QUALITY RECYCLES.

Wastewater purification with Lewatit® ion exchange resins

Lewatit®

QUALITY WORKS.

LANXESS
Energizing Chemistry

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. We operate production facilities at our sites in Leverkusen and Bitterfeld, Germany, and in Jhagadia, India.

SPECIFIC SOLUTIONS FOR CRITICAL COMPOUNDS IN WASTEWATER

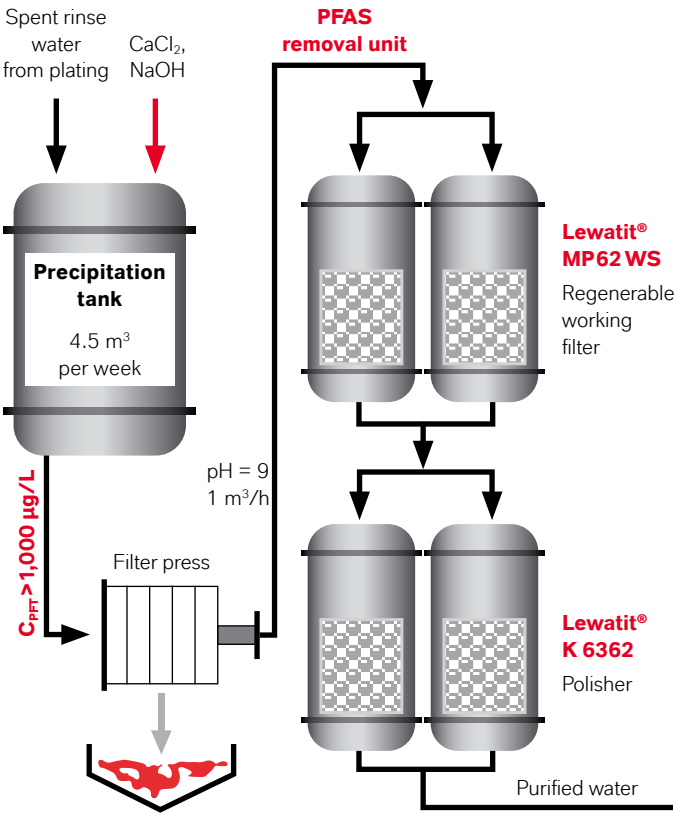
For the purification of industrial wastewater the removal of toxic, both ionic and non-ionic substances is a crucial task. LANXESS has a wide range of special Lewatit® ion exchange and adsorber resins that remove many types of heavy metal ions and organic pollutants efficiently. Due to the high selectivity 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.

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.

