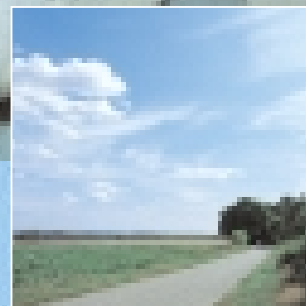
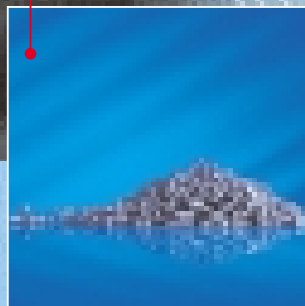


Gas & Air

- NORIT ACTIVATED CARBON
IN THE GAS PHASE



Keeping it clean

Activated carbon is used in a multitude of applications in the area of gas/air purification. Many applications have to do with the prevention of emissions that are damaging to the environment. This involves combating odour emissions at waste-water plants and pumping stations, catching dioxin emissions at waste incineration sites or restricting the discharge of hydrocarbons in soil cleaning.

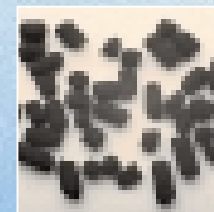
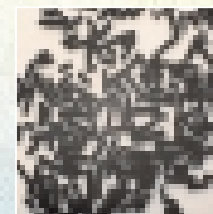
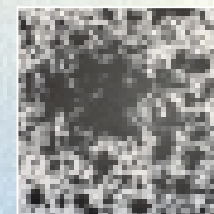
These are all applications where rules and regulations for the immediate surroundings indicate the permissible emissions levels.

This is how NORIT helps you to achieve a cleaner environment.

In an application such as the recovery of solvents, the primary focus is not the environment, but there is an economic reason to use NORIT activated carbon. The value of the recovered solvents is so great that an investment in a recovery installation already pays for itself in the short term.

Additionally, NORIT activated carbon is used in production processes involving all kinds of gases. – for example, in the production of hydrogen and LNG. For all these applications a purification objective is served using NORIT technology. Here NORIT commands not only the suitable carbon but also the systems and services needed to use the NORIT carbons successfully.

NORIT, in fact, means dedicated technical, sales and service support!



