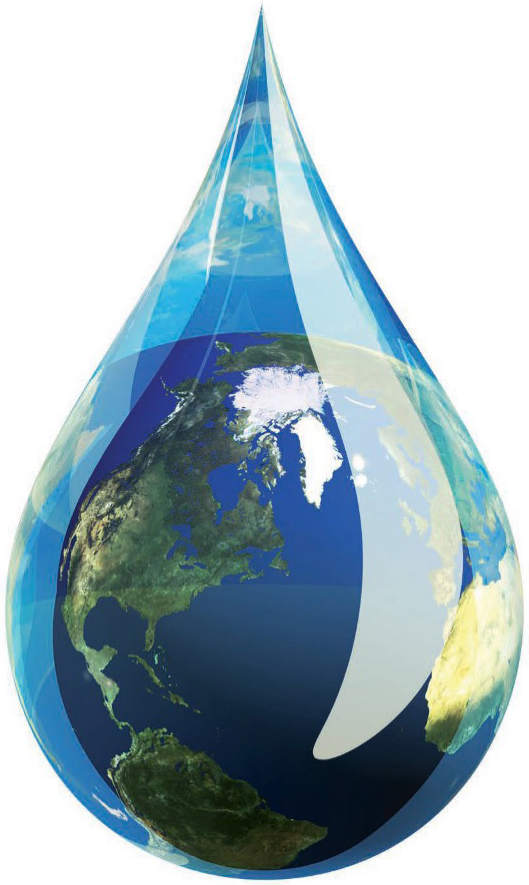
NORIT
ACTIVATED CARBON

Water Treatment Services

WASTEWATER

NORIT® Activated Carbon: Making Water Cleaner

We are a leader in wastewater purification with products tailored to meet the treatment objectives for various wastewater applications. As a leading global manufacturer of activated carbon, we deliver consistently high-quality, reliable products and offer services to help customers meet or exceed their environmental responsibilities.

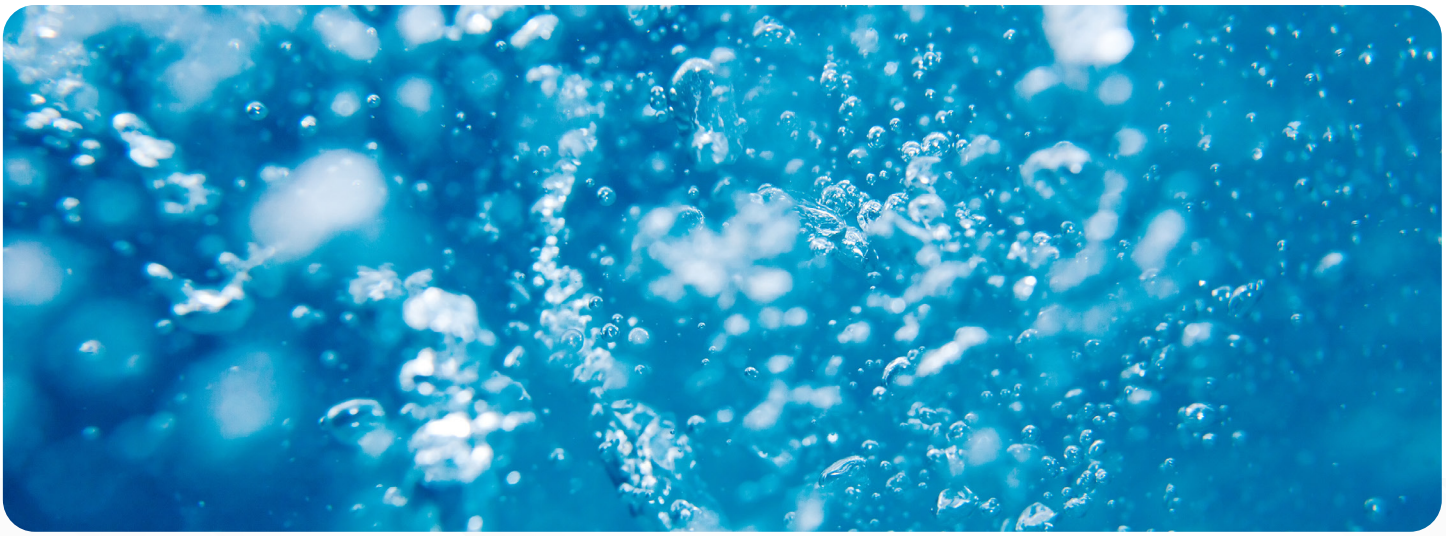


Activated carbon plays a key role in improving the quality of water systems by removing impurities from wastewater before it is discharged to water bodies, applied to land, or reused. It is highly effective at removing hydrophobic and/or high molecular weight organic contaminants from a wide range of wastewater.

