

Potable Water



Norit

leading in purification

Activated Carbon



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 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.

The key to making water potable



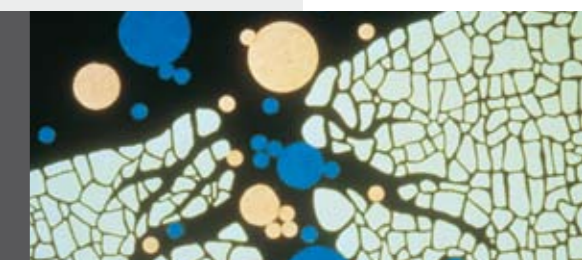
Activated carbon

Activated carbon is a porous material consisting mainly of elementary carbon modified to have a large internal surface area: typically 500 up to 1500 m²/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.



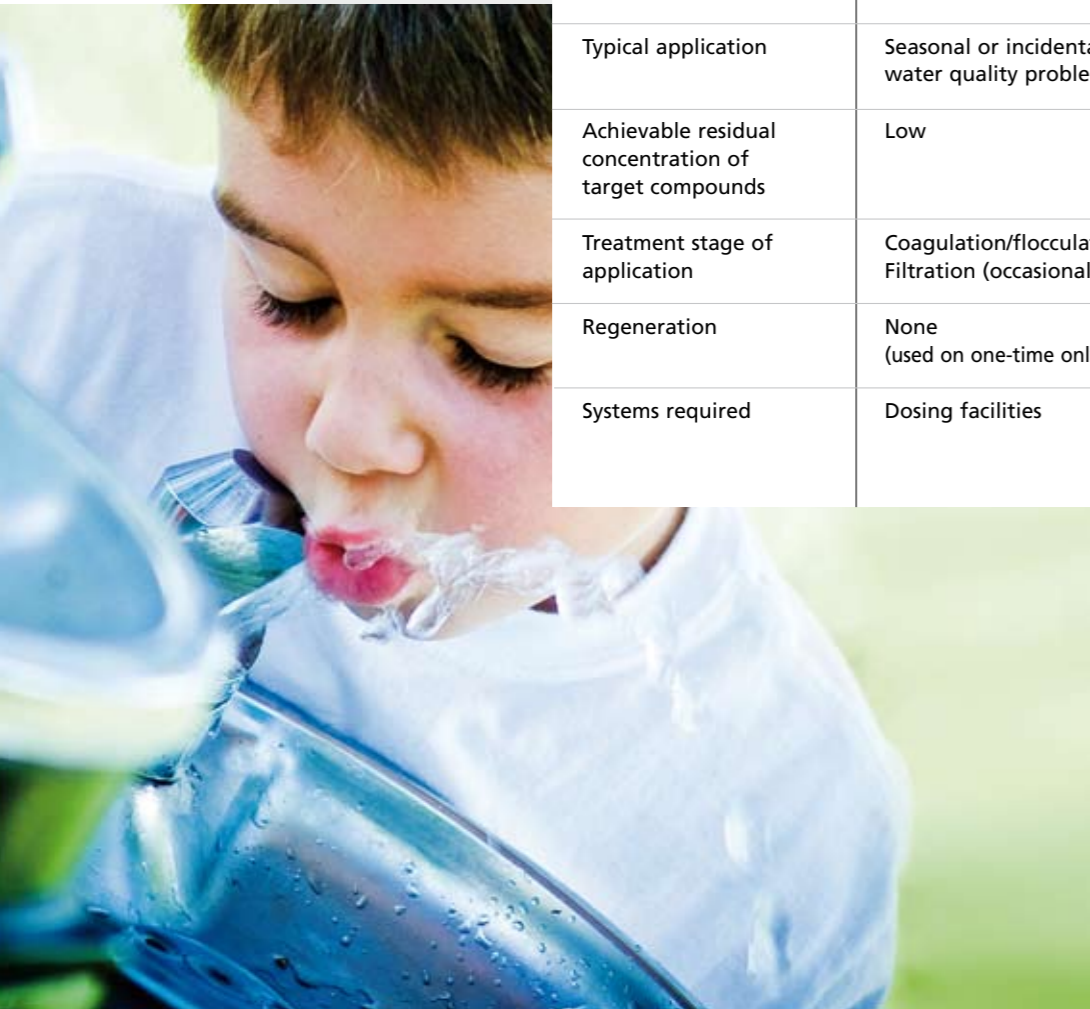
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PAC and GAC - What's the difference?

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 below.

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 ozonation. 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, KMnO_4 number, UV-abs.), biodegradable organics (AOC, BDOC), pesticides, 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. More over 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 reactivation - a sound solution

When GAC is exhausted, regeneration is generally the best option compared with 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 preserved.

