Potable water

Potable water: contents

The key
to making water potable

POTABLE WATER

To make water potable, a large number of pollutants may need to be removed. The compounds of concern range from micropollutants like pesticides, detergents and chlorinated solvents to suspended solids and residual oxidants such as ozone. NORIT® Activated Carbon plays a vital role in the removal of all kinds of organics from potable water. Activated carbon, in fact, is the key to making water clean and safe enough to drink. Around the world, in hundreds of cities and companies, our products are used by water professionals.

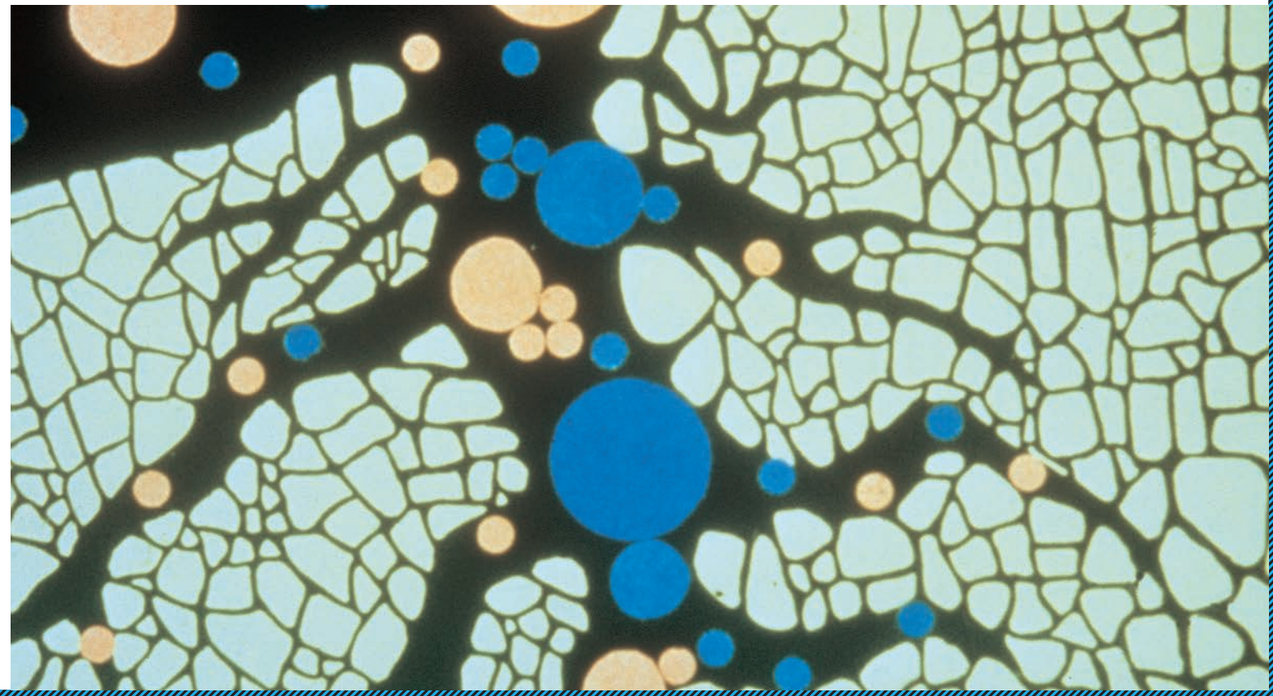
ACTIVATED CARBON

Activated carbon is a porous material consisting mainly of elementary carbon modified to have a large internal surface area: typically 500 up to 1500 m^2/g.

Activated carbon is available in two forms:
- Powdered Activated Carbon (PAC): particle size 1-150 µm
- Granular Activated Carbon (GAC): particle size 0.5-4 mm

HOW DOES ACTIVATED CARBON WORK?