Offering the broadest product portfolio in the industry, we produce activated carbon from a variety of raw materials in ISO 9001-certified plants worldwide.

In addition to high-quality activated carbon products for applications in the wastewater industry, we also provide a comprehensive service offering, including:

- Review of your activated carbon needs
- Technical assistance through evaluations
- Reactivation services



PAC or GAC?

Whether to use powdered activated carbon (PAC) or granular activated carbon (GAC) as the preferred treatment option is determined by the contaminant loading levels of incoming wastewater, the treatment targets for treated wastewater, capital costs, and if the activated carbon will be recycled or reactivated (GAC applications only) after its useful life. Beyond meeting the purification requirements of your final product, selecting the right activated carbon can have a significant effect on your operational efficiency.

Feature	PAC	GAC
Low residual concentration of contaminants achieved	++	+++
Achievable contaminant loading level of carbon	++	+++
Capital costs	$	$$

We offer a full range of NORIT® PAC grades for wastewater treatment, with:

- Different pore structures and adsorptive properties to optimally eliminate your target compounds
- A variety of particle size distributions, allowing the best selection for adsorption kinetics and sedimentation requirements

Likewise, we offer a full range of GACs:

- Virgin and reactivated (recycled) types
- Different pore structures and adsorptive properties to optimally eliminate your target compounds
- A variety of particle size distributions, allowing the best selection for adsorption kinetics, pressure drop, and backwash conditions
- Suitable for reactivation

Powdered Activated Carbon (PAC)

Granular Activated Carbon (GAC)

Biological PAC Process

Biological PAC treatment refers to the use of activated carbon for adsorption of organic contaminants from wastewater. It creates a buffer to keep microorganisms alive and provides a surface where these beneficial microbes can attach. This process delivers a number of benefits, including:

- Increased removal efficiencies
- Increased process stability
- Cost-effectiveness
- Low capital cost required to retrofit an existing activated sludge plant

The biological PAC process is used by both industrial and municipal wastewater treatment plants to treat wastewater originating from the textile, dye and pigment, chemical, pharmaceutical, and refinery industries. It is also used for coke production, tanker cleaning operations, and leachate from waste deposits. Our activated carbons enable:

- Improved removal of BOD, COD, and total organic carbon (TOC)
- Greater removal of non-biodegradable organic compounds and toxicity
- Heightened stability of the process to highly concentrated contaminant loads
- Better sludge dewatering
- Reduced aerator foaming

Wastewater Applications

Industrial Wastewater

Industrial wastewater treatment plants treat wastewater from manufacturing industries, including chemical, refinery, paper, textiles, mining, and heavy manufacturing sites. Activated carbon plays a key role in adsorbing hydrophobic and/or high molecular weight compounds commonly found in these wastewater streams, including a range of organics, colorants, phenolic compounds, and chlorinated organics. Target impurities are:

- Synthetic organics/micropollutants
- Pesticides
- Benzene, toluene, ethylbenzene, and xylene (BTEX)
- Overall organics
- Chemical oxygen demand (COD)
- Compounds that can inhibit biological wastewater treatment systems

Municipal Wastewater

Municipal wastewater treatment plants primarily treat wastewater from households and sometimes small industries prior to discharging the treated water to surface water bodies. Activated carbon is used as an advanced treatment step when the discharge of mechanically and biologically treated effluent would still degrade water quality. Here, PAC and GAC can be used as a polishing step to remove compounds that are not biodegradable, such as medicine residues and other synthetic organic chemicals that can be toxic at low concentrations.

Landfill Leachate

Landfill leachate contains complex mixtures of chemical contaminants that vary by site, age of the landfill, types of waste present, and treatment processes used at the location. GAC is typically used for this process, and the amount required depends on the treatment objectives, the organic load of contaminants, and the flow to be treated.

