Ion exchange resins – “all-rounders” for Plating Industry

Chemical processes comprise the steps of processing chemical starting materials, synthesizing the products, isolating the generated materials from the reaction mixture and subsequent purification. In the broader context of the industrial process, they also include detoxifying waste streams to protect the environment and recovering valuable materials. The ion exchange units and resins and from the Ronuk product range is put to successful use in all of these steps.

Ion exchange resins offer a high potential for innovation in a range of applications. They enable processes involving complex chemistry to be configured with relatively simple apparatus.

Examples from a range of applications provide impressive illustrations of this. Most of these processes have already been implemented on an industrial scale, in the plating industry Ronuk ion exchange units and resins are used for following applications

- Chromic Acid Recovery/ Rinse Water Recycling
- Trivalent Chrome bath recycling
- Zn and Ni Electrolyte bath recycling
- Acid Purification/ retardation (HCl, H2SO4)
- Precious metal Recovery (Gold, Silver, Platinum, Rhodium….)

**Purification of chemicals:** Ion exchange resins can have a positive effect on the lifetime and quality of a wide range of electrolyte solutions, such as those used in electroplating. Some of the applications are described below

a) Chromic acid recovery

Chromic acid baths are used in metal working plants for plating and passivation of metal surfaces. During operation these chrome (VI) containing electrolytes may accumulate different metal ions depending on the base material of the processed working piece. Iron, brass or other pre-electroplated metal layer liberate ions like Fe³⁺, Ni²⁺, Cu²⁺ or Zn²⁺ whereas Cr³⁺ originates from the cathodic reduction of the chromate containing electrolyte.
b) Trivalent Chrome Passivation bath recycling

Cr (III) containing electrolyte baths in galvanic applications are contaminated by metals like Fe (III) or Zn (II). The impurities need to be removed without taking out the Cr (III). Impurities of Zinc and Iron can be selectively removed from Cr(III)-baths using special Ronuk resins which needs specific measures with respect to regeneration, backwashing and rinsing. Critical issues are a) a potential loss of the active substance D2EHPA due to improperly washing b) the prevention of clogging of the resin bed and of the distribution system by Continuous backwashing in up flow.
d) Zn / Ni Electrolyte bath recycling

Ronuk’s Ion Exchange Resins business unit has tailored the exchange resins’ characteristics as “Chelating resins”. These resins selectively remove the specific metal ion from the process bath. In the Zn and Ni Electrolyte bath, the impurities like Fe$^{2+}$ can be selectively removed and the bath can be recycled.

Recycling of Zn/Ni Electrolyte for Surface Plating

![Diagram of recycling process]

- **Regenerants:** $\text{H}_2\text{SO}_4$, $\text{NaOH}$, $\text{H}_2\text{O}$
- **Zn/Ni electrolyte, pH = 3.5**
- **IX**
- **Recycled Electrolyte**
- **Waste Water**
- **Selectiv**

**Acid recovery:**

Acids are widely used in production processes such as etching, pickling, polishing, deburring, metal-rafﬁnation, passivation and activation, as well as ore digestion, leaching, nitrilation, sulﬁonation, neutralisation, catalysis, ion exchange and many others. There are different types of acids as hydrochloric acid, sulphuric acid, phosphoric acid, nitric acid, ﬂuoric acid and mixtures of these. In the production process they are taking up impurities as metal ions, metal complexes, organics and solid impurities. An acid puriﬁcation step enables us to remove these impurities and release them within a smaller and concentrated waste stream. The recycled acid can be reused in production.

When you pump an acid containing salt through an anion exchanger column, the acid will be adsorbed by the ion exchanger and the salt will just run through without being effected. On this way you can separate the salt and the acid. Another interesting effect is, that after loading the column with acid, you can easily regenerate the column with very low amounts of water, just by ﬂushing in the opposite direction.
d) Precious Metal recovery:
Precious metals like Gold, Silver, Platinum, and rhodium can be recovered from the waste stream or the process stream by using ion exchange resins.

e) Wastewater treatment:
Selective exchange resins enable the removal of heavy metals from wastewater streams. Alkali metals and alkaline earth metals, which are much less problematic in environmental terms, are not affected and remain in the water. Threshold values with residual concentrations in the ppb range can be maintained in situations where simple precipitation methods generally fail.

A Modular system for customized solutions

The selectivity of the functional groups integrated into the resin beads is generally the key for how the application functions. The appropriate chemical group must be selected from some twelve possible options. Furthermore, endowing the resin with metal ions such as palladium, iron, zinc, calcium and aluminum represents further ways of controlling the reaction and binding possibilities in the resin.

The efficiency of the process can also be controlled via the inner (pore structure) and outer resin structure (particle size distribution). Thus, the introduction of ion exchange resins with a narrower particle size distribution, known as monodisperse resins, was a key milestone in product optimization.

With over 100 products, Ronuk offers a range of ion exchange resins that can be used as a modular system to create individually tailored solutions. Collaboration is an attractive option for customers not only due to the high-quality products this enables, but also in particular because of the quality of technical service it delivers. Chemists and process technicians from the applications Laboratory handles customer inquiries and collaborates on projects.