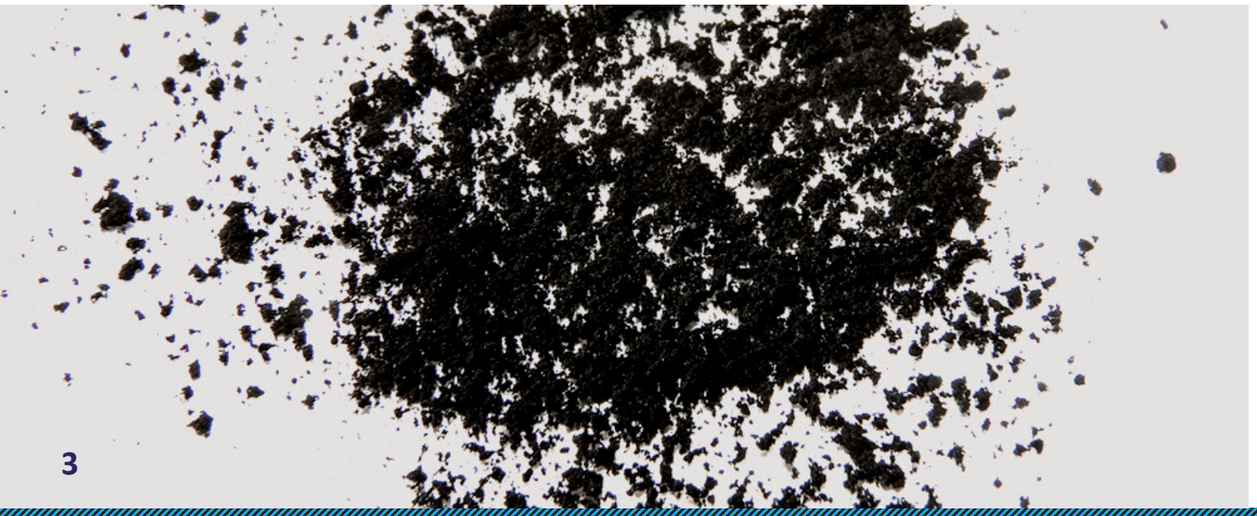
Due to its large surface area and specific surface chemistry, activated carbon can adsorb large quantities of organic pollutants from water. The compounds are adsorbed into the internal pores. A general rule of thumb to determine the adsorbability is the more hydrophobic (or less soluble in water), the more adsorbable the compound.



PAC and GAC:
what ’s the difference?

PAC stands for Powdered Activated Carbon, and GAC means Granular Activated Carbon.
The application of PAC versus GAC differs greatly, both having their own merits in the water treatment process. Around the world NORIT® has references for PAC and GAC applications. For key features of both technologies see the table.

Issue	PAC	GAC
Scope of compounds removed	Taste & odor Organic micropollutants	Taste & odor Organic micropollutants Overall organics (DOC etc.) Biodegradables (BDOC, AOC) Suspended solids Residual oxidants
Typical application	Seasonal or incidental water quality problems	Continuous need for activated carbon treatment
Achievable residual concentration of target compounds	Low	Low/very low
Treatment stage of application	Coagulation/flocculation Filtration (occasionally)	Dedicated adsorbers Converted sandfilters
Regeneration	None (used on one-time only basis)	Thermal reactivation
Systems required	Dosing facilities	Filter vessels GAC transport/handling facilities



GAC:
state-of-the-art technology

GAC filtration is currently the state-of- the-art technology in many water treatment plants. NORIT® products are often applied as one of the final treatment steps (polishing), either stand-alone or after ozonization. Due to (partial) oxidation of organic matter by ozone, bio-activity in the GAC filter is enhanced, usually resulting in an increased filter service time.

Treatment objectives

The major treatment objective for GAC is the removal of dissolved organics, of both low and high molecular weight: taste and odor causing compounds, overall organics (DOC, TOC, KMnO4 number, UV-abs.), biodegradable organics (AOC, BDOC), pesticides, PFAS, micropollutants, detergents, etc. Additionally, GAC removes suspended solids and residual oxidants (such as ozone).

Filter types

Around the world you will find GAC filters using NORIT products. Gravity filters are most common, but pressure filters are used as well. Both dedicated adsorbers and existing (mechanical and/or biological) filters are used:

- Dedicated adsorbers
  Filters specifically designed for GAC, with empty-bed contact time (EBCT) one time only of 10-20 min.
- Converted existing filters
  Rapid sandfilters: conversion to GAC or GAC/sand multi-layer results in relatively short EBCT (< 10 min.)
  Slow sandfilters: GAC put on top or between sand layers (the 'GAC Sandwich'), results in relatively high EBCT (> 30 min.)

Purity requirements

NORIT products meet the most stringent requirements concerning purity and leaching behavior. Moreover they comply with the requirements of the US Food Chemicals Codex and the EN 12915 (EU) requirements for leachable metals, PAH and cyanide. Additionally, a number of grades have been certified by NSF (USA) and/or KIWA (NL). Details are available on request.

GAC packaging, handling, and commissioning

NORIT products are supplied in bags, bulk bags containing 1 or 2 m^3 or in bulk tank cars containing up to 50 m^3. For handling and commissioning of our products, Technical Bulletins are available.

Systems and Support Systems

We supply dedicated systems:

- Pilot columns (50 l GAC) for on-site testing
- Mobile filter units (AQUA# series; 2-18 m^3 GAC) which are highly suitable for large scale trials and emergency situations

Application support

Many water treatment plants rely on support from our application specialists and laboratories for:

- Set up and execution of lab or pilot studies
- GAC performance/cost optimizations
- GAC handling and GAC filter commissioning
- Analysis of GAC samples

GAC:
reactivation services

GAC reactivation - a sound solution

When GAC is exhausted, regeneration is generally the best option compared to disposal, from both economical and environmental points of view. Thermal reactivation is state-of-the-art regeneration technology. During heat treatment, up to 900-950 °C, adsorbed organics are cracked and gasified using steam. The original pore structure is almost completely restored.

