

NEW TECHNOLOGY: CAPACITIVE DEIONIZATION

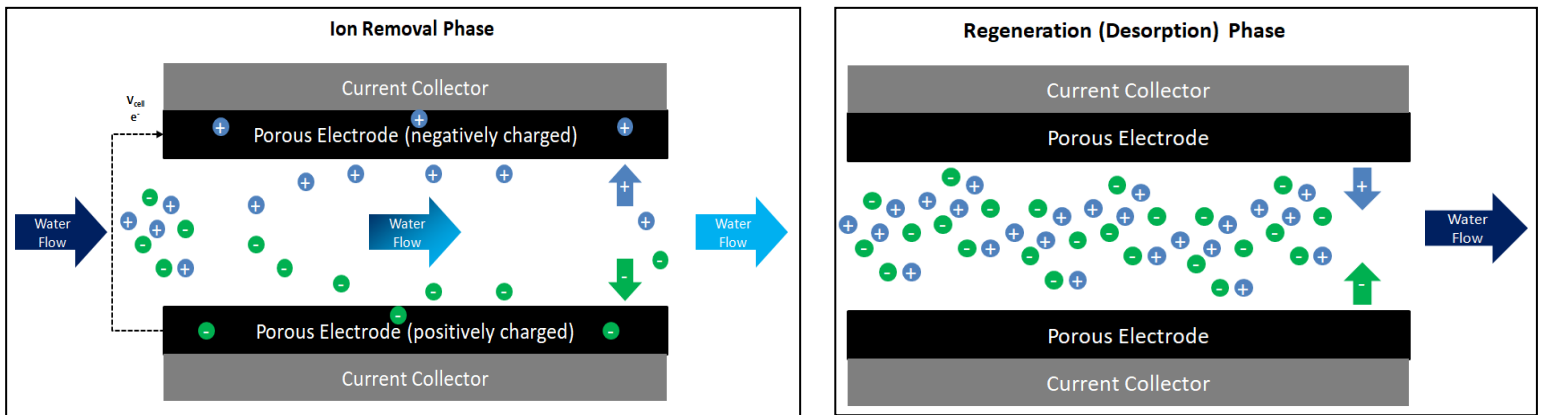
What is CDI?

Capacitive Deionization (CDI) is a promising, new regenerable technology used that is able to remove ions from water by applying an electrical potential difference over two electrodes, typically made with Kuraray's YP product series.

Application Detail: The YP Product series' tailored pore size distribution, specialized particle size, and high purity make it the industry standard for CDI applications and energy storage devices, such as supercapacitors.

How Does CDI Work?

There are two phases within a CDI cycle: an ion removal phase and a regeneration phase. During the ion removal phase, water that contains ions passes over the carbon electrodes that are charged: one negatively charged and one positively charged. The negatively charged ions in solution are attracted to the positively charged electrode and the positively charged ions in solution are attracted to the negatively charged electrode, thus deionizing the water. Once the device's capacity for the ions has been exhausted, the electrodes will enter a regeneration cycle where the electric potential is removed (or reversed). Ions that have accumulated in the electrode are now entered back into solution and extracted as a brine concentrate. The electrodes can be reused in the next cycle.



Benefits of the Technology:

While there are other technologies, primarily Reverse Osmosis and Ion Exchange, that can remove ions from water, there are several benefits to the CDI Technology: the tunability in performance, primarily the ease of regeneration, and the drastically reduced operating cost for waters < 1,500 ppm TDS. By adjusting the operating conditions, the CDI technology can tune its ion removal rate- this is beneficial for applications that don't require complete ion removal from solution, such as drinking water or bottling facilities where salts are often added back into solution to improve taste. Another benefit is the

simplicity of the regeneration cycle. Ion Exchange medias can be regenerated using high concentration/high volume brine solutions that are often expensive, difficult to handle, and difficult to dispose of solution once used. The CDI technology is able to be regenerated simply by removing the electric potential and creating a lower volume, concentrated brine. Below is a table summarizing the different technologies:

Parameter	CDI	Reverse Osmosis	Ion Exchange Resin
Driving Force	Electricity (Low Voltage)	Water Pressure	Ion Exchange
Removal Rate	≈ 95%	≈ 99%	≈ 99%
Removable Ion	Permeable Ions	All Ions + Organics	Multivalent Ions
Water Recovery/Yield	High (70-90%)	Low (30-50%)	Medium (50-90%)
Capital Cost	Medium	Low	Low
Operating Cost	Low	Medium	Low
Tunability in Performance	Yes	No	No
Regeneration Method	Turn off Potential	None	High Concentration Brine/Acid
Flow Rate	Medium	Low	High

Applications:

While this technology can be applied to remove a wide range of ions from aqueous solutions, below is a list of applications where this technology has been effectively applied:

Industrial/Commercial
Cooling Tower
Process or Feedwater
Commercial Laundry
Wastewater

Agriculture
Horticulture
Vineyards
Water Reuse

Residential
Point of Entry Systems
Point of Use
Consumer Appliances
Municipal Well Water

Calgon Carbon & Kuraray Advantage:

- Our YP product series has been successfully used in this application for ~ 10 years and demonstrates performance advantages over competitive products in the marketplace.
- CCC/Kuraray is able to produce electrodes for testing if requested.
- Technical know-how in the application and tailoring products to meet specific customer needs

North & South America

Calgon Carbon Corporation
 3000 GSK Drive
 Moon Township, PA 15108
info@calgoncarbon.com

Europe, Middle East, & Africa

European Operations of Calgon Carbon Corporation
 Zoning Industriel C de Feluy
 B-7181 Feluy, Belgium
info@chemvironcarbon.com

Japan & Asia

Kuraray Co., Ltd. Carbon Materials Division
 8-1, Kakudacho, Kita-ku
 Osaka 530-8611, Japan
Eminfo.jp@kuraray.com