NORIT
ACTIVATED CARBON

Water Treatment Services

BEVERAGE

The Technology Behind a Myriad of Drinks

Consumers expect their beverages to look good, smell good, and taste good. This is the basis of beverage quality, the major determining factor for beverage sales.

Activated carbon is an agent for keeping things clean, for example, by removing contaminants from fruit juices, juice concentrates, wine, malt beverages, and distilled liquor. Dedicated products ensure that essential ingredients such as water, CO_2, and sugar are purified to fulfill the most stringent quality criteria. Activated carbon can be used for everything from the removal of bad tastes and odors to the provision of long-term color stability to the removal of disinfectants and their degradation products from water.

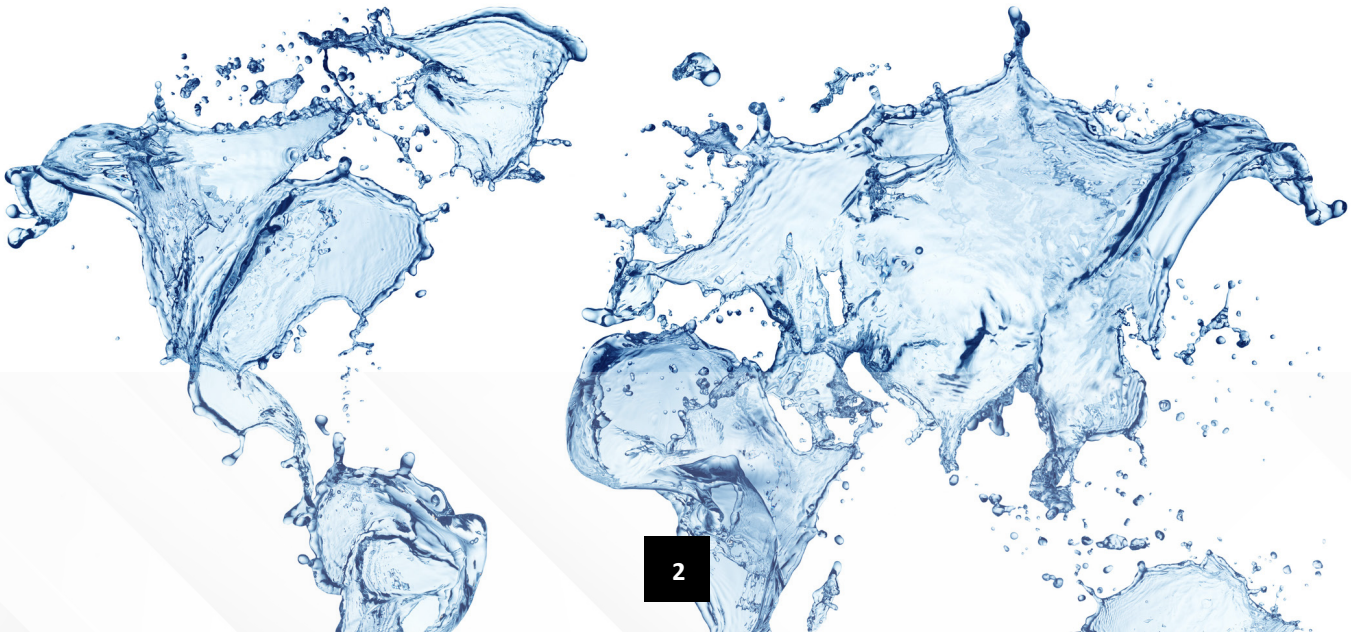
With NORIT® Activated Carbon you will find the best fit for your purification needs and overall improvement in the efficiency of your operation and in the final quality of your product.

Safety and Purity Worldwide

We represent safety and consistent quality. Our activated carbons have a reputation that dates back more than 100 years. This reputation is underlined by the fact that all our manufacturing and reactivation facilities are ISO certified.

Quality assurance is built into the stringent quality processes for manufacturing and handling from raw materials, entirely of vegetable origin, to safe means of activation to product delivery and dosing our food grade products that are regularly tested against standards including the U.S. Food Chemicals Codex.