NORIT® provides reactivation services at facilities in The Netherlands, UK and Italy, or in cooperation with third parties. This maximizes flexibility and minimizes logistical costs. In all cases, the first and foremost criteria are reliability and quality.

Reactivation skills

Our unique chain of production facilities enables production of any GAC grade used in potable water treatment. Creating the right pore structure is a skill, preserving the original pores during reactivation even more so!

GAC replenishment

The 8 to 10 percent loss due to attrition and burn-off during reactivation and handling is compensated by an equivalent amount of virgin GAC. Whatever grade of added GAC is required, it is produced in a NORIT facility or NORIT controlled facility.

Returning customer's own GAC

We treat the content of each filter separately, and after reactivation return the customer's own GAC.

Pilot reactivation trials

Pilot trials come into the picture, for new customers, for example, in order to optimize the quality of the reactivation process. These trials are the basis for a customer specific reactivation recipe.

Customer fit logistics

The logistical system offered by NORIT is designed to match the customer's wishes for the intake of exhausted GAC and the return of reactivated GAC as closely as possible.

Field service

We offer support and training during filter emptying, filling and filter start up.

Quality control

GAC is reactivated according to agreed quality specifications. This is achieved by sound quality control, including analysis of exhausted and reactivated GAC.

High purity standards

Reactivation kilns, GAC handling systems and transport means are all dedicated for potable water/food grade.

ISO certification

NORIT reactivation plants are certified according to a.o. the ISO 9001 and ISO 14001 systems (details are plant specific).

Compliance

State-of-the-art reactivation plants; high environmental standards and human safety precautions are respected.

GAC conditioning

In some cases, problems related to pH drift and leaching of Al and Mn occur while starting up a filter with reactivated GAC. NORIT provides dedicated GAC conditioning in order to avoid these issues.

PAC:
low investment costs

PAC is widely used in potable water treatment for removal of taste, odor and organic micropollutants, such as pesticides.

The major strengths of PAC are:

- Flexibility: as the dosage and type are adapted to the actual need (e.g. during emergencies)
- Low investment costs: because PAC separation occurs in existing solid separation steps
- High efficiency for specific compounds
- Cost effectiveness

Treatment objectives and PAC properties

The chemical nature of the target compounds differs greatly. The various compounds each require a dedicated pore structure to provide optimal adsorption. The NORIT® product range is designed to provide a superior match of water treatment requirements and PAC properties (pore structure, particle size, purity).

Purity requirements

NORIT products meet stringent purity requirements for activated carbon for potable water treatment. All potable water grades comply with the US Food Chemicals Codex and the EN 12903 (EU) requirements for metals, PAH and cyanide. Additionally, a number of grades have been certified by NSF (USA) and/or KIWA (NL). Details are available on request.

PAC packaging, handling and dosing

NORIT products are supplied in paper bags, bulk bags or in bulk tank cars. If PAC is dosed manually, e.g. in the event of small scale operations, modified PAC products are available:

- Water dispersible PAC granules: 3 mm diameter pellets which disperse on contact with water
- Wetted PAC: At typically 50 mass percent moisture level, the PAC behaves dust-free

PAC performance assessment

The water to be treated, process conditions and treatment targets determine the optimal PAC grade and dosage level. Lab scale batch trials with the actual water to be treated usually give a good indication of full scale PAC performance. This yields the major performance criterion: the dosage required to achieve the target residual concentration of impurities.

NORIT application specialists are available to share their extensive experience in the field of potable water treatment.

PAC SEPARATION TECHNOLOGIES

Floc separation

In its conventional application, PAC is dosed ahead of, or into, the coagulation/flocculation stage. The PAC is incorporated in the flocs, thus being separated simultaneously with the flocs. Net contact time in the floc system amounts to 0.5 – 2 h or longer, depending on the separation system.

Ultrafiltration (UF)

In this process, PAC is dosed upstream of the UF system - the PAC being separated from the water by UF membranes. Between successive backwashings, the PAC level in the system gradually increases in case of crossflow filtration. PAC residence time is up to 1 h, depending on the time interval between two backwashings.

Rapid sand filters (RSFs)

PAC is dosed ahead of the RSF and is separated during the filtration process, possibly with the aid of a flocculant. The net contact time can be considered from two different points of view:

- Hydraulics: The residence time between PAC dosing and filtration (typically < 1 h)
- Filtration: The total PAC residence time in the filter, that is, the average time between successive backwashing cycles (typically > 1 d)

NORIT® Activated carbon purification for living

Building on our > 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, 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've got you covered.

HELPING OUR CUSTOMERS MEET THEIR SPECIFIC PURIFICATION NEEDS

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

NORIT ACTIVATED CARBON

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