The Purification Company

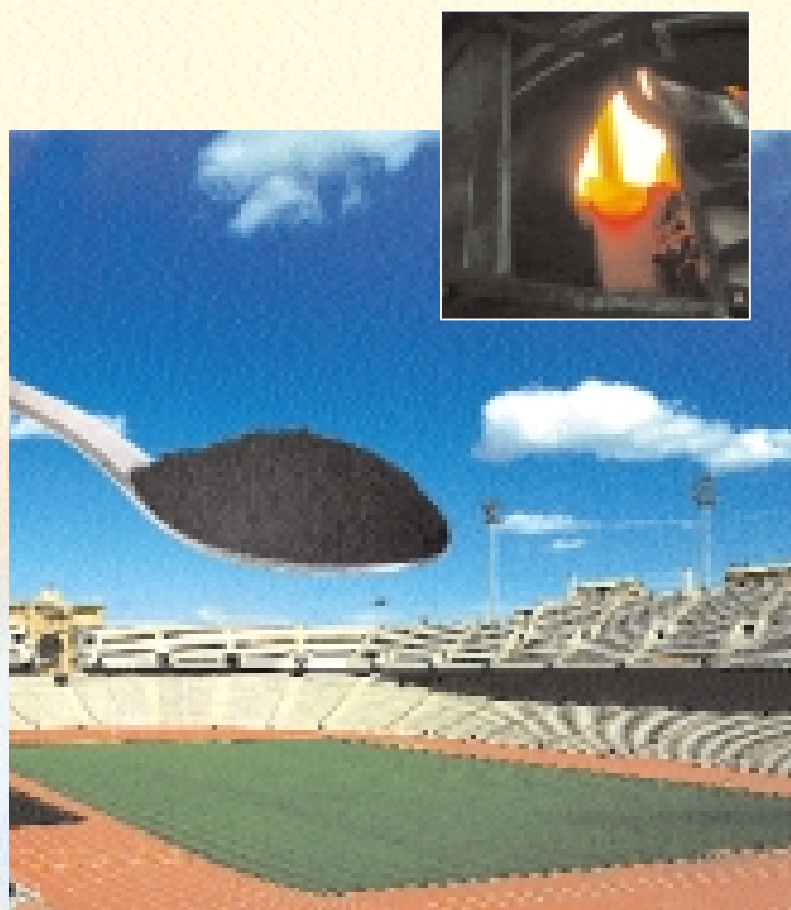


NORIT activated carbons

Activated carbon is a micro-porous form of carbon. It is manufactured from peat, wood, lignite, coal, coconut shells or even olive stones. Activation is achieved with steam, or via a chemical process. The activation process develops a myriad of pores of molecular dimensions within the carbon which together constitute an enormous internal surface area. This surface area can exceed 1500 m²/g of activated carbon. A spoonful of activated carbon has the same surface area, in fact, as the surface area of a football field!

Adsorption

Impurities are adsorbed in the porous structure of the activated carbon. Either by physical adsorption or chemisorption. In physical adsorption the impurities are held on the surface by weak van der Waal's forces, where'as in chemisorption the forces are relatively stronger and occur at active sites on the surface. The efficiency of the activated carbon will therefore depend on its accessible surface area and also upon the presence of active sites on the surface of the activated carbon. High adsorption capacities can be achieved by condensation within the pores.



Powdered, extruded or granular activated carbon

NORIT activated carbons are available in different forms and sizes, ranging from very fine powders, to granular and extruded carbons.

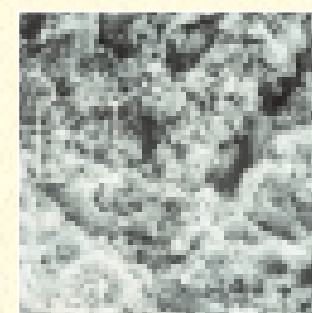
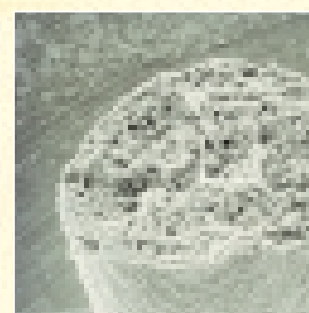
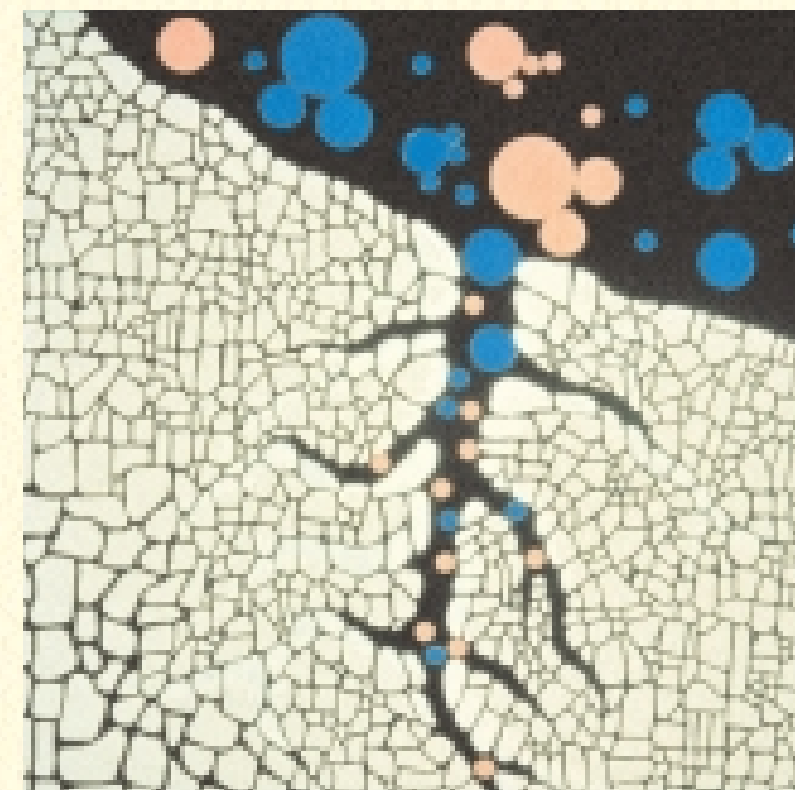
Fine powdered activated carbons are used for flue gas cleaning in bag filter operations. Thanks to its fine particle size, activated carbon forms an excellent filter cake on the fabrics, and dioxins and heavy metals can be removed with high efficiency.