For the food industry, HACCP (Hazard Analysis and Critical Control Points) is a key factor in the quality and safety of our products. The principles of HACCP are implemented for the production and supply of our food grade activated carbons. They are produced from both vegetable and mineral origin at our plants around the world.



How Activated Carbon Works

Purification by activated carbon is a proven, modern, state-of-the-art technology for a multitude of purification needs. Nevertheless, the principles behind activated carbon have a rich history. The ancient Greeks described the use of charcoal to reduce the effects of food poisoning. During the golden age of sailing, sailors used to char the insides of water barrels with fire. They had learned that the water would stay fresh much longer by doing so.

The beneficial behavior of carbonized materials is caused by the phenomenon that contaminants, organic compounds in most cases, tend to accumulate on surfaces — a process commonly referred to as adsorption.

The purifying function of activated carbon is based upon the same principle of adsorption onto carbonized materials. It is the nature of the surface that makes adsorption occur, but in activated carbon, it is the sheer size of surface that makes it so highly effective — the size of the surface "activates" the carbon.

The surface area of activated carbon is impressive, ranging from 500 to 1500 m_2/g or even more. This means a teaspoon of activated carbon easily equals the surface area of a soccer field. The surface area is created during the activation process.

Carbon can be activated by two main processes: steam activation or chemical activation. The most common process is steam activation. At around 1000°C steam molecules selectively burn holes into the carbonized raw material, thus creating a multitude of pores inside the carbonaceous matrix. In chemical activation, phosphoric acid is used to build up a porous system at a lower temperature.

The prime application of activated carbon is in purification. It is the vast porous structure in a carbonaceous matrix that allows activated carbon to adsorb contaminants from liquid and gas flows, in a cost-effective way. In addition to adsorption, activated carbon acts as an active reagent in the presence of oxidative disinfectants such as chlorine and ozone when percolated with water. Under such circumstances, the oxidants are chemically reduced at the surface of the activated carbon.

How Activated Carbon Works [cont.]

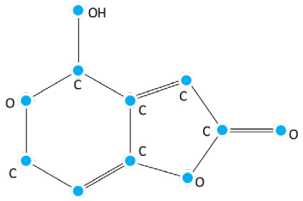
TARGET IMPURITIES

Activated carbons are used in a wide range of processes, to remove widely differing impurities, mostly of organic nature. The optimal treatment technology for your process depends on the nature and concentration of the impurities to be removed.

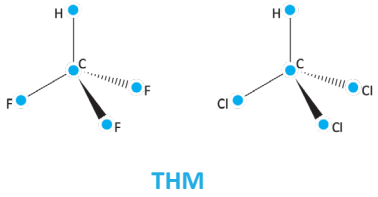
For effective adsorption, the pore size must roughly match the size of the molecules of the impurities.

Knowing what impurities have to be removed is the key to selecting the optimal activated carbon grades with proven ability to adsorb identical or similar compounds. Thus, activated carbon actually removes the impurity, unlike oxidative bleaching operations in which the colored impurity is only changed to colorless products.

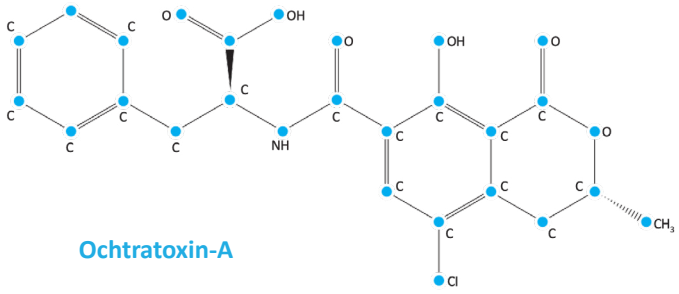
In the case of chemically reducing disinfectants in water, such as chlorine and ozone by Granular Activated Carbon (GAC), other physical properties such as particle size, shape, and hardness are of major importance for the selection. When both adsorption of organic matter and de-chlorination/de-ozonation of feed water is required, a good balance between both adsorptive and other important physical properties must be achieved.



