



Water Treatment Services | Wastewater

MICROPOLLUTANT REDUCTION

Micropollutant Reduction

Superior Performance

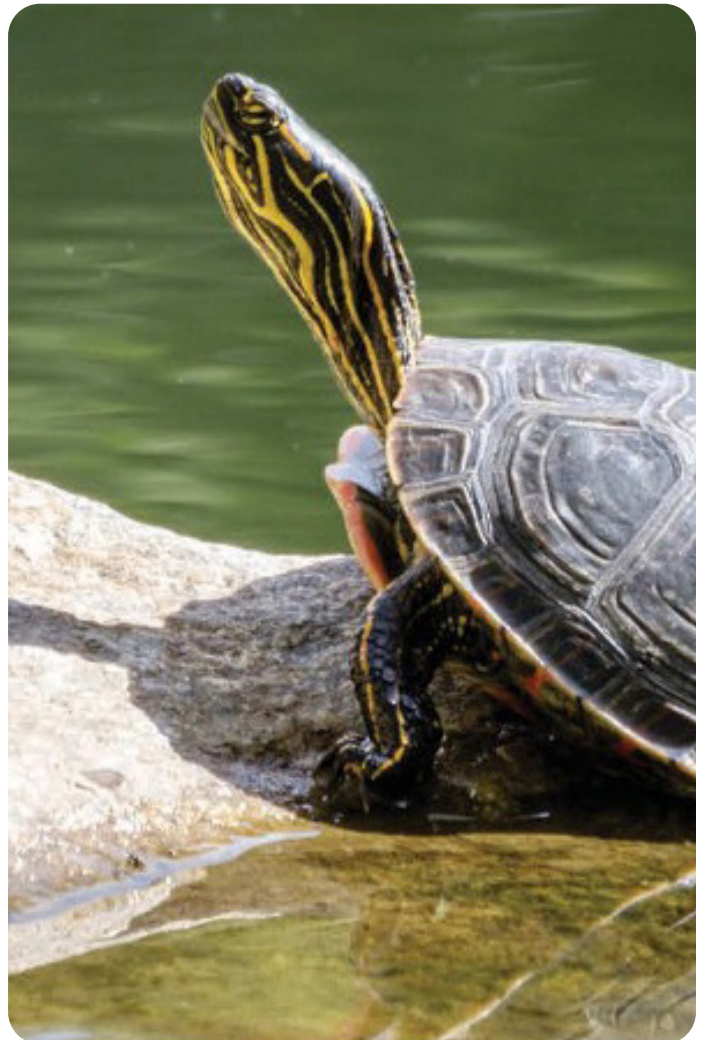
- Very high elimination of micropollutants (MPs) by dosing with powdered activated carbon (PAC) at 10-20 mg/l
- Very high reduction of post-ozone oxidation byproducts with granular activated carbon (GAC) filters
- Improved water quality and ecosystem health by reducing MP loads to surface waters

Application Overview

MPs refer to an emerging threat to water quality in rivers, lakes, and reservoirs caused by the release of organic and mineral substances into surface waters. These substances are present in many common products that pass through the body into wastewater, eventually polluting the aquatic environment. Although there are many sources of MPs, the main source is wastewater treatment plant (WWTP) effluent. Existing WWTPs were designed to reduce solids, organic materials, and nutrients, but not MPs. Common MPs include:

- Pharmaceuticals
- X-ray contrasting agents
- Cosmetics and personal care products
- Hydrocarbons and solvents
- Hormones
- Plastics
- Pesticides
- Metals and radioactive elements

When released into the environment, many MPs become persistent, bioaccumulating in the food chain, and posing risks to the environment and human health. Endocrine disruptors, for example, are chemicals that can interfere with the body's endocrine system and produce adverse developmental, reproductive, neurological, and immune effects in humans and wildlife. MPs can mimic or block naturally occurring hormones in organisms and have been linked to lowered fertility rates, pre- and post-natal development abnormalities, and the increased incidence of some cancers. Moreover, MPs can cause these adverse effects at extremely low concentrations in water (nanograms per liter).



Advanced Treatment Technologies

Because many MPs are not easily removed in conventional WWTPs, advanced wastewater treatment technologies are required to reduce their release. Two advanced treatments have been shown to remove over 80% of micropollutants from wastewater: 1) dosing with PAC followed by sand filtration (SF); and 2) oxidation by ozone followed by GAC filtration.

