



# *Activated carbon for the food industry*

Decolourization, odour and taste adjustment

## Activated carbon in the food industry

The first industrial application of activated carbon was in food sector, in the sugar industry. In 1794 charcoal was used for the first time in an English sugar refinery. Today, activated carbons are not only used for treatment of sugar solutions but also cover a wide range of applications from treatment of edible oils and fats, over application in the beverage industry for wine and fruit juices to the coloration of food as E153 (vegetable carbon).

Apart from decolorization, activated carbon is used for removing dissolved organic compounds and controlling odor and taste are utilised. These applications predominantly powdered activated carbons of our **Carbopal**<sup>®</sup>-Qualities are used and applied by stirring or suspension technique or granular activated carbons **Epibon**<sup>®</sup>-Qualities by the percolation process, where activated carbon is used in a fixed bed filter.

### Carbopal

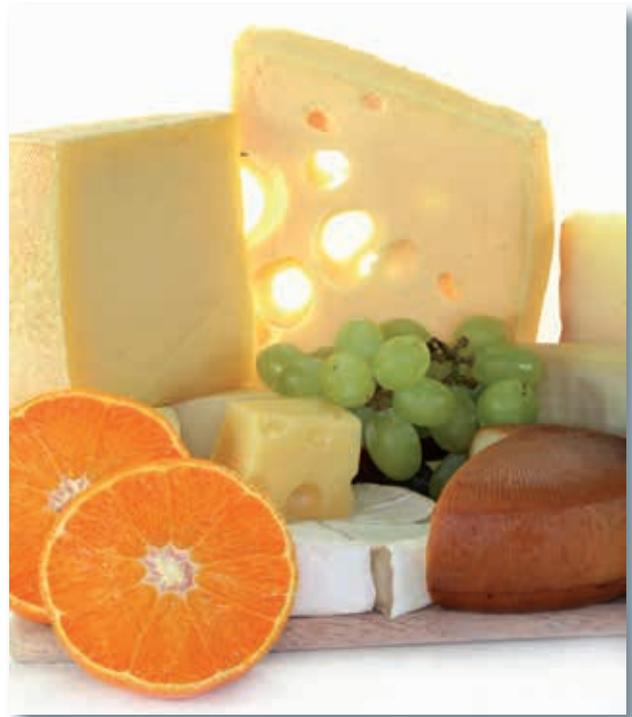
#### Stirring or suspension process

In this widely used method, the activated carbon is either directly stirred into the solution to be treated or mixed and dispensed as a 15% suspension.

Activated carbon dosage rates are normally in the order of 0.1 to 1% related to the liquid volume to be treated. The contact time of the activated carbon has to be matched with the physical properties of the liquid to be treated, such as viscosity, temperature, pH value and the substances to be removed. Hence a contact time between 15 and 30 minutes will normally be sufficient. The separation of activated carbon from the liquid phase is accomplished by filtration in suitable filter systems. In large-scale applications, dust-free dosing of powdered carbon from silos or containers is realized by appropriate dosage and transport systems.

#### Precoat filtration

The use of the precoat or so called sheet filtration process is limited to applications involving the removal of low concentrations of impurities or not requiring high treatment standards. Here, a filter element is precoated with powdered activated carbon - if required, in combination with a filter aid - to produce a filter layer through which the solution to be treated is passed. One advantage of the precoat filtration process is the simultaneous separation of particulate impurities as suspended solids.



### Epibon

#### Percolation filtration

In the percolation process, the solution to be treated is likewise filtered through an activated carbon layer.

Contrary to precoat filtration, percolation is cleaning the solution to be treated by granular activated carbon charged in adsorption columns. During the adsorption process, a typical concentration profile results for the activated carbon layer or bed.

#### Adsorbers for the liquid purification

In food industry, the use of Donau Carbon filters with granulated activated carbons is widely used for the treatment of liquid (intermediate) products of all kinds. It applies the high quality requirements, for example to achieve in the discoloration of solutions or smell and taste neutralization.

# General information on active carbon

## Activated Carbon Characteristics

The manufacturing and activation process and the used basic raw materials have a determining influence on the adsorptive capacity of activated carbon products.

In the Gas Activation Process, previously carbonised material is subjected to the oxidising action of gas, such as steam, carbon dioxide, air or a mixture of these. Activation temperatures typically range from 700 to 1.000 °C.

In the chemical activation process non-incinerated carbonaceous material like sawdust are initially mixed with dehydrating or oxidising chemicals like zinc chloride or phosphoric acid and heated up to temperatures between 400 and 800°C under exclusion of oxygen.

The selection of the most suitable type of activated carbon for a specific application depends on the physical and chemical properties of the substances to be adsorbed. Aside from this material data, other process-related factors also play a role in the adsorption process.

## Application technology liquid treatment

Adsorption technology is widely used for the treatment of liquids.

Apart from decolorization, activated carbons are removing impurities, which are typically organic compounds. In these applications predominantly activated carbon in powder form is used. Our powdered activated carbon series **Carbopal®** can be applied by stirring or suspension.

With powdered activated carbons, a multi-stage process including recycling is possible.

By using granular activated carbons with the percolation process, the solution to be treated is filtered through an activated carbon layer charged in columns. The **Epibon®** granular activated carbon products possess an open porous structure making them highly suitable for such treatments.

The filtration behavior of powdered activated carbons depends partly on the fineness, and also the grain shape of the product.

In the production of powdered activated carbon, the fineness is adjusted for optimum filtering characteristics.

Here, a filter element is precoated with powdered activated carbon – if required in combination with a filter aid – to produce a filter layer through which the solution to be treated is passed.

The combination with filter aid has no negative impact on the adsorption capacity of the powdered activated carbon. Separation