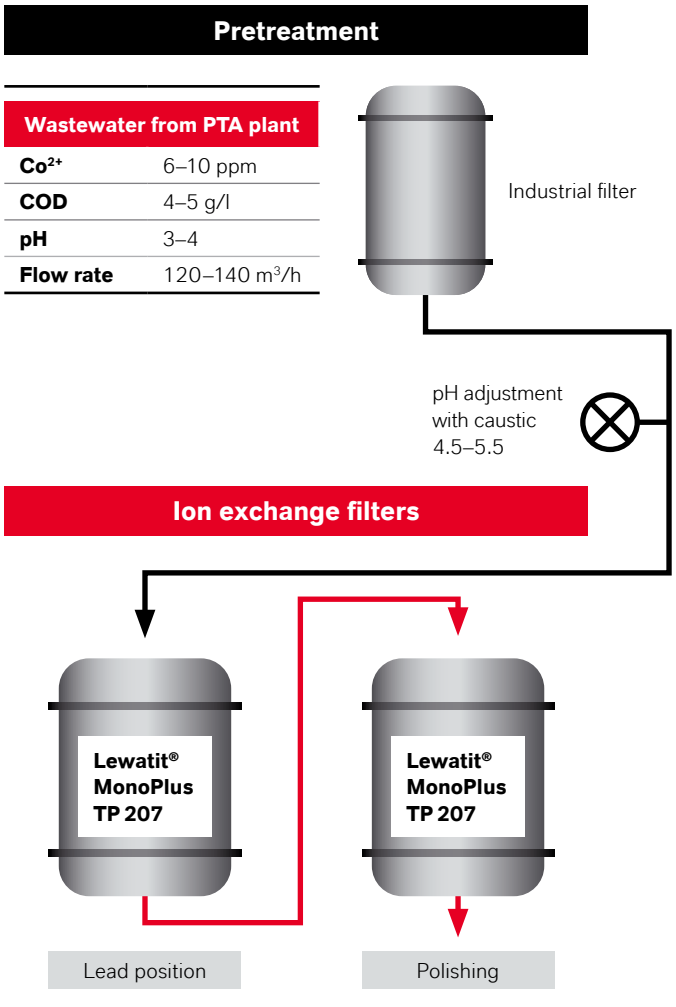


Recovery of cobalt and manganese catalysts from wastewater

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

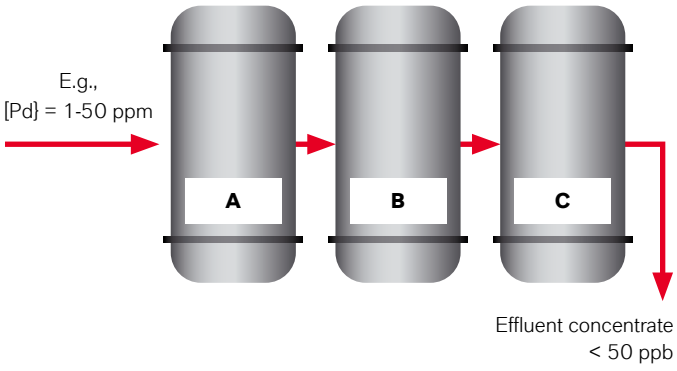


Precious metal recovery Lewatit® MonoPlus TP 214

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 Lewatit® MonoPlus TP 214 for Au+, Ag+, and platinum group metals

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



Order of selectivity:

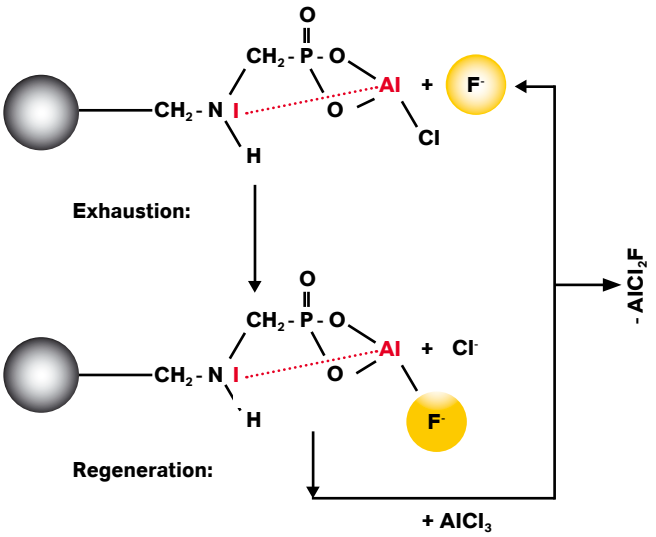
- Filter **A** is run until equilibrium (inlet = outlet concentrate)
- Filter **A** is removed and incinerated
- **B** goes into lead position, **C** becomes 2nd, and new **A** is 3rd

Fluoride removal with aluminum-doped Lewatit® 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 $AlCl_3$

Figure 4: Schematic of fluoride removal by the use of aluminum-doped Lewatit® MonoPlus TP 260



