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## Abstracts

### Kevin J. Shields, Keith Fruzzetti, and Michael A. Sadler
### Condensate Polishing in Fossil and Nuclear Steam/Water Cycles

Impurity levels in the water supplied to the high pressure steam raising plants used for power production must be maintained at as low a level as reasonably possible in order to minimise corrosion and deposition in their steam/water circuits. This has led to the Electrical Power Research Institute strongly supporting the continuous purification of condensate on fossil and nuclear power stations by the use of ion exchange and filtration. It has sponsored the testing and investigation of new processes and currently is exploring innovative approaches aimed at meeting the perceived future requirements of the power industry. This paper briefly reviews the work already carried out in this field and stresses the need to reduce both the capital and operating costs of condensate polishing plants on fossil fired power stations. It also suggests possible developments.

### Alan D. Miller and Keith Fruzzetti
### ptimization of Ion Exchange in Polishers at PWRs

Blowdown polishers are indispensable components in the secondary systems of pressurized water reactors. The application of advanced amines to reduce iron levels in final steam generator feedwater influences the resin selection for and operation of condensate polishers. There are many opportunities to optimize blowdown polisher performance. This paper summarizes the work currently underway to optimally use resin properties such as ion selectivity and capacity and operational parameters to maximize water quality while minimizing cost. It is shown that the best amine for a given power plant is a complex function of amine properties, ion exchange resin choice, purification systems and other plant design and operational parameters.

### Claudia Lacher, Matthias Franzreb, and Wolfgang H. Höll
### Improving the Efficiency of Electrodeionization by Means of Magnetic Ion Exchange Resins

Magnetic micro ion exchangers have been used in an electrodeionization cell within a magnetic field to prevent demixing of the ion exchange filling in the diluate chamber. Initial studies showed that the electrical resistance is an appropriate parameter to characterize the homogeneity of the mixed bed. In order to describe the effect of the magnetic field on magnetic ion exchangers, the electrical resistance of the cell has been determined prior to electrodeionization experiments. Experiments were conducted within and outside a magnetic field to evaluate the improvements.

**Stuart Harrison, Brendan Poots, and Geoff Grellman**
**An Evaluation of MIEX® for DOC Removal from Power Station Water Supplies**

A revolutionary process for the removal of dissolved organic carbon (DOC) has been developed in Australia by Orica Advanced Water Technologies in conjunction with the South Australia Water Corporation and the Commonwealths Science and Industrial Research Organisation. The MIEX® resin process is a continuous ion exchange process, employing a unique strong base anion resin, designed for the removal of DOC from water supplies.

In the first stage of the process, the MIEX® resin is mixed with the water to be treated and its small size encourages rapid removal of DOC. The resin beads also contain a magnetic component responsible for their rapid agglomeration and very efficient removal by sedimentation in the second stage of the process. Flexibility in the process is achieved by recycling approximately 90 % of the recovered resin and adding the remaining 10 %, required for maintaining the resin concentration, as fresh (regenerated) resin. The remaining 10 % of the recovered (used) resin is sent to a regeneration system where it is regenerated and returned to the system for use. The high capacity and unique structure of the resin guarantees minimal attrition, a long performance life and makes the process very cost effective.

The MIEX® resin process differs significantly from conventional ion exchange processes in that the overall ion exchange capacity within the process is continuously maintained. That is, it does not drop off with time as ion exchange capacity is progressively exhausted, as is the case for conventional ion exchange processes. As a consequence, the product water from this process is of consistent quality with DOC controlled at a predetermined level. The process is capable of handling significant fluctuations in raw water quality.

The MIEX® process was evaluated to determine how it might be best implemented for DOC removal at Delta Electricity's Wallerawang Power Station in New South Wales, Australia. DOC in the raw water supply to Delta Electricity's steam generation demineralisation pre-treatment plant was compromising the efficiency of the overall process. The DOC was fouling the demineralisation plant resulting in the production of poorer quality water, repeated cleaning and increased maintenance requirements. Batch and pilot plant studies were conducted to evaluate the MIEX® resin performance when it was applied to treat raw water before the existing demineralisation pre-treatment facility. The demineralisation plant is currently used to supply water to the steam generation plant. Measurements of DOC and ultraviolet absorbance at 254 nm were made to characterise DOC removal. In addition, the impact of this MIEX® treatment on the existing treatment regime together with potential improvements in operational efficiency of the plant were also evaluated.

This paper provides an assessment of the MIEX® treatment process for DOC removal in power station applications. Data on process performance, the impact of operating conditions, point of application, resin concentrations and potential alternative applications of this technology in power stations are presented and discussed.

**Frank McCarthy and Gerry O'Connor**
**Ammonia Form Operation of Condensate Polishing Plant for Long Periods in High pH Systems at Moneypoint Power Station**

This paper details ammonium form operation experience of the condensate polishing system at Moneypoint Power Station, a 3 x 300 MW coal fired station operated by the Electricity Supply Board (ESB) of Ireland.

Ammonium form operation is part of the normal operation of the condensate system since June 1988. Regeneration procedures using a conventional two vessel regeneration system have been developed using both two bed and three bed resin systems to achieve very low levels of cross contamination of resins necessary to allow ammonium form operation whilst still maintaining a very high level of polished condensate quality. Sodium levels of about 0.3 $\mu g \cdot kg^{-1}$ are being achieved without the aid of high efficiency separation/regeneration plant by the adoption of optimum resin particle sizes and densities and the use of a double resin movement technique. Bed run lengths of up to 200 days are being obtained at pHs as high as 9.6.

**Padma S.Kumar, Puspalata Rajesh, Sumathi Suresh, Sinu Chandran, Sankaralingam Velmurugan, and Sevilmedu V. Narasimhan**
**Studies on the Process Aspects Related to Chemical Decontamination of Chromium-Containing Alloys with Redox Processes**

Presence of chromium in the oxide layer makes oxidative pre-treatment with oxidizing agents such as potassium permanganate ($KMnO_4$) a must for the decontamination of stainless steels and other chromium containing alloys. The effectiveness of pre-treatment with oxidizing reagent varies with the conditions of treatment such as temperature, concentration and whether the medium is acidic or alkaline. A comparative study of the two acidic oxidizing agents, i.e., nitric acid-permanganate and permanganic acid was made. The dissolution behavior of copper and its oxide in permanganic acid was found to be comparable to that of chromium oxide. Citric acid and ascorbic acid were investigated as alternatives to oxalic acid for the reduction/decomposition of permanganate left over after the oxidizing pre-treatment step. It has been established that the reduction of chromate by citric acid is instantaneous only in presence of $Mn^{2+}$ ions. It has also been established that reduction of residual permanganate can be achieved with ascorbic acid and with minimum chemical requirement. The capabilities of nitrilotriacetic acid (NTA)-ascorbic acid mixture for the dissolution of hematite have been explored. This study would help to choose the suitable oxidizing agent, the reducing agent used for decomposition of permanganate and to optimize the concentration of reducing formulation so that the process of decontamination is achieved with a minimum requirement of chemicals. The generation of radioactive ion exchange resin as waste is therefore held at a minimum. Ion exchange studies with metal ion complexes of relevance to decontamination were carried out with a view to choose a suitable type of ion exchanger. It has been established that treatment of the ion exchange resin with brine solution can solve the problem of leaching out of non-ionic organics from the resin.

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