For fixed-bed operations, granular or extruded carbons are used. NORIT offers a range of such carbons with variation in

particle size and degree of activation. Granular and extruded carbons are available in various different sizes to meet your needs.

NORIT extruded activated carbons are the most durable carbons available on the market. A high abrasion resistance and extreme hardness are very important, because the breakdown of carbon particles will result in an increase in pressure drop over the activated carbon filters. The breakdown can also cause damage and blocking in downstream equipment.

To enhance adsorption of impurities with low physical adsorption, NORIT also provides impregnated carbons for the removal of specific impurities, e.g. mercury and hydrogen sulphide, by chemisorption





Systems and Services

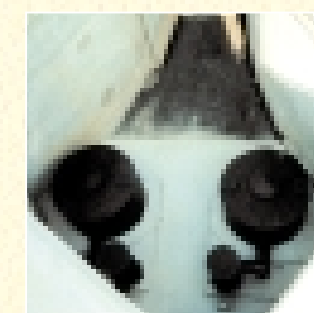
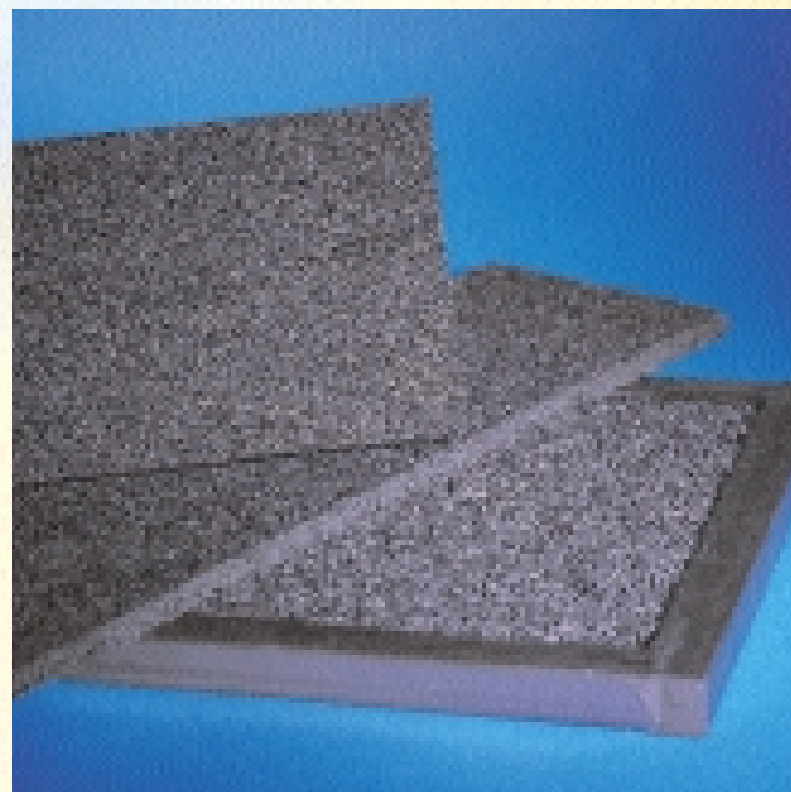
In addition to supplying activated carbon, NORIT's Systems and Services Group acts as a consultant/contractor for a full range of equipment for many applications, such as solvent recovery installations, gas and air filters, dust-free dosing equipment and the related transport systems for powdered activated carbons.

NORIT also produces NORITHENE. This NORIT technology removes low concentrations of impurities from large air flows in air-conditioners and related applications. The plates are made of bonded extruded activated carbons. They can be supplied with or without a polyurethane rim.

Advantages:

- **Great reliability**
- **Quick installation**
- **Dust-free handling**
- **No dust emissions**
- **Airtight fitting to the sides of the NORITHENE unit**
- **Low pressure drop**

Activated carbon is in common use for odour control at sewage gas treatment and pumping stations. To support the carbon, NORIT supplies a range of sewage gas filters and sewage gas breathing filters. These filter units, with their guaranteed long life, are dedicated to the use of NORIT activated carbons



Dosing equipment is used for accurate dosing rates of powdered activated carbons. Since the dosing rates of powdered activated carbons (PAC) are typically low, an accurate dosing system will save you time and money. Therefore NORIT has developed a series of essentially dust-free dosing systems. In addition to dosing systems, NORIT can design and supply a carbon storage facility. A silo, for example, with a volume from 75 to 125m³, for storing powdered activated carbons for dioxin removal at a waste incineration plant.

