

ION EXCHANGE TECHNOLOGY Advances in Pollution Control

EDITED BY ARUP K. SENGUPTA
Published by Technomic, Lancaster, PA 1995

Ion Exchange Technology contains nine chapters dealing with the role that ion exchange and adsorption play in the solution of serious causes of pollution. Each section gives an in-depth review of the problem and how ion exchange processes can be developed to solve the problem in a manner acceptable to the environment.

The introduction written by Sengupta ties the various areas together with a short historical review of the ion exchange process. He states the hope that the book will be useful to professionals working in the field. I believe that his desire has been fulfilled, particularly in the individual concentration on the problem under consideration. Perhaps a tenth chapter on ion exchange phenomena might have served some purpose for those who have not worked in the field.

Clifford's chapter on the removal of uranium and radium from groundwater is an excellent summary of the extensive work that his group has done in this area. The studies were supported by the Environmental Protection Agency. Perhaps it should be recognized that natural radiation unrelated to mining or industrial activity occurs in many parts of the world. Clifford's use of mixtures of cation and anion resins for simultaneous removal of radium and uranium is excellent to reduce radiation in drinking water.

The chapter on nitrate removal from drinking water reports on data collected under and EPA contract. Recognition of selectivity for nitrate over sulfate was discovered by the author, Gerald Guter. By modification of the exchange site, a group of new strong base anion exchangers were prepared which were selective for monovalent over divalent anions. His model calculations show good agreement with plant performance. His survey of large plants did not include a large 10 million gallon per day installation at Pomona, California.

The chapter on chromate has a complete review of the chromate chemistry in relation to the chromate-

dichromate relationship. Here again the EPA has supported the work. Simon's chapter on the effect of natural organic substances as foulants with strong base resins is excellent. Organic fouling of strong base resins is the chief cause of performance failure in strong base anion exchangers. The section is a fine summary of what is being done at this time to solve these problems.

Changing to a different subject, Streat's chapter on hexacyanoferrates as an adsorber of cesium is a classic in detail exposition of a complex subject. He developed the methods of preparation as well as use so that workers could prepare materials for their research studies. In a similar fashion, the chapter on biomass also develops ways to immobilize algae, and peat. Several commercial products are discussed with application information. Mathematical modeling using standard adsorption equations are developed and fair agreement with laboratory results are reported. This work was supported by the Department of the Interior.

The chapter on the Carix process gives a complete discussion on this interesting water treatment system which can partially deionize drinking water using carbon dioxide as a regenerant. Several large plants have been constructed in Germany using pressurized carbon dioxide. The removal of gaseous pollutants by ion exchange was also summarized in a chapter from Japan. This work was supported by the space station program to remove carbon dioxide by weakly basic anion exchange using heat as a regenerant. The use of macroporous exchange structure was shown to be superior to the gel resins. These studies showed that gas adsorption occurs at the exchange site with fair agreement with standard adsorption equations. The final chapter dealt with acidic gas removal using thermal or pressure cycles to regenerate the resin.

This book is a fine example of the wide range of processes which can be developed using ion exchange and adsorption methods. The excellent and quite complete

bibliography associated with each chapter makes this an excellent reference for anyone working in ion exchange and adsorption. Much of the costs of these

projects have been paid for by Government funds. Let us hope that future volumes will have the same benefit.