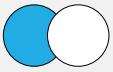
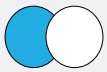
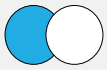
Patulin



THM



Ochtratoxin-A

	Proteins	Usually very large, found in many natural products
	Dark colorants (typically dark brown)	Present initially or formed during processing
	Medium size colorants (typically light brown/ golden)	Present initially or formed during processing
	Natural pigments	Responsible for many color impurities
	Off-taste	Present initially or formed during processing
	Light colorants (typically yellow)	Present initially or formed during processing
	Color precursors	Responsible for color re-appearance during storage of finished products
	Mycotoxins (e.g. Patulin)	Formed by blue mold rot of apples
	Odor compounds	Small, relatively volatile compounds
	Trihalomethanes (THM)	Small, relatively volatile compounds

PAC or GAC?

Two types of activated carbon are used in basic treatment technology: (1) Powdered Activated Carbon (PAC) and (2) Granular Activated Carbon (GAC).

The type you select (sometimes you use both) depends on the answers to questions such as:

- Does the purification plant run continuously?
- Are there feasible possibilities for regenerating spent carbon?
- Does the process require a typical batch purification?

The answers to these questions lead to the initial selection: PAC or GAC. PAC, particle size 1-150 µm, is the best solution for batch processes. Dosage can be adjusted easily to ensure consistent purity requirements from a variable process flow. NORIT® offers a wide array of PAC grades for food applications. They range from micro-porous to meso-porous to macro-porous, from acid to neutral to alkaline reacting, from fast adsorbing to fast filterable. PAC is suitable for many purification processes in the food industry, from bulk decolorization to final taste and odor improvements. You never need to "force fit" a NORIT product!

GAC, particle size 0.5–4 mm, is typically used in processes running continuously. The process can be designed on an optimum service life basis for which downtime can be eliminated during change-out or regeneration.

Powdered Activated Carbon (PAC)

Granular Activated Carbon (GAC)

The regeneration option is one of the key benefits of GAC as, following regeneration, the GAC can be re-used in its original application. The regeneration process is either in situ or off-site.

- **In situ:** in specific cases, the exhausted GAC is regenerated in situ with steam or caustic soda; further, some large-volume industries have in-situ thermal reactivation plants
- **Off-site:** the exhausted GAC is regenerated by thermal reactivation; NORIT Activated Carbon provides this service from a network of dedicated plants in North America

Contact us for further information on carbon regeneration.

Purity of Activated Carbon

Activated carbon is used to purify a process flow — not to add impurities — so a carbon of the purity required has to be selected. NORIT® products are produced from raw materials of vegetable and mineral origin.

Activated carbon contains trace levels of some impurities originating from the raw material used (e.g. wood contains calcium, coal contains iron) or from the activation agents used in chemical activation processes. Because the purity of your beverage product is of the utmost importance, the activated carbon you use should not leach any metals into your product that could be potentially hazardous or reduce the stability of the treated product. NORIT offers a number of grades certified for very low levels of extractable minerals.

For final purification (polishing) of sensitive beverage products, very pure carbons manufactured by steam activation are recommended. Where a strong decolorizing carbon is required to upgrade your beverage, we advise the use of carbons manufactured by the phosphoric acid activation process rather than activated by the zinc chloride activation process because of purity-related standards in the food and beverage industries.

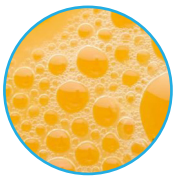
The Codex Oenologique International (published by the Office International de la Vigne et du Vin) cautions against the use of carbons activated with metals.

Beverage Main Applications

Below is a selection of main applications where NORIT® products have been established for the purification of beverages and their ingredients. The selection suggests the diversity of tasks for which you can use NORIT for safe and cost-effective solutions.

Liquid Sugar

In the sugar and beverage industries, activated carbon is used for decolorization and improvement of the sensory characteristics of sugar syrup. Depending on the origin of the sugar and the type of beverage to be produced, dedicated PAC grades can be used to meet the high standards for color and sensory characteristics required for soft drinks, alcoholic beverages, etc. It is common practice that, for example, soft drink producers demand certification of the activated carbon quality showing compliance of the activated carbon grade with the stringent purity requirements specified for liquid sugar, water, or CO_2 purification. NORIT is able to provide the relevant documents upon request to meet the quality assurance requirements.