POCKET HEATERS



When you open the pocket heater, heat is generated in your pocket. Inside this pocket heater is NORIT activated carbon.





Flue gas cleaning

The preservation of our environment calls for waste incineration and the re-use of limited resources. This includes the re-melting of metals. From these processes, pollutants are emitted that necessitate a thorough flue gas clean-up. Elaborate systems have been developed to remove dust, acid gases, nitrogen oxides, dioxins and heavy metals from the flue gas of incinerators. NORIT has therefore developed special grades of powdered activated carbons (PAC), such as NORIT GL 50, to take care of the elimination of low concentrations of poisonous dioxins/furans, mercury and other trace elements.



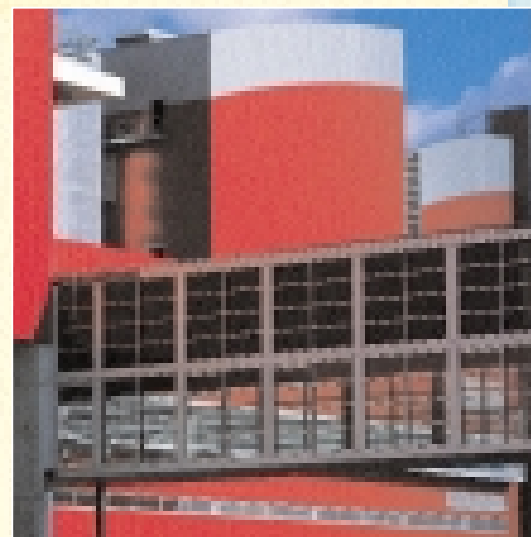
SOME NORIT PAC BENEFITS:

- NORIT PAC can be dosed in different types of flue gas clean-up systems
- NORIT PAC 's particular pore size distribution and particle size contributes to their good adsorption capacity
- Emission levels using NORIT PAC are far below the legal requirements in Europe
- The dosing system is simple to operate. Flexible dosing rates give optimal efficiency and carbon consumption
- Maximum safety for storage and handling
- Easy and effective removal by bag and electro filters
- Spent PAC can be incinerated, disintegrating dioxins and furans substantially
- Control of auto-ignition temperature of NORIT PAC
- Suitable PAC for every application, from high mercury concentration to wet scrubbers

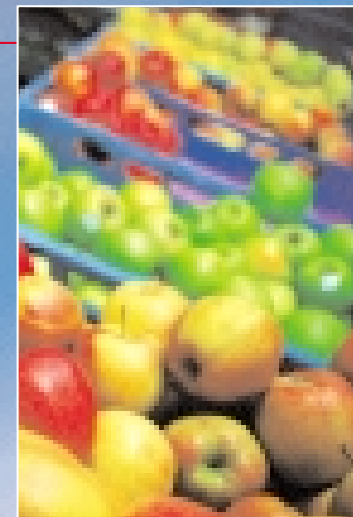


NORIT offers a wide range of special products for dioxin and mercury removal. Along with the NORIT GL 50 already mentioned, a specific carbon has been developed for the removal of mercury, NORIT GLZ 50. For dioxin control in wet conditions, such as scrubbing operations, NORIT produces a carbon with a well-developed pore structure, NORIT SA Super DD. This carbon is ideally suited for removal of dioxins/furans from the wet phase. NORIT can also supply specially developed carbons for specific use.

Fixed-bed activated carbon systems are also used for small-scale incineration operations. NORIT R 2030 is an excellent carbon for the removal of low concentrations of organic components such as dioxins and mercury in a fixed-bed configuration.



FRUIT STORAGE



The apple you eat in winter may have been stored under controlled conditions in a cold warehouse. Controlled by NORIT' activated carbon.



