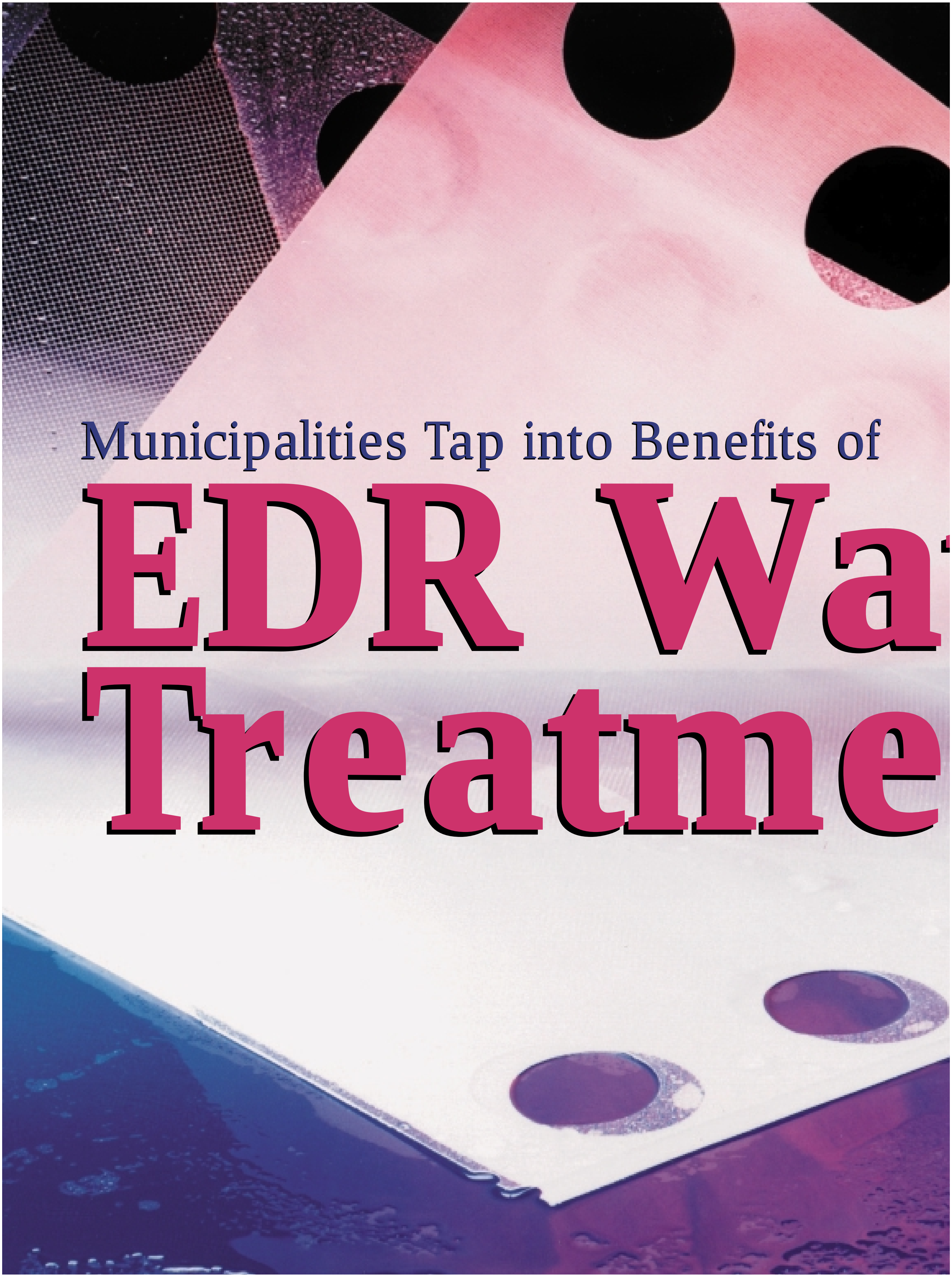
Municipalities Tap into Benefits of

EDR Wa
Treatme



EDR uses voltage potential to force contaminants through semipermeable membranes to filter out dissolved ions from water.

No one wants to drink radium, nitrates or arsenic. However, if not for some technologically advanced methods of removing these contaminants, we all might be sipping on some very unhealthy water.