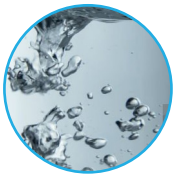


Fruit Juices

We offer dedicated decolorizing carbon grades which are able to remove colorants such as polyphenols and melanoidins from fruit juices such as apple juice and grape juice. A special product enables maximum throughput and minimizes membrane damage when PAC is used in conjunction with membranes. Other products might be appropriate to remove undesirable taste compounds and color precursors created during fruit juice processing. The same carbons are suitable to remove traces of pesticides and fungicide residues, such as mycotoxin patulin, to meet international health standards.

Wine, Vermouth

White and red wine are sometimes treated with PAC for color and taste correction. The purpose for decolorization can vary from slight color correction to complete decolorization, for example during the production of vermouth. Quality, dosing rates, and treatment conditions are extensively described in various directives such as the “Codex Oenologique International.” The presence of the mycotoxin Ochratoxin A in wine might require a NORIT Activated Carbon product in order to comply with the regulations. Water dispersible granulated products are available to simplify direct dosing of smaller quantities into treatment tanks with a minimum of carbon dust release.

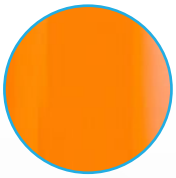


Water

Water is the basis for most beverages. For the production of beer and soft drinks, tap or well water is used. A disinfectant such as chlorine, ozone, or chloramines is added to the water to inhibit microbial activity. This treatment is followed by flow through a GAC bed in order to eliminate the residual disinfectant, possible reaction products such as trihalomethanes (THM), and other organic contaminants.

Beer, Malternatives

During the production of malt beer, a very fine GAC is sometimes added to the wort to remove the “straw-taste” and is removed with the sediments afterwards. Today, another established application is the use of beer as the basis for so-called malternatives (malt-based alcoholic drinks with a low alcohol content). The beer, for this purpose, is completely decolorized by PAC or GAC and may require taste correction established by PAC. Occasionally, PAC is used to correct beer to remove foaming inhibitors such as traces of proteins or to slightly correct taste and color variances.



Rum, Vodka, Whiskey

Our products are used to decolorize rum, to prevent turbidity during the aging of whisky, or to remove unwanted congeners such as fusel oils and aldehydes that influence the sensory character (taste/odor). For occasional purification needs PAC grades are used and for continuous processes GAC grades are used. The spent GAC bed is sometimes regenerated in-situ with steam.

Carbon Dioxide Gas (CO_2)

More than 1 billion people consume drinks purified by NORIT® Activated Carbon

CO_2 is the sparkling element in soft drinks and beer. The CO_2 used in the beverage industry usually comes from two sources:

Breweries

In breweries, CO_2 recovered during the fermentation process can be used in many ways. It may be added to the beer, or provide a protective atmosphere during bottling, canning, or transporting the beer. In addition, excess CO_2 may be sold as an end product for various applications in other industries. To enable this use of CO_2, it must be purified by GAC to remove taste and odor-causing compounds including H_2S and mercaptanes, and other organic compounds.

External sources

It is common practice for this sourced CO_2 to be treated by GAC in safety filters before it is used as an additive. Pretreatment is required to assure that traces of taste and odor-causing compounds, as well as traces of aromatic hydrocarbons, are completely eliminated.

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've got 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.

---

www.norit.com

EMEA REGIONAL OFFICE
Norit Nederland B.V.
Astronaut 34
3824 MJ Amersfoort
THE NETHERLANDS
T +31 33 464 8911
E info.emea@norit.com

AMERICAS REGIONAL OFFICE
Norit Americas, Inc.
3200 University Avenue
Marshall, Texas 75670
USA
T +1 903 923 1000
E info.americas@norit.com

ASIA/PACIFIC REGIONAL OFFICE
Norit Singapore Pte. Ltd.
101 Thomson Road
United Square #16-04
Singapore 307591
Singapore
T +65 6631 9386
E info.ap@norit.com

Brochure Potable Water 03/2024