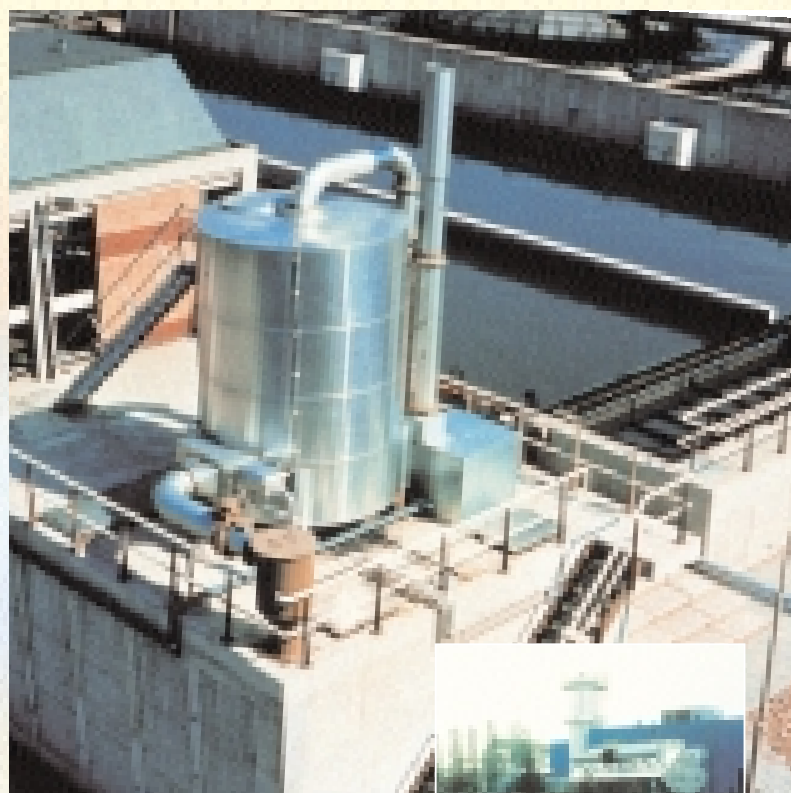


Air purification

Most manufacturing plants, particularly in the chemical, engineering, food processing and printing industries, are required to restrict their air-borne emissions of harmful or odorous compounds. Activated carbon air-treatment systems are amongst the most effective technologies available to deal with these problems. Both organic and inorganic impurities can be removed with NORIT activated carbons.

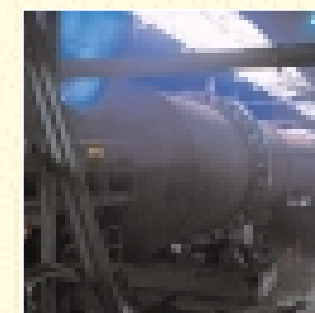
Similarly, activated carbon is used to purify intake air to buildings whose use or content imposes special demands on air purity. Examples include museums and art galleries, hospitals, computer rooms, etc.

Activated carbon is most cost-effective where the impurity levels range up to a few hundred ppm. At these concentrations, it is almost always cheaper to use activated carbon than any other purification technology.



Regeneration of granular and extruded carbons

NORIT has possibilities for reactivation of selected exhausted granular activated carbons (GAC) which have become hazardous waste. Exhausted carbon is sometimes classed as hazardous goods because of the type of components adsorbed. Reactivation by the NORIT Recycling Service is done at the NORIT factory in Zaandam, the Netherlands, under government license. Spent activated carbon can be collected in dedicated filters and tanks.



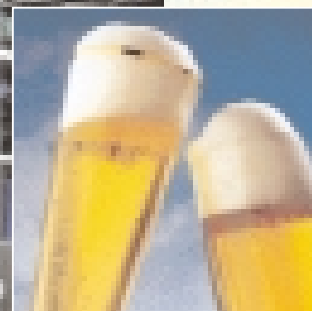


Gas purification

Contaminants frequently have to be removed from industrial process gases to protect catalysts and downstream equipment, or to yield a pure intermediate or final gas. Activated carbon is a particularly effective medium for gas purification where contaminants are present at ppm levels.

Examples of these gas purification applications:

PROCESS GAS	CONTAMINANT	INDUSTRY
Synthesis gas	HCN	Chemical
Natural gas	Mercury	LNG (liquefied natural gas)
Natural gas	THT	Fuel cells
Hydrogen	Mercury	Chloro-alkali industry
Hydrogen	VOC's	Chemical industry
Carbon dioxide	Hydrogen sulphide	Breweries
Carbon dioxide	Organics (sulphur)	Soft drinks
Compressed air	Oil, VOC's	Various



Fuel Cells

Fuel cells are a sophisticated technology for electricity generation. Fuel cells are gas-operated, electric batteries. They are environmentally clean, quiet and a highly efficient method for generating electricity and heat from natural gas and other fuels. When using natural gas as fuel for fuel cells, the sulphur containing natural gas needs to be purified. This purification is done with activated carbon, which will eliminate the sulphurous components in one step, resulting in a clean natural gas.



