DTB000183

RELITE P50 - Granular Activated Carbon

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RELITE P50

RELITE P50 is a highly active, regenerable granular activated carbon, with porous structure. It is particularly suitable for the removal of chlorine, ozone and permanganate used in the pretreatment of potable waters and for the removal of the organic contaminants always present in civil and industrial primary and waste waters.

RELITE P50 is manufactured from carefully selected bituminous mineral coals. The thermal activation process, carried out at strictly controlled temperatures, gives RELITE P50 a large surface area and a porous structure allowing the adsorption of low and high molecular weight organic compounds.

RELITE P50 is an activated carbon having high density and good resistance to the attrition and the mechanical shocks which could occur during backwashing and thermal regeneration.

Its high resistance to abrasion, high density, short wetting time, the sub-microscopic structure of its pores and their average size, uniformly ranging between 10 and 1000 Å, make RELITE P50 particularly effective in several applications:

- elimination from potable waters of free chlorine and substances causing bad taste and odour;
- removal of primary and secondary organics, such as haloforms, epoxides, aldehydes and ketones deriving from the chlorination and ozonization treatments of waters for civil and industrial use;
- removal of oils, greases, detergents and brighteners present in the rinse waters of galvanic electro-deposition processes in order to protect the ion exchange resins used for the recycling of plating industry rinse waters and for the recovery of precious metals;
- adsorption of biodegradable and non-biodegradable organic pollutants such as pesticides, phenols, dyes, detergents, polyoils and others usually expressed as COD, always present in waste waters.

Furthermore, RELITE P50 is sussessfully employed in many processes in the chemical, pharmaceutical and food industries to purify and decolorize the most different solutions as citric acid, glycerine and urea.

TYPICAL CHARACTERISTICS

Physical form	:	**Black, rugged granules shipped in dry form**	
Moisture content as shipped	:	**5 %**	**max**
Ashes	:	**10 ± 2**	**%**
pH	:	**8 ÷ 10**	
Total surface area (N_2, B.E.T. method)	:	**1050 ÷ 1150**	**m^2/dry g**
Iodine number	:	**950 min**	**mg/g**
CTC index	:	**60**	**%**
Apparent density	:	**450 ± 20**	**g/l**
Density, backwashed and drained column	:	**420 ± 20**	**g/l**
Particle size range	:	**0.6 - 1.7**	**m m**
Standard packaging	:	**52**	**liter bags**

Resindion S.r.l.
A Subsidiary of MITSUBISHI CHEMICAL

Via Roma,55 - 20082 Binasco (MI) - ITALY - Fax: +39.02.90090774 - Phone: +39.02.900130221-223 - E-mail: technical@resindion.com

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RECOMMENDED OPERATING CONDITIONS

Minimum bed depth			
- for dechlorination	**:**	**750**	**m m**
- for organics adsorption	**:**	**1500**	**m m**
Specific operating flowrate			
- for dechlorination	**:**	**8 ÷ 32**	**BV/h**
- for organics adsorption	**:**	**2 ÷ 6**	**BV/h**
Backwash expansion	**:**	**40 ÷ 50**	**%**

TREATMENT OF POTABLE AND FOOD INDUSTRY WATERS

1. *DECHLORINATION*

The activated carbon RELITE P50, thanks to its excellent catalytic power, is particularly suitable for the removal of free chlorine, bad odours and tastes from potable waters. Its screen size distribution, uniformly ranging between 0.4 ÷ 1.7 mm, and its negligible dust content make the use of this activated carbon recommended both in the house-hold filters, when very high operating flowrates are required, and in the industrial installations.
The dechlorination process consists of a simple oxireduction reaction, catalyzed by RELITE P50, allowing the transformation of free chlorine into hydrochloric acid, which is neutralized by the water bicarbonate alkalinity. The highest catalytic power is reached when working at pH values lower than 7.5 and at temperatures above 10°C.

The dechlorination capacity of the activated carbon is also strongly influenced by the contact time. In fact, at constant free chlorine concentration in the influent, the higher is the contact time, i.e. the lower is the specific flowrate expressed in l/h/l of activated carbon, the higher is the dechlorination power of the activated carbon.
When the free chlorine content in the feed water exceeds 2 ppm, it is recommended to operate at specific flowrates ranging between 8 and 16 l/h/l.