The citizens of Washington, Iowa found that out when problems arose. In 1979, the Iowa Department of Natural Resources notified Washington that the city was in violation of the radium standard for drinking water. Even then, radium was recognized as a dangerous carcinogen. Washington evaluated a number of options for improving the water quality and removing the radium from the water. Town officials decided on implementing an electrodialysis reversal (EDR) process. This was a relatively new variation on the electrodialysis process that had been commercialized by Ionics, Inc., in the 1950s. Thanks to that technology, the city has seen its way clear to having no water quality problems.

Today, there are many other examples of cities, towns and municipal organizations that have found EDR demineralization to be an economical, high performance way to transform nonpotable water into high-quality, safe drinking water.

Self-Cleaning

EDR is a variation on the electrodialysis process, in that it uses electrode polarity reversal to automatically clean membrane surfaces. The electrodialysis process uses a driving force of direct current (DC) power to transfer ionic species from the feed water through cation (positively charged ions) and anion (negatively charged ions) transfer membranes to a concentrate stream, creating a more dilute stream. EDR works similarly, except that the polarity of the DC power is reversed two to four times per hour. When the polarity is reversed, the dilute and concentrate compartments also are reversed. (See Figures 1 and 2.) The alternating exposure of membrane surfaces to the dilute and concentrate streams provides a self-cleaning capability that enables purification and recovery of up to 94 percent of the feed water.

There currently are a number of alternatives to the EDR technology for

Figure 1: Negative Polarity

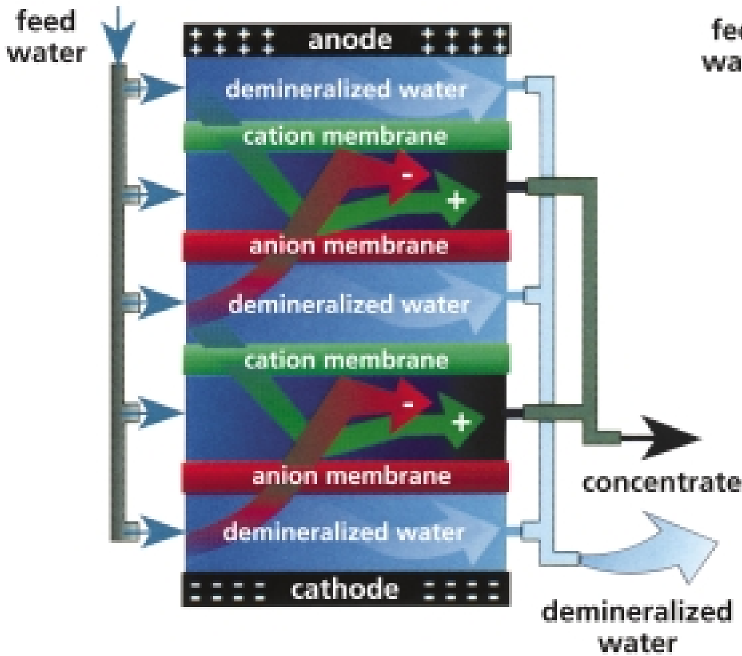
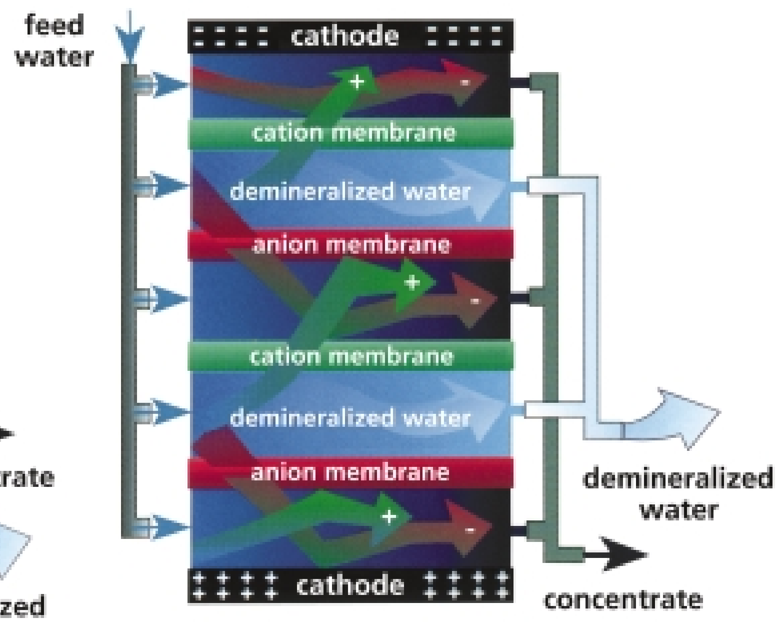


Figure 2: Positive Polarity



treating and reducing contaminants in drinking water and feed water. Probably the best known of these processes is reverse osmosis (RO). Both EDR and reverse osmosis use semi-permeable membranes to filter out dissolved ions from water. However, where RO uses the application of pressure to overtake osmotic pressure and force water through the membranes, EDR uses voltage potential to force contaminants through the membranes.