Products

Our high-quality granular and powdered activated carbon products deliver exceptional MP elimination and adsorption of ozonation oxidation byproducts for wastewater effluent purification, significantly reducing total MP loads and potentially harmful residuals from entering surface water.

| Powdered Activated Carbon (PAC) | | | Granular Activated Carbon (GAC) | | |
|---|--|---|--|---|---|
| NORIT® SAE SUPER | HYDRODARCO® C | NORIT® PAC 20R | HYDRODARCO® 3000 HYDRODARCO® 4000 | NORIT GAC 400 | NORIT GAC 830R |
| <ul style="list-style-type: none"> • Best performing • Eliminates 80% of many MPs with a PAC dose of 10-20 mg/l | <ul style="list-style-type: none"> • For high NOM (natural organic matter) burdens • Eliminates 80% of many MPs with a PAC dose > 20 mg/l | <ul style="list-style-type: none"> • Reactivated • For high NOM (natural organic matter) burdens • Eliminates 80% of many MPs with a PAC dose > 20 mg/l | <ul style="list-style-type: none"> • For high solids loads • Removes MPs • Eliminates oxidation by-products | <ul style="list-style-type: none"> • For lower solids loads • Removes MPs • Eliminates oxidation by-products | <ul style="list-style-type: none"> • Reactivated • For high solids loads • Removes MPs • Eliminates oxidation by-products |

Powdered Activated Carbon

NORIT SAE SUPER activated carbon is the industry benchmark in terms of performance, delivering extremely high MP elimination at low PAC dose rates < 20 ppm (Figure 1). The carbon has high mesoporosity, which reduces the effect of pore blocking from adsorption of the dissolved organic carbon (DOC) fraction, and high microporosity, which enables the adsorption of MPs (Figure 2).

Figure 1 MP Removal with NORIT PAC

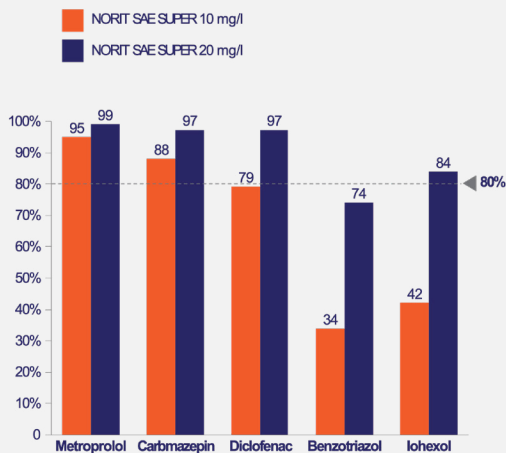
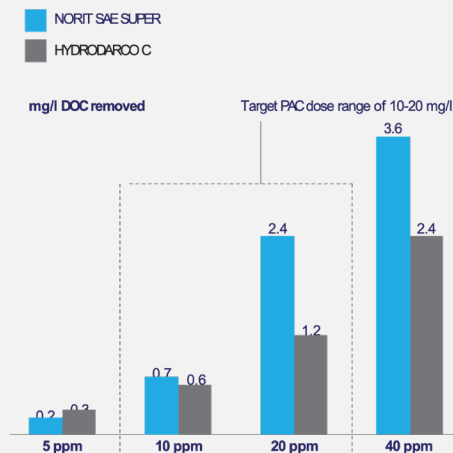


Figure 2 DOC Removal with NORIT PAC



NORIT SAE SUPER

NORIT SAE SUPER has been proven to effectively remove the major compound classes of MPs, including:

| Compound Class | Description | PAC Ability to Adsorb |
|--------------------------|---|-----------------------|
| Pharmaceuticals | Analgesics, antibiotics, antidepressants, bronchodilators, chemotherapy drugs, hypolipidemics | +++ |
| Hormones | Natural and synthetic hormones (birth control pills) | ++++ |
| Endocrine Disruptors | Chemicals that interfere with body's endocrine system (plasticizers, PCBs, dioxin) | ++++ |
| Pesticides & Chemicals | Organic micropollutants including algicides, biocides, corrosion inhibitors, herbicides, insecticides | ++++ |
| X-ray Contrasting Agents | Hydrophilic, iodine containing, radio-opaque compounds given to patients to enable x-rays | ++ |

GAC Filtration Following Ozone Treatment

HYDRODARCO 3000 activated carbon features open pore structure to better fit biological processes, making it an ideal biological filter following ozone treatment. This process prevents the release of harmful byproducts into the environment, while simultaneously handling the high solids loads and long filtration cycles required. HYDRODARCO 3000 has many meso and macropores that handle natural organic matter (NOM) to help maintain bed life.



NORIT® Activated Carbon – Purity for Life



**Helping our
customers meet
their specific
purification
needs**

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 changeout, 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.

NORIT

ACTIVATED CARBON



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

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