Once the activated carbon has been used and is loaded with contaminants, the spent or exhausted GAC can usually be thermally reactivated and reused. This enables customers to minimize disposal costs and enhance their recycling programs. We offer fresh and reactivated GAC that deliver proven and cost-effective solutions for the removal of the two principal contaminants commonly found in leachate:

- **Chemical oxygen demand (COD):** the sum of all oxidizable organic compounds and an indicator of how much oxygen is needed for the complete chemical oxidation of an existing organic impurity (expressed in mg/l O2)
- **Adsorbable halogenated organic compounds (AOX):** the total amount of halogenated organic substances in water that can be adsorbed by activated carbon; most are chlorine-containing compounds, including both simple volatile compounds and complex toxic organic molecules.

Ground Water Remediation

Typically, groundwater remediation projects entail in situ flushing on a zone of contaminated groundwater or soil. Clean water or an extraction fluid is injected into the contaminated zone, and extraction wells are used to remove the solution and impurities. Whether used in pump-and-treat or funnel-and-gate methods, activated carbon readily removes a broad range of organic contaminants from groundwater.

We manufacture both fresh and reactivated granular and extruded activated carbon to meet challenging groundwater remediation objectives. This includes the removal of chlorinated solvents, mineral oil, and BTEX. We accomplish this by developing and manufacturing activated carbon grades with properties critical to performance, including:

- Excellent adsorption
- High mechanical strength for thermal reactivation
- Low pressure drop
- A range of particle sizes to meet backwashing requirements

NORIT® REACTIVATION SERVICES (NRS)

When it comes to purifying wastewater streams, we know you are focused on complying with regulations in the most cost-effective manner possible. That is why it is important to know that we offer both fresh and reactivated carbon worldwide to help meet your treatment objectives. Using reactivated carbon can lower costs and help you work toward your sustainability goals.

Due to the adsorption process, GAC becomes exhausted after a certain service period. In many cases, this spent GAC can be thermally reactivated, making it suitable for reuse. During thermal reactivation, the spent GAC is heated in dedicated kilns to temperatures over 900°C.

Adsorbed organics are thermally destroyed in a highly specialized process under strict environmental control. Following reactivation, the adsorptive properties of the GAC are restored to a level close to fresh GAC quality. In most cases, spent activated carbon from many wastewater customers can be pooled and reactivated, providing logistical flexibility to customers operating GAC adsorption systems.

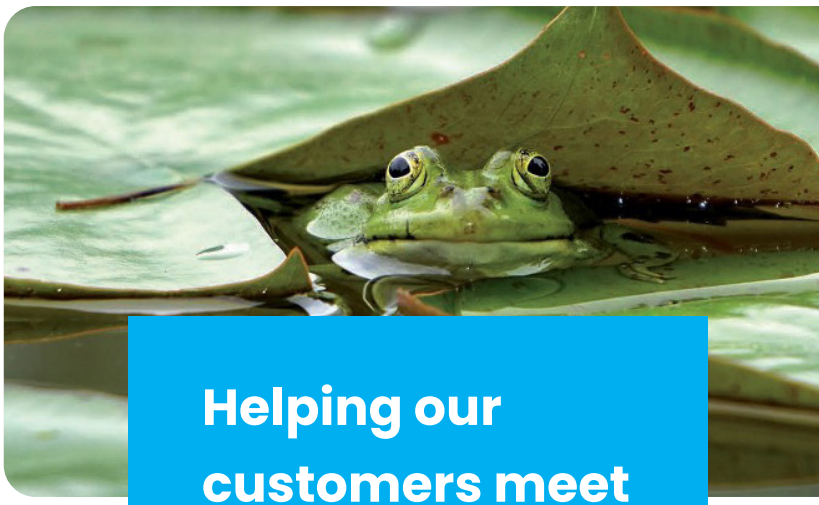
NORIT® Activated Carbon Purification for Living

Building on our greater than 100-year history of innovation in manufacturing and product development, NORIT Activated Carbon is the world's most experienced and one of the largest producers of activated carbon.

Our products are used to remove pollutants, contaminants and/or other impurities from water, air, food and beverages, pharmaceutical products, and other liquids and gases in an efficient and cost-effective manner.

In addition to our unparalleled product portfolio, we offer a full range of activated carbon services including rental systems, carbon reactivation, bulk delivery and change-out, some types of carbon evaluation, as well as technical service and support to help our customers meet their specific purification needs.

We provide our customers with a worldwide network of sales and service support. In fact, we manufacture activated carbon and reactivate carbon in multiple plants around the world. So whether you have one operation or many facilities around the globe, we have you covered.



Helping our customers meet their specific purification needs

NORIT
ACTIVATED CARBON

Our sales, technical service, and customer service teams are well prepared to serve customers around the world.

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