Wastewater purification with Lewatit® ion exchange resins and Lewabrane® reverse osmosis elements

QUALITY WORKS.
LANXESS is one of the world’s foremost suppliers of products for treating water and other liquid media. We have more than 80 years of experience in water treatment and are a leader in the development and production of ion exchange resins. Furthermore, LANXESS develops and manufactures reverse osmosis membrane elements. We operate production facilities at our sites in Leverkusen and Bitterfeld, Germany, and in Jhagadia, India.
SPECIFIC SOLUTIONS FOR CRITICAL COMPOUNDS IN WASTEWATER

For the purification of industrial wastewater the removal of toxic, both ionic and non-ionic substances is a crucial task. LANXESS has a wide range of special Lewatit® ion exchange and adsorber resins that remove many types of heavy metal ions and organic pollutants efficiently. Due to the high selectivity of the resins, extremely low effluent concentrations are economically achievable, thus providing cost savings by achieving minimal or even zero liquid discharge. Additionally, precious metals can be recovered and value is preserved by recycling.

When both the selective removal of certain compounds and general purification of the water are requested, Lewabrane® reverse osmosis elements offer an efficient treatment option. Apart from the high rejection of organic substances and salts, LANXESS offers a broad variety of products to find a good balance between rejection and applied pressure. The high-crosslinked brackish water elements (HP and FR) offer a high rejection. Ultra-low pressure (ULP) products benefit from a lower fouling tendency in highly polluted water due to their hydrophilic surface. Overall, reverse osmosis is a safe barrier against pollutants, viruses and bacteria in wastewater and is therefore a good solution to fulfill the highest standards of wastewater discharge.
Removal of per- and polyfluoroalkyl substances (PFAS) with Lewatit® K 6362 and Lewatit® MP 62 WS

Toxic perfluorinated surfactants from fire-extinguishing foams, water-resistant textiles, galvanic applications, paper, the photographic industry, and fertilizers are efficiently removed with the help of Lewatit® ion exchange resins.

- Higher operating capacity than activated carbon enable more than three times longer cycle times and savings on investment costs
- Regeneration provides savings on operational costs
- High operating capacity even in the presence of high concentrations of other water constituents such as chloride, chromate and sulfate
- Ion exchange resins provide PFAS concentrations in effluent below 1 ppb

Figure 1: Flow sheet describing a pilot plant setup for the removal of PFAS from plating baths. Lewatit® MP 62 WS acts as a regenerable working filter, removing the main part of PFAS. Lewatit® K 6362 polishes the water and enables our customers to comply with wastewater limits.

Recovery of cobalt and manganese catalysts from wastewater

Ion exchange resins recover catalysts such as cobalt and manganese from the wash water of terephthalic acid production and therefore help to save operational costs by value preservation to save operational costs by catalyst recycling.

- High selectivities and operating capacities of Lewatit® MonoPlus TP 207 for cobalt and manganese allow value preservation by catalyst recovery and reuse
- Heavy metals are removed from wastewater to (i) protect the environment and (ii) to avoid potential penalties associated with violating discharge limits

Figure 2: Flow sheet of a heavy metal removal unit from flue gas scrubbing water: hydroxide precipitation, mercury removal by Lewatit® MonoPlus TP 214, removal of zinc, cadmium, and lead by Lewatit® MonoPlus TP 207

**Table:**

<table>
<thead>
<tr>
<th>Wastewater from PTA plant</th>
<th>Co²⁺</th>
<th>6–10 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD</td>
<td>4–5 g/l</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>3–4</td>
<td></td>
</tr>
<tr>
<td>Flow rate</td>
<td>120–140 m³/h</td>
<td></td>
</tr>
</tbody>
</table>
Precious metal recovery LWatit® MonoPlus TP 214

The removal, recovery, and recycling of precious metals from wastewater in the plating and automotive industry can be achieved by the use of selective ion exchange resins from LANXESS.

- Efficient metal removal with leakage values below 5 ppb allow a high-value recovery by recycling precious metal
- High selectivities and operating capacities of LWatit® MonoPlus TP 214 for Au+, Ag+, and platinum group metals

Figure 3: Flow sheet describing the recovery of palladium by the use of LWatit® MonoPlus TP 214 in a merry-go-round configuration

Fluoride removal with aluminum-doped LWatit® MonoPlus TP 260

Many industries, such as the solar, glass, microprocessor, and metal-finishing industries, generate fluoride-containing water, which can be purified by ion exchange resins from LANXESS below the wastewater limit of 1 ppm.