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.



Potable Water



Norit reactivation services

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

Because the content of each filter is treated separately Norit guarantees the return of 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

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 food grade.

ISO certification

Norit reactivation plants are certified according to the ISO 9001:2000 and ISO 14001:2004 systems. External audits are welcome.

Reactivation plants

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.

GAC Packaging, Handling and Commissioning

Norit products are supplied in bags, bulk bags containing 1 or 2 m³ or in bulk tank cars containing up to 50 m³. For handling and commissioning of our products, Technical Bulletins are available.

Systems and Support

Systems

Dedicated systems are supplied by:

- Pilot columns (50 l GAC) for on-site testing
- Mobile filter units (AQUA# series; 2-18 m³ 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
- *SimBIOSIS*® simulation software as an aid in determining GAC service life and optimizing reactivation strategy



"More than 8 percent of the world's population is consuming water purified by Norit"



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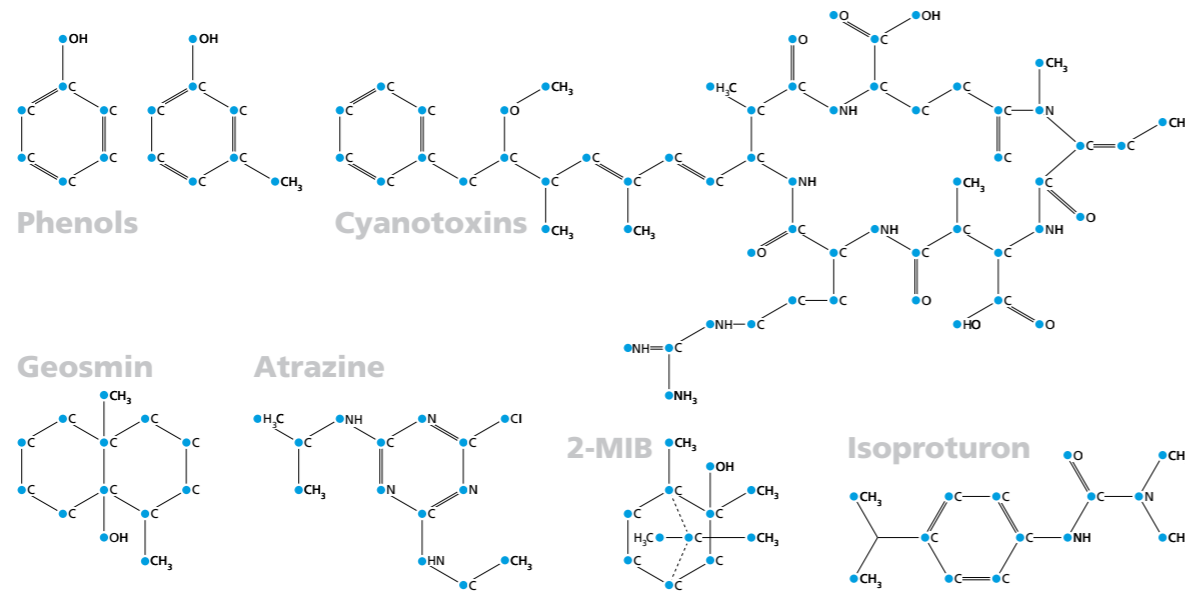
PAC - low investment costs

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, as can be seen in the figure below. These compounds each require a dedicated pore structure to provide efficient adsorption. Norit product range is designed to provide a superior match of water treatment requirements and PAC properties (pore structure, particle size, purity).



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 recently developed 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 sandfilters (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)



Potable Water



Purity requirements

Norit products meet the most stringent purity requirements for potable water. 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.

Norit

Norit 'leading in purification' develops and applies state-of-the-art purification technologies to help society, through our clients, meet environmental, health, and safety challenges, and work towards a sustainable future. The Norit Group, headquartered in The Netherlands, supplies consumables, components, systems, and solutions, based on proprietary technology in every step of the water and beverage value chains. More than 8 percent of the world's population - over half a billion people - already consumes water purified by Norit!

Norit's activated carbon, membranes, pumps, aseptic and hygienic valves, carbon dioxide systems, and quality control equipment rank among the world's best. Norit offers global coverage with research and development, engineering, and manufacturing facilities in seven countries. A network of dedicated Norit sales and service centers, business partners, and distributors serves customers in more than 150 countries around the world.