The RO process often has a capital cost advantage over EDR but can require extensive pretreatment, higher pumping power and more chemicals. RO also has a lower water recovery rate if the water has positive scaling tendencies.

An Evolving Technology

Over the last ten to fifteen years, numerous advances in membrane and system technology have made EDR an especially attractive technology, both in terms of performance and cost-effectiveness. Improved membrane technology now allows for one-step machine manufacture of ion exchange membranes, reducing costs and lowering membrane resistivity. New high performance spacers (placed between the membranes) allow better transport of contaminants like nitrates, speeding the process, reducing the number of membrane stacks required and shrinking costs.

The next generation of EDR systems has made major improvements in the design. This new design streamlines the process flow with simpler hydraulics and standardized components, substantially lowering the capital and operating costs of EDR demineralization. It features the new spacer technology, as well as a more compact design that is easy to install in an array of configurations.

The growing popularity among municipalities of the next generation EDR systems, with their new compact efficient design and field-tested track record of success, comes as no surprise. In recent years, completely new EDR installations have taken place around the world for a variety of applications. At the Ruth Fisher School in Arizona, an EDR system was installed with the objective of removing inorganic components from groundwater and reducing nitrates to meet U.S. Environmental Protection Agency drinking water standards. The nitrate concentration in the feed is more than 100 mg/L, but the EDR system produces water with extremely low total dissolved solids and nitrate concentrations.

At the Bermuda Water Works, EDR is used to reduce hardness in the island's existing water supply (600,000 gpd). The brackish water lens under the island is contaminated from septic tank leach fields, making nitrate removal essential. The plant removes 86 percent of the nitrates, while achieving 90 percent water recovery.

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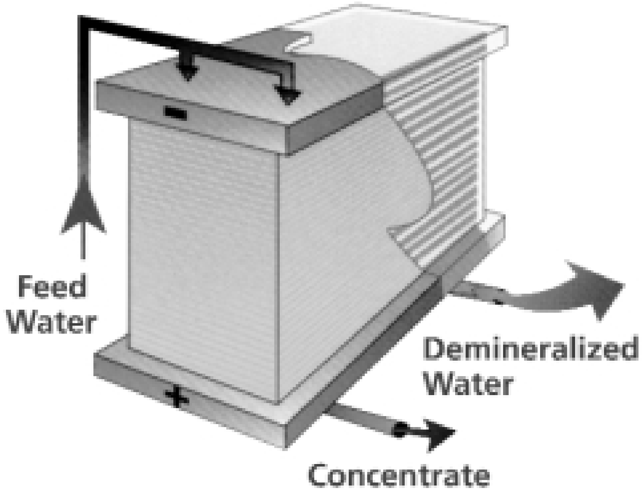
Figure 3: EDR Module



In Kazusa Town, Japan, concerns were about nitrate levels as high as 80 mg/L in the water supply. An EDR system worked to reduce the nitrates to less than 27 mg/L in order to provide safe, great tasting drinking water to the city.

After years of proven performance in Washington, Iowa, other Iowa municipalities have installed EDR, with ever-larger capacities to treat groundwater for radium, hardness and salinity reduction. Mt. Pleasant, Iowa, installed a 2.5 mgd EDR system in 1997. Following the old adage that success breeds success, Fairfield, Iowa, is building an EDR plant to desalt groundwater that then will be blended in an existing lime softened water system for up to 4.0 mgd of product water.

A new installation near Albuquerque, N.M., is using EDR in a very deep well water source that has limited flow capacity. This EDR installation will be removing salinity, arsenic, iron and manganese for the supply of drinking water. With EDR, 92 percent water recovery is achieved. EDR was selected for this application because RO was not efficient from a recovery standpoint with the anticipated level of silica in the raw water supply.

As EDR technologies evolve and improve and efficiencies increase, one thing is becoming increasingly clear: EDR has a bright future. EDR systems now are simpler and more reliable, which means that the demineralization of difficult-to-treat water is easier for municipalities to handle. In addition, the costs are becoming easier to swallow.

Information for this article was contributed by Ionics, Inc., Watertown, Mass.