- Resin is selective even in the presence of high concentrations of chloride, sulfate, etc.
- Reliable and safe method for fluoride removal. First reference plant in Gujarat, India, in operation for several years
- Regenerated with AlCl₃

Order of selectivity:
- Filter A is run until equilibrium (inlet = outlet concentrate)
- Filter A is removed and incinerated
- B goes into lead position, C becomes 2nd, and new A is 3rd
Heavy metal removal with **Lewatit® MonoPlus TP 214** and **Lewatit® MonoPlus TP 207**

Purification of contaminated water from coal-fired power plants, incineration plants, and mining activities can be efficiently achieved by the combination of **Lewatit® MonoPlus TP 214** and **Lewatit® MonoPlus TP 207** below the wastewater limits.

- Efficient mercury removal with **Lewatit® MonoPlus TP 214** effluent concentration below 0.1 ppb
- Removal of copper, zinc, cadmium, and lead below 10 ppb by **Lewatit® MonoPlus TP 207**

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**Figure 5: Flow sheet of a heavy metal removal unit from flue gas scrubbing water: hydroxide precipitation, mercury removal by **Lewatit® MonoPlus TP 214**, removal of zinc, cadmium, copper, and lead by **Lewatit® MonoPlus TP 207****
Hexavalent chromium removal with **Lewatit® TP 107**

Wastewater is contaminated with toxic hexavalent chromium by the input from leather tanning, from textile dyeing, wood preservation, plating, and metal-finishing industries. The use of **Lewatit® TP 107** allows our customers to comply with the wastewater limit of 100 ppb.

- Savings on operating costs due to less frequent regeneration and thus diminished chemicals' consumption compared to standard technologies
- Up to five times higher Cr(VI) removal capacities compared with conventional strong base anion exchange resins
- Chromate reduction by five orders of magnitude from 100 ppm to 5 ppb
- High tolerance towards background constituents such as chloride and sulfate
- Legal requirements regarding discharge limits are fulfilled in a cost-efficient manner

**Purification of wastewater from chemical and pharmaceutical industry by the use of Lewatit® AF 5 and Lewatit® VP OC 1064**

Surfactants, chlorinated solvents, dyes, solvent extractants, and other organic contaminants can be removed with the adsorbers **Lewatit® AF 5** and **Lewatit® VP OC 1064**.

- Much higher mechanical stability than standard materials like active carbon provides **savings on investment costs**
- High operating capacities require less frequent regeneration cycles and provide **savings on operating costs**
- More efficient regeneration with steam and organic solvents compared to active carbon

**Table 1: A strong portfolio of solutions for critical water problems**

<table>
<thead>
<tr>
<th>Chelating resins</th>
<th>Strong base anion exchange resin</th>
<th>Weak base anion exchange resin</th>
<th>Adsorbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP 207</td>
<td>TP 107</td>
<td>MP 62 WS</td>
<td>VPOC 1064</td>
</tr>
<tr>
<td>TP 260</td>
<td></td>
<td></td>
<td>AF 5</td>
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<tr>
<td>TP 214</td>
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</tbody>
</table>

| PFAS             | 1)                             | 2)                             |           |
| Cu²⁺, Pb²⁺       |                                 |                                |           |
| Co²⁺, Mn²⁺       |                                 |                                |           |
| Pt²⁺, Pd²⁺, Rh²⁺ | 1)                             |                                |           |
| F⁻               | 4)                             |                                |           |
| Hg²⁺             | 1)                             |                                |           |
| CrO₄²⁻            | 3)                             |                                |           |
| Organics         | 5)                             | 6)                             |           |

1) Single use  
2) Regeneration 4% NaOH, conditioning 4% HCl  
3) 7.5% HCl regeneration, 4% NaOH conditioning  
4) Functionalized and regenerated with AlCl₃  
5) Regenerated 7% NaCl  
6) Regeneration with steam or alcohol (e.g. methanol, isopropanol)
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Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling the LANXESS products mentioned in this publication. For materials mentioned which are not LANXESS products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be followed. Before working with any of these products, you must read and become familiar with the available information on their hazards, proper use and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets, product information and product labels. Consult your LANXESS representative in Germany or contact the Health, Safety, Environment and Quality Department (HSEQ) of LANXESS Germany or for business in the USA - the LANXESS Product Safety and Regulatory Affairs Department in Pittsburgh, PA.

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