The data reported in Fig. 1 refer to feed waters free from organic matters, having a pH of 7, and a temperature of 20°C. The organic matters present in the influent clog the pores of the activated carbon, reducing the surface area and, consequently, the dechlorination capacity.
Since the life of the activated carbon RELITE P50 used in the dechlorination can be considerably long, several years in some cases, it is necessary to periodically backwash the filters to eliminate the particles retained by the bed, the gas pockets, the channels and to hydraulically re-grade the bed. The backwash flowrate must allow a bed expansion of 40 - 50 % for approximately 15 minutes or till the effluent is perfectly clean.
Fig. 2 shows the relation existing between the bed expansion of RELITE P50, the backwash flowrate and the water temperature.
Fig. 3 shows the pressure drop of RELITE P50; the data refer to waters free from suspended solids, and new activated carbon.

2. *REMOVAL OF ORGANICS, PARTICULARLY HALOFORMS, AFTER CHLORINATION AND OZONIZATION*

The growing need of potable water and the progressive deterioration of water resources have compelled water system suppliers and food industry to more and more use activated carbons in the potable water processes in order to obtain a water quality meeting the existing regulations.

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Though the disinfection processes are run following highly qualified know-hows and strong oxidizers are used, such as chlorine and ozone, the obtained water may not be potable yet due to the even low presence of organics as haloforms and epoxides.
The activated carbon RELITE P50, thanks to its high activation degree and to its marked adsorption characteristics, has the power to remove such compounds, whatever their molecular weight and origin may be, at really advantageous operating costs.

The adsorption capacity of RELITE P50, as far as haloforms are concerned, is a function of the molecular weight of the adsorbed matters and increases with it till values equal to 20% of its weight for compounds such as hexachlorobutadiene and hexachlorocyclohexanone.
Particularly high adsorption performances and high-quality water may be obtained operating with two or more filters in series of RELITE P50. In such a system the last filter acts as polisher, allowing to fully exploit the adsorption capacity of the filters ahead. Contact times exceeding 10 minutes and bed depths higher than 1500 mm are always recommended to obtain a high-quality water.

TREATMENT OF INDUSTRIAL WATERS

1. *REMOVAL OF ORGANIC MATTERS FROM GALVANIC WASTE WATERS*

The rinse waters coming from the electro-deposition processes, due to their low salinity, may be demineralized and recycled.
The presence of oils, greases, surfactants and brighteners in these waters calls for the installation of an activated carbon filter ahead the demineralization plant to preserve the ion exchange resins from an irreversible fouling that will progressively deteriorate the performances of the resins.
RELITE P50, with its high adsorption capacity, is fully reliable in these applications, assuring good operating performances for sufficiently long periods.

2. *REMOVAL OF ORGANIC MATTERS FROM INDUSTRIAL WASTE WATERS*

RELITE P50 is sussessfully used also for the removal of organic matters, biodegradable and non-biodegradable, often present in the industrial waste waters.
It is very difficult to give, in this case, values of adsorption capacity since the pollutants are often of the most different nature and frequently interact giving not always foreseeable results. The only reliable system for the determination of the adsorption power of an activated carbon working on waste waters is to run adsorption tests in pilot plants.
It will be noticed that the adsorption capacities change according with different parameters such as contact time, bed depth, water temperature, relative and absolute concentrations of the compounds to be adsorbed, admitted leakage at the endpoint.

In the adsorption of mineral oils, for instance, in favourable conditions and with an admitted endpoint leakage of 1 mg/l, capacities in the range of 20% of the weight of the activated carbon are reached, i.e. capacities of approximately 100 g of oils per liter of RELITE P50. In case the admitted leakage is only 0.1 mg/l, the adsorption capacity of RELITE P50 is reduced, in the same operating conditions, by about 50%.
The same phenomenon, though less evident, takes place in the adsorption of ionic and non-ionic surfactants, for which capacities of 60 g/l are reached. Also in this case, the remark made on the adsorption of the haloforms in the treatment of potable waters is valid, that really interesting adsorption capacities can be obtained operating with two or more filters in series in order to exclude one filter from service only after the activated carbon is fully exhausted.

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REGENERATION

The regeneration of the granular activated carbon RELITE P50 can be run following different techniques, chosen according to the nature of the adsorbed compounds.

The activated carbon is in general thermally regenerated. This kind of regeneration is more properly called thermal reactivation, for which rotary kilns or Herrenshoff furnaces are used. The activated carbon is in this case subjected to high temperatures in carefully controlled atmosphere.
The result is the cracking and volatilization of the adsorbed organic compounds without damaging the structure of RELITE P50, which regains its original porosity.
The physical loss of thermally reactivated RELITE P50 is about 10%.