CIGARETTE FILTERS

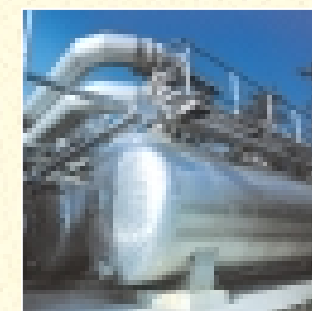
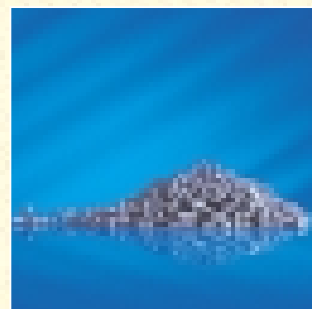
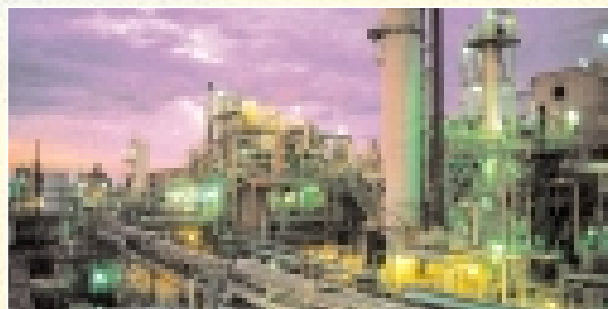
Even the smoke of cigarettes may have been purified using NORIT activated carbon.



Solvent recovery

Various industries use organic solvents in processes that involve eventual evaporation into the air. These solvent vapours can be recovered economically by means of an activated carbon solvent recovery plant.

The solvent-laden air is passed through an adsorber filled with the SORBONORIT activated carbon types. These carbons adsorb the vapour until it is saturated and breakthrough occurs. The vapour stream is then switched to a second adsorber while the solvent is recovered from the first adsorber – by desorption with low-pressure steam. The cycle is continuously repeated.



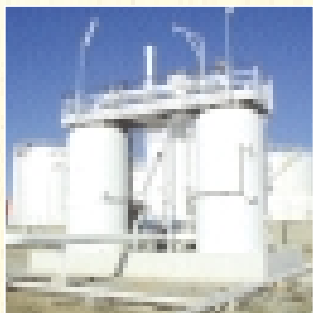
SORBONORIT solvent-recovery systems run for several years on one charge of carbon. Recovery costs, depending on the compounds involved, are less in most cases than the price of the solvent, so that the investment costs for the installation can be earned back in 1 to 3 years. NORIT can provide you with the proper carbon type for your process, but also with a complete recovery system, engineered especially to your specific needs

For hydrogen purification there are dedicated regeneration systems that operate on the principle of pressure difference. These systems are called pressure swing adsorption units (PSA units). They are found at many industrial sites all over the world where technically clean hydrogen is needed. For such processes NORIT's extruded RB grades or granular GAC grades are used world wide.



Hydrocarbon vapour recovery

Vapour recovery units (VRU's) have been developed to meet environmental requirements for vapour control at bulk terminals. These units utilise the principle of adsorption. The adsorption medium, activated carbon, is regenerated in-situ by vacuum and purge air. The recovered fuel is led back to the storage tank. After regeneration the adsorber is ready to receive new vapours from truck filling or storage tank breathing. The purified air stream is vented to the atmosphere. NORIT has developed a specific carbon with a high adsorption capacity combined with a good desorption capability, resulting in a high working capacity. This grade is called NORIT GF 40.



Personal protection



Industrial workers and others exposed to toxic or harmful gases can be protected by means of air filters filled with special grades of activated carbon. NORIT supplies activated carbons for industrial respirators which are conform to the CEN EN 141 class I and class II norms.