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

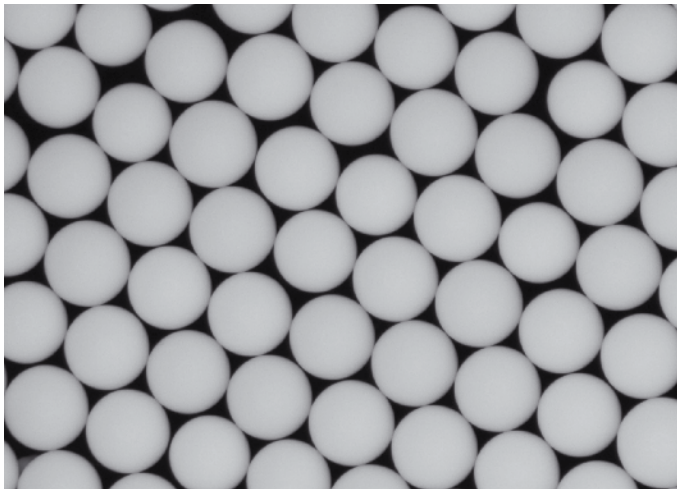
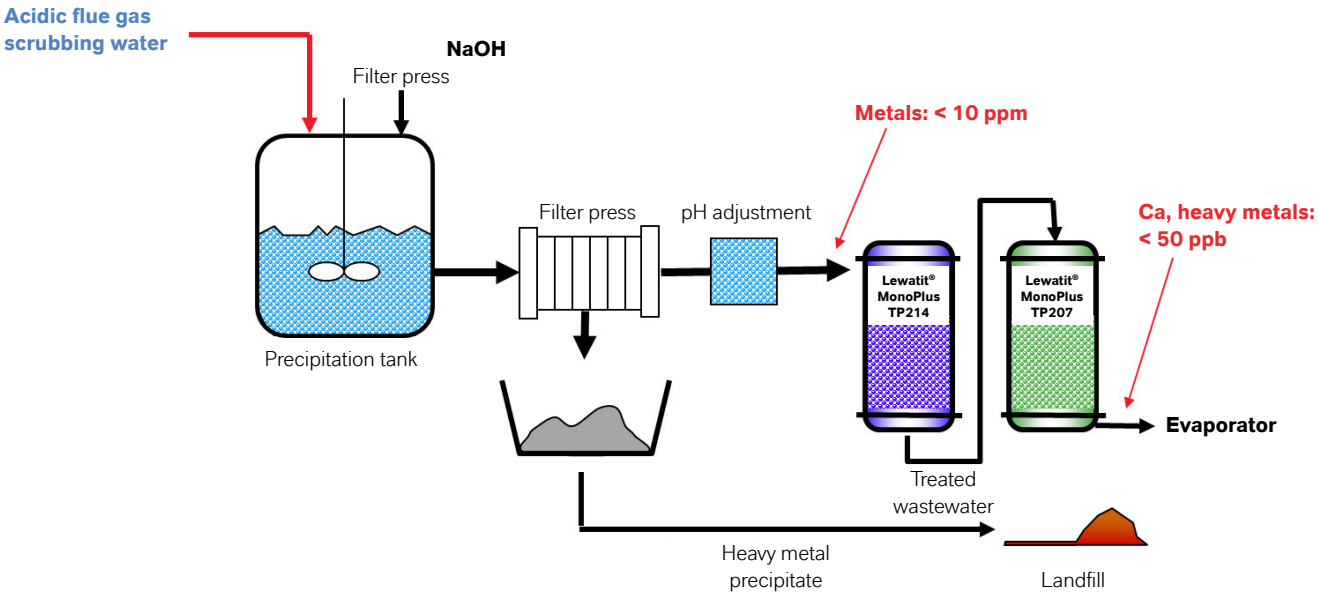


Figure 5: Flow sheet of a heavy metal removal unit from flue gas scrubbing water: hydroxide precipitation, mercury removal by Lewatit® MonoPlus TP 214, removal of zinc, cadmium, copper, and lead by Lewatit® MonoPlus TP 207



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

	Chelating resins			Strong base anion exchange resin		Weak base anion exchange resin	Adsorbers	
	Lewatit® TP 207	Lewatit® TP 260	Lewatit® TP 214	Lewatit® TP 107	Lewatit® K 6362	Lewatit® MP 62 WS	Lewatit® VPOC 1064	Lewatit® AF 5
PFAS					■ 1)	■ 2)		
Cu^{2+}, Pb^{2+}	■ 3)							
Co^{2+}, Mn^{2+}	■ 3)							
Pt^{2+}, Pd^{2+}, Rh^{2+}			■ 1)					
F^-		■ 4)						
Hg^{2+}			■ 1)					
CrO_4^{2-}				■ 5)				
Organics							■ 6)	■ 6)

1) Single use
2) Regeneration 4% NaOH, conditioning 4% HCl
3) 7.5% HCl regeneration, 4% NaOH conditioning
4) Functionalized and regenerated with $AlCl_3$
5) Regenerated 7% NaCl
6) Regeneration with steam or alcohol (e.g. methanol, isopropanol)

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Energizing Chemistry

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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.

Regulatory Compliance Information:
Some of the end uses of the products described in this publication must comply with applicable regulations, such as the FDA, BfR, NSF, USDA, and CPSC. If you have any questions on the regulatory status of these products, contact your LANXESS Corporation representative, the LANXESS Regulatory Affairs Manager in Pittsburgh, PA or the Health, Safety, Environment and Quality Department (HSEQ) of LANXESS Deutschland GmbH in Germany. The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations are beyond our control. Therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent.

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Order No.: 10583-EN, Edition: 2021-09