Other rather well-known regeneration techniques are the extraction with solvent, the acid and caustic rinses, the steam stripping.
The extraction with solvent may be sussessfully used only when a solvent exists capable to solubilize the adsorbed matter.
The acid rinse, on the other hand, is suitable when the matter present on the activated carbon is soluble in acid medium. The same for the caustic rinse.
In the above cases, RELITE P50 can regain, at each regeneration, up to 90% of its original adsorption capacity. Obviously, after some cycles, the capacity decreases to no more economically attractive values and a thermal reactivation is necessary.
The regeneration is carried out percolating through the bed of activated carbon an amount of solvent or acid/ caustic solution sufficient to draw the adsorbed matters out of the carbon.

An additional rather common regeneration is the steam stripping. This treatment is suggested when volatile compounds are adsorbed on the carbon. Steam is used to heat the carbon bed at a temperature exceeding the boiling temperature of the adsorbed matter. The stripped product is then recovered by condensation. Hot gases, if available, can be advantageously used instead of steam.

Fig. 1 RELITE P50 CHLORINE REMOVAL CAPACITY FOR VARIOUS INFLUENT CHLORINE CONCENTRATIONS AND DIFFERENT FLOWRATES

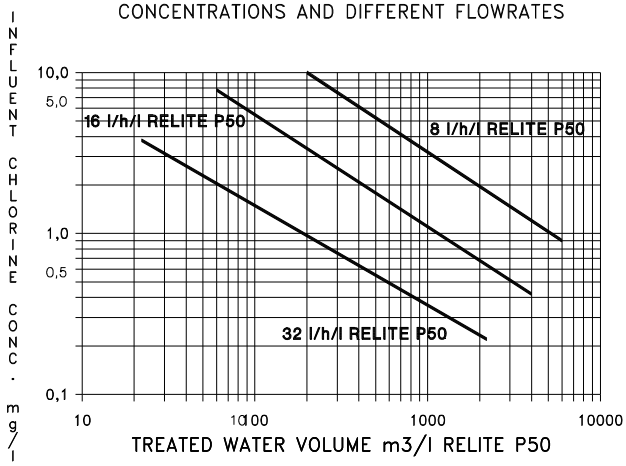

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Fig. 2 BED EXPANSION IN WATER

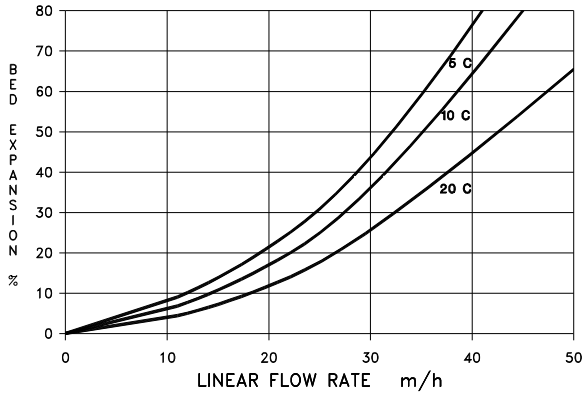
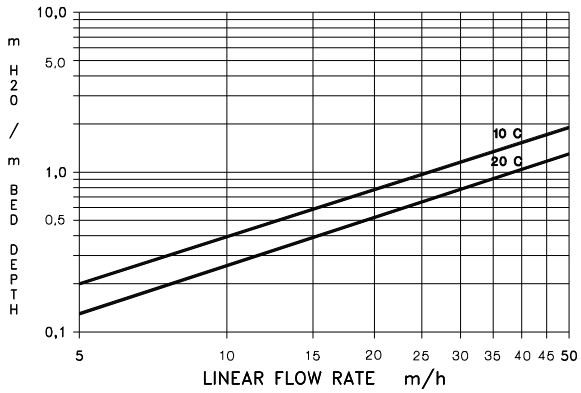


Fig. 3 PRESSURE DROP IN WATER



WARNING

The wet activated carbon adsorbs oxygen from the air. The adsorption rate is connected with the degree of exposure of the wet carbon to the air, therefore the process is relatively quick in drained beds.
The oxygen depletion inside closed or partially closed activated carbon vessels may reach dangerous levels in short times. Consequently it is necessary, when workers enter a carbon vessel, to follow all security procedures for potentially low oxygen atmosphere.

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