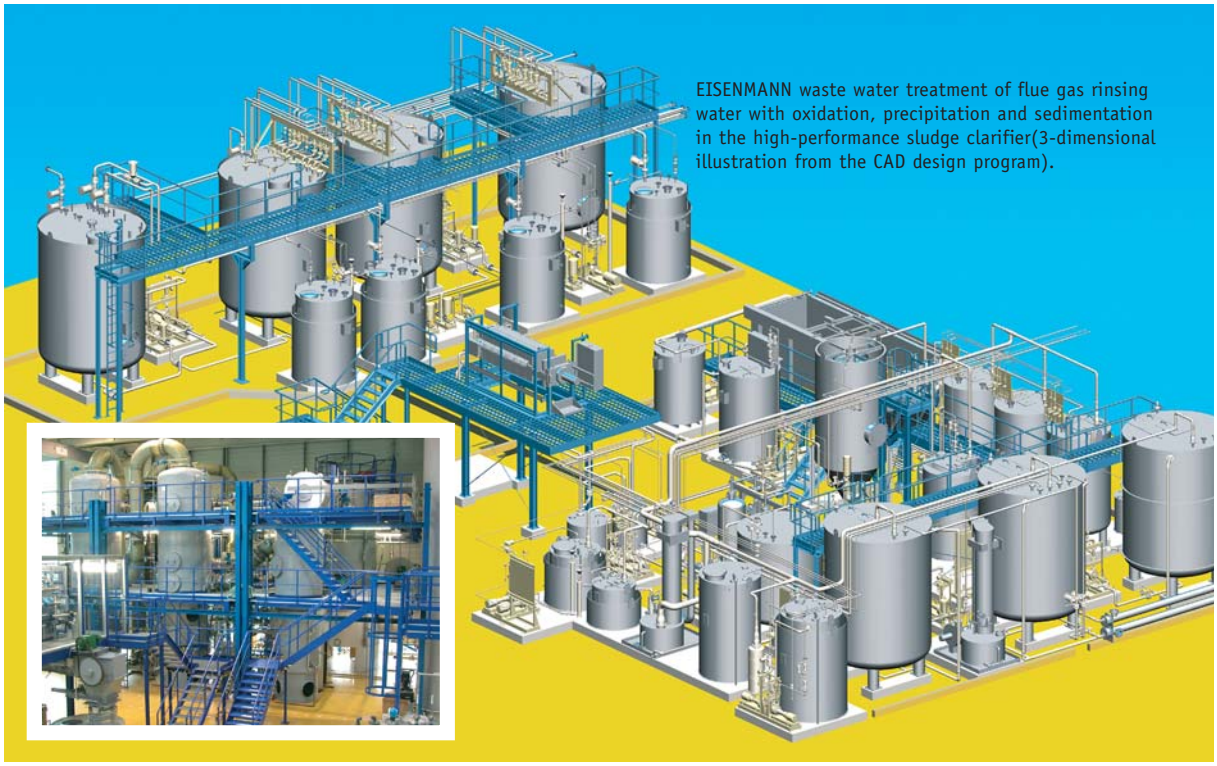
By integration of an evaporator in a pretreatment line zero discharge operation can be achieved. Because waste water no longer discharges into the sewer, a whole series of official regulations and controls are eliminated.

Another example of an optimum combination of economy and ecology is the two-step membrane process for printing ink recycling. The wash water from production has traditionally been treated by coagulation, creating a sludge that had to be disposed of. With the recycling process developed by EISENMANN, the ink containing wash water is treated by ultrafiltration so that the printing ink is recovered and can be reused. The second step, the nanofiltration, removes the trace organic substances and heavy metals from the filtrate of the ultrafiltration. The nanofiltrate can then be reused for cleaning or discharged into the sewer.

The example described shows that the combination of recovery of valuable substances and waste water treatment leads, even for environmental plants, to interesting amortisation periods.

Ultrafiltration with tubular modules for printing ink recycling

Complete environmental technology from a single source



EISENMANN waste water treatment of flue gas rinsing water with oxidation, precipitation and sedimentation in the high-performance sludge clarifier(3-dimensional illustration from the CAD design program).

EISENMANN's extensive product range of environmental technology, with technologies for waste water, exhaust air and waste, enables EISENMANN to develop complex installations and to deliver them from a single source supplier. This ensures optimal process design with minimum operating costs. A typical example is the following modular disposal system.

1st Module: High turbulence reactor ("Turaktor") for the thermal treatment of liquid waste.

2nd Module: Exhaust air purification system for cleaning the flue gas from the Turaktor.

Disposal system for toxic wastes: In the background the thermal treatment and the exhaust air purification, in front of the waste water treatment plant. The total system was completely pre-assembled and commissioned at EISENMANN.

3rd Module: Waste water treatment plant for the treatment of wash water from the flue gas line.

In these three steps, dangerous, highly toxic substances are transformed into waste that can be disposed of without a problem. The waste water will be directly dis-charged into the sewer, and the exhaust air can be released into the atmosphere.

EISENMANN develops and installs customized facilities for environmental protection for

- Water purification, waste water treatment, water circulation
- Exhaust air purification and heat recovery
- Thermal utilization of industrial wastes and recycling of valuable substances
- Biogas plants

In order to avoid conflicts between ecology and economy, our engineers are already researching, in the field of pre-production, all possible methods to avoid or reduce pollutants prior to production.

Adsorption wheel with thermal oxidation system for the treatment of exhaust air from a chemical production site

EISENMANN's new environmental technology program includes all available methods and technologies, enabling them to select, free of bias, the most economical and beneficial solution after the correct disposal concept has been determined.

Remote service is possible with the transfer of digital images and data over telephone lines or the Internet. With this option, service specialists can immediately help maintenance personnel by sending them instructions.

Service and maintenance

Preventative maintenance and continuous system optimization are the basis for a high availability and long-lasting trouble-free operation of your systems.

EISENMANN has a wide range of service options:

1 **Interval service**
2 **Full-time service**
3 **Complete service**

There is an increasing demand for PC and modem-based remote system diagnostics. In these cases, our service specialists check your system remotely at their own PC workstations, and they are in many cases able to restore the operation of the system without having to change locations.

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