**No following.
Norit. Just leading.**



Potable Water



Potable Water

All over the world you will find waterworks using Norit products. We supply these products from a number of plants around the world. Wherever the carbon is produced, the products have one important feature in common: they are all produced under stringent quality control as reflected by our ISO 9001:2000 system.



Main Norit GAC grades

Main grades

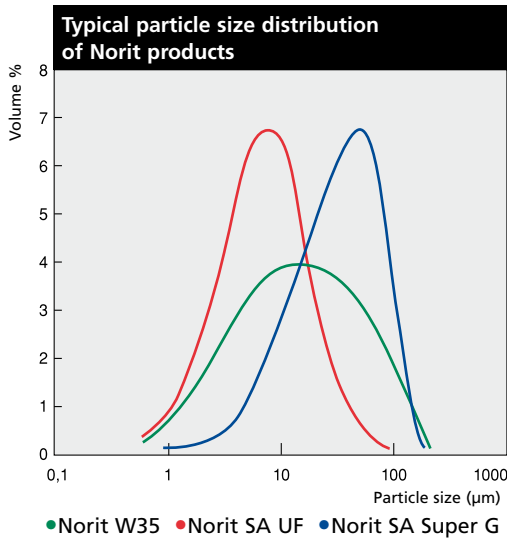
Products covering a broad range of functionalities, produced from selected grades of coal. The numbers reflect the mesh size, i.e. 12x40 mesh and 8x30 mesh.

Grade name	Features
Norit GAC 1240W/830W	Standard grade, mainly for removal of organic micropollutants, taste & odor
Norit GAC 1240EN/830EN	Premium quality, mainly for removal of organic micropollutants, taste & odor; very durable (high mechanical strength)

Grades with special features

In some cases the application requirements focus on a particular item. In these cases, alternative Norit Activated Carbon products are available to suit the demand optimally.

Feature	Norit Product
Adsorption	
Chlorinated solvents, trihalomethanes (THM)	Norit GCN 1240/830 Norit ROW 0.8 SUPRA
High DOC and color, heavy duty	Norit GAC 1240/1020/830
Biocarrier	
BAC process under stress conditions, long life carbon	Norit BACF 20/30/40
Catalytic properties	
Catalytic activity for reduction of oxidants	Norit ROW 0.8 CAT
Filtration properties	
First stage, gravity filters	Norit GAC 1020EN/1020
Low density surface layer in multi-layer filters	Norit PK 1-3/3-5
Hydrodynamic properties	
Low pressure drop	Norit GAC 1020EN/1020 Norit ROW 0.8 SUPRA



Main Norit PAC grades

Main grades

Grade name	Features
Norit W20	Standard grade, mainly used for removal of taste and odor
Norit W35	Multi-purpose grade (taste and odor, pesticides, etc.)
Norit SA SUPER	Highest activity, multi-purpose grade

Grades for dedicated applications

Grade name	Features
Norit SA UF	Specially designed for UF membrane systems, extremely fine grade
Norit CASPF	Optimal pore structure for the removal of cyanotoxins
HYDRODARCO series	Multi-purpose PAC with many references in the USA

Technical documentation

A selection of documents related to the use of Norit products in potable water treatment:

Product information sheets

- Datasheets
- MSDS (material safety data sheets)

Reference information

Reference lists and case studies of Norit PAC and GAC users in potable water treatment

PAC, Technical Bulletins (TB)

- Norit TB 72A: Evaluation of activated carbon in liquid phase applications, preparation of isotherms
- Norit TB 49: Delivery of steam activated powdered carbon by tank car

GAC, Technical bulletins (TB)

- Norit TB 72A: Evaluation of activated carbon in liquid phase applications, preparation of isotherms
- Norit TB 72B: Evaluation of activated carbon in liquid phase applications, Pilot column tests with granular carbon
- Norit TB 79: Hydrodynamic properties of granular activated carbon grades
- Norit TB 56: Delivery of granular activated carbon by tank car
- Norit TB 40: Transport, handling and reactivation of granular activated carbon
- Norit TB 121: Granular activated carbon in potable water treatment, filter volumes
- Norit TB 102: Conditioning of reactivated granular activated carbon for potable water treatment
- Norit TB 41A: Commissioning granular activated carbon adsorbers for liquid phase applications
- Norit TB 61: BAC: Biological activated carbon in potable water treatment
- Norit TB 78: Upgrading slow sandfilters with activated carbon
- Norit TB 1: Granular activated carbon for mechanical filtration purposes
- Norit TB 103: Simulating the performance of granular activated carbon: Norit *SimBIOSIS*® service

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Please visit our website to obtain information about your local supplier.

Norit Nederland BV reserves the right to make changes in the technical specifications at any time.

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