Technology Summary: Enhanced Ion-Exchange Resin for Ammonia Nitrogen Removal in Wastewater Treatment

Opportunity Statement

The control of nitrogenous compounds in wastewater is an important issue owing to their undesirable effects on the environment. Discharge of excessive wastewater nutrients in the form of ammonia into surface water can cause problems such as eutrophication, corrosion and fouling. It is also a potential cause of diseases like methemoglobinemia, stomach cancer and hypertension. Ammonia can dissociate into ionized ammonium (NH_4^+) in water, but it is only the non-ionized ammonia (NH_3) that is harmful to aquatic life.

Ammonia in wastewater can originate from many sources such as coke firing stations, tanneries, food processing, fertilizer manufacturing, slaughter houses and landfill leachate. Increasing industrialization in developing countries has caused regulators to set stricter limits on the ammonia content in wastewater. There is a strong demand for technologies that can provide a cost-effective solution for removal of ammonia from wastewater.

Current technologies for removing ammonia content in wastewater include the following:

a. **Air Stripping**

   This method involves the removal of ammonia from wastewater by gasifying it with air or steam. The key shortcoming of this method is that it is not cost-effective in achieving low concentration of ammonia in wastewater.

b. **Biological Method**

   The method involves biological denitrification of wastewater to convert ammonia into harmless ammonia gas with the use of bacteria. The main disadvantages of this process are that growth of denitrifying bacteria is slow and the required reaction time is long.

c. **Ion-Exchange Method**

   Ion exchange is a reversible chemical reaction where NH_4^+ from the wastewater is exchanged for an ion attached to an immobile solid particle. The process is simple and easy to implement. However, existing ion-exchange resins in the market have low ammonium adsorption capacity, have very little ammonia adsorption capacity and are expensive.

Therefore, there is a need for a technology that can meet the increasingly stringent requirements of ammonia nitrogen content in wastewater in a cost-effective manner.

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360ip Partner's Solution

360ip's partner employs a proprietary technique to produce an ion-exchange resin with both high ammonia and ammonium ion adsorption. The ion-exchange resin can be regenerated easily to be reused multiple times.

The technology involves the following process steps:

1. Preparation of enhanced ion-exchange resin

1.1 Selected metal ions are bound to resin material. This produces an enhanced ion-exchange resin with improved ammonia adsorption capacity. The metal ions are selected from the group consisting of Ag, Cd, Co, Cr, Cu, Hg, Ni, Pd, Zn, and combinations thereof.

2. Adsorption - Wastewater Treatment

2.1. Wastewater is passed through the enhanced ion-exchange resin for ammonia ($R\text{-}Cu+xNH_3=R\text{-}Cu(NH_3)_x$)and ammonium ($R\text{-}Cu+xNH_4^+ + xOH^- = R\text{-}Cu(NH_3)_x + xH_2O$) adsorption at specified process parameters.

3. Desorption - Regeneration

3.1. The resin is then desorbed with a stripping solution to regenerate the resin.

3.2 Ammonium salt can be recovered from the desorption process and sold to realize economic value that can offset the cost of the process.

Compared to existing methods, the invention has the following advantages

- High adsorption capacity and ammonia selectivity
- Adsorbs ammonia and ammonium ions
- Convenient regeneration of the adsorbent material
- Concentration of ammonia in the wastewater can be easily controlled
- Environmentally friendly since no sludge is produced

Patents

360ip's partners have filed one China patent and have one US patent granted on this technology.

360ip is seeking interested parties for the licensing, further development and commercialization of this technology-based product

For additional information, contact: licensing@360ip.com