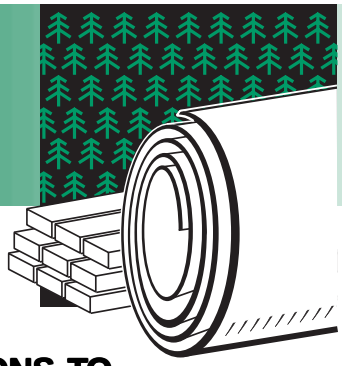
FOREST PRODUCTS

Project Fact Sheet



Electrically Switched Ion Exchange (ESIX) for the Separation of Potassium and Chloride Ions to Enhance Water Recycle Opportunities in Pulp Mills

Benefits

- Little secondary waste
- Species specificity
- Electrode film materials stable to repetitive cycling
- Energy expenditures, about $120/day (in a mill generating 2700 kg/day of potassium and about 35% removal rate)
- Leveraging of a similar technology for cesium removal

Applications

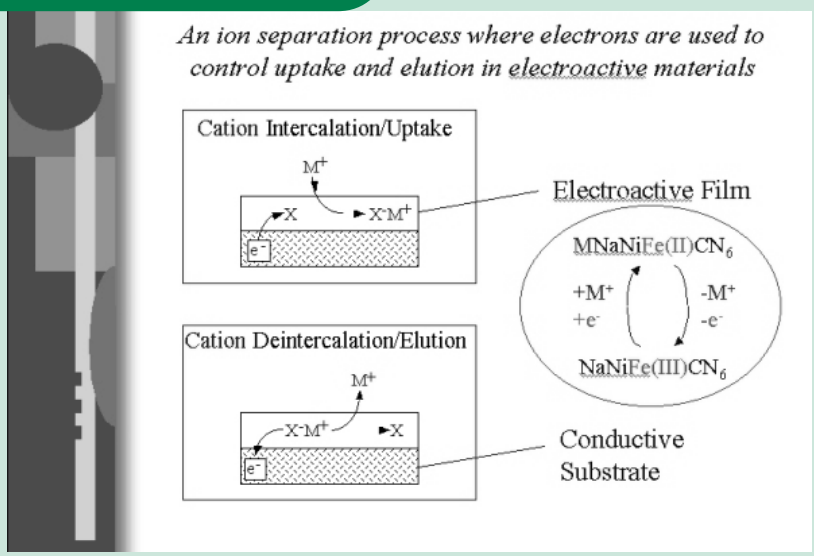
Data from the bench-scale testing will be used for the design, development, and testing of an on-site pilot-scale system that would be carried out as a separate effort. The new technology could lead to a more widely applicable process for removing other waste elements such as calcium and manganese.

Simple, economical technology is proposed to remove potassium and chloride ions from pulp mill process streams

Potassium and chloride non-process elements (NPEs) present in pulp mill process streams can cause a number of problems. The reduction of wastewater discharges from pulping and bleaching via recovery of bleach filtrates is currently limited due to the build-up of these NPEs. NPEs can cause recovery boiler corrosion and plugging. In addition, potassium and chloride must be eliminated to achieve bleach plant closure.

A new system has been proposed for cost-effectively removing potassium and chloride from a pulp mill stream, which has distinct advantages over other removal methods. A hybrid Electrically Switched Ion Exchange (ESIX) system has the potential benefits of lower energy costs, increased selectivity for potassium salt, and an easier operating mode. The hybrid system consists of an ESIX material selective for potassium extraction and a commercial anion-exchange membrane for selective separation of chloride.

Electrically Switched Ion Exchange (ESIX)



Project Description

Goal: To develop a cost-effective technology for removing potassium and chloride ions from a pulp mill process stream.

The ESIX component involves deposition of a suitable electroactive ion exchange material (e.g., nickel hexacyanoferrate for potassium) on a conductive substrate. Through control of the potential applied to the electrode, ions from an adjacent solution are selectively adsorbed and desorbed. Thus, during the adsorption (loading) phase, the ESIX material is in contact with the stream to be treated, and there is uptake of ions. To unload the ions into an appropriate waste stream, the polarity of the potential is simply reversed.

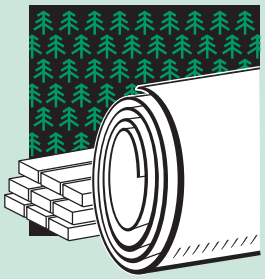
Two methods for separating chloride ions are being evaluated in parallel. One is based on the ESIX concept and the other is based on electrodialysis (ED), which is a more established technology. In ED, a commercially available anion-exchange membrane is used to selectively remove chloride ions. A potassium chloride system will be tested at a bench scale for potential scaling up for use in mills. The WinGEMS computer model will be used for system integration, to evaluate the effects of the technology on total mill operations, and to calculate the economics of a mill using a hybrid ESIX system. The project extends over a two-year period.

Progress & Milestones

- Selectivity testing of nickel hexacyanoferrate materials for potassium over sodium has been completed. A selectivity factor of up to 25 has been determined.
- Laboratory- and bench-scale EH-Cl testing showed that 97% chloride removal can be achieved while still recovering 98% of the sulfate.
- Preparation of nickel hexacyanoferrate materials in forms suitable for laboratory- and bench-scale flow systems is underway.
- Leveraging of developmental work underway through the Department of Energy's Office of Science and Technology on a technology related to a cesium-control process can shorten the time for commercialization of the hybrid ESIX technology.

Awards, Patents, and Invention Records

Two patents are in preparation, an application patent and a matter of composition patent.



Project Partners

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