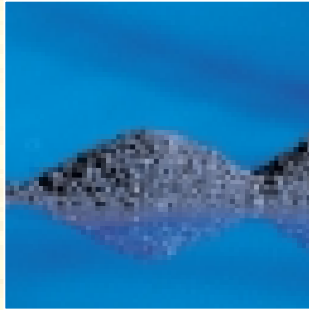
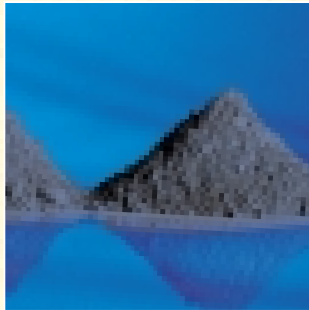
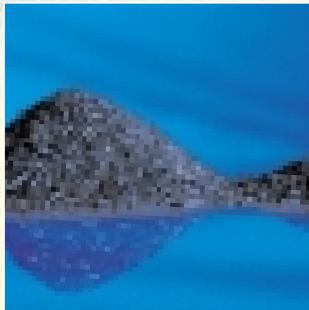
NORIT also supplies activated carbons for military respirators and shelter filters in conformance with the TL and other army standards. Most of the activated carbons are impregnated to provide both physical and chemical adsorption.

PROTECTION AGAINST	APPLICATION	CEN FILTER TYPE
Organic components	Industrial	A
Inorganic components, Cl ₂ , H ₂ S, HCN	Industrial	B
Acidic vapours; SO ₂ , HCl,	Industrial	E
Ammonia, amines	Industrial	K
War gases	Military gas masks, vehicle and shelter filters	In accordance with German TL standards



Main grades

Main grades		FLUE GAS CLEANING	GAS MASKS	SOLVENT RECOVERY	VAPOUR RECOVERY	AIR PURIFICATION	PRESSURE SWING ADSORPTION	GAS PURIFICATION	DEMERCURISATION	DESULPHURISATION	
AC-Type	Size										
Powdered	Activated	Carbon									
NORIT GL 50		■									
NORIT GLZ 50		■								■	
NORIT SA Super DD		■									
Granular	Activated	Carbon									
NORIT GCN	4x8						■				
NORIT Vapure	6x12							■			
Extruded	Activated	Carbon									
NORIT R 2030	3	■				■			■		
NORIT RB	2,3,4					■	■		■		
SORBONORIT B	3,4		■								
SORBONORIT	3,4		■								
NORIT GF 40	2						■				
NORIT R EXTRA	0.8,1	■									
NRS Carbon	3-4						■				
Impregnated	Activated	Carbon									
NORIT RBHG	3,4						■		■	■	
NORIT ROZ	3						■		■	■	
NORIT RZN	1	■									
NORIT RGM	0.8,1,3	■							■		■



Remember... NORIT means dedicated technical, sales and service support

Technical support is
always close at hand.

Our team of experts provides ongoing support in advising you on your specific application and treatment goals. Each team member is a committed expert who wants to keep your process running at optimum specifications and output levels.

NORIT serves customers
world wide.

NORIT provides our customers with a world wide network of sales and service support. In fact, we manufacture activated carbon at six plants around the world.

This means that we take our
commitment to our
customers very seriously.

We are proud to work in partnership with you to provide our extensive technical expertise and the most choices in activated carbon. In turn, you can be assured of getting the best fit for your application, at an optimal price/performance.



Some of our services:

- Test evaluations
- Pilot dosing units
- Samples
- Technical bulletins
- Sample analyses
- Basic design calculations

• NORIT the purification company

NORIT, founded in 1918, is a company operating world-wide in activities in the area of purification. With its 1750 employees. NORIT achieves an annual consolidated turnover of about 300 million Euros. Nuon, the Netherlands-based multi-utility supplier, owns more than 99% of the shares.

NORIT the purification company supplies products, installations and services for the chemical, pharmaceutical, water, beverage, food, gas-air, automotive and mining industries. This involves products such as activated carbon, membranes, aseptic and hygienic valves, CO₂ recovery installations and CO₂ analysis equipment.

As integration manager NORIT the purification company supplies total solutions and turnkey projects for the pharmaceutical, water, beverage, food and dairy industries. The most important sales markets are in Europe, the United States, Canada, Latin America and Asia, with growth in other important regions.

• **NORIT Activated Carbon**

(Europe, Africa, Asia, Pacific)

Nijverheidsweg-Noord 72

3812 PM AMERSFOORT

P.O. Box 105

3800 AC AMERSFOORT

Niederlande

Tel.: + 31-334648911

Telefax: + 31-334617429

Internet: www.norit.com

e-mail : info@norit.com

• **NORIT Activated Carbon & Membranes**

(America's)

5775 Peachtree Dunwoody Rd.

Building C, Suite 250

ATLANTA, GA 30342

U.S.A.

Tel.: +1-404 2566150

Telefax:+1-404 2566199

Internet: www.norit-americas.com

e-mail : info@norit-americas.com

Internet: www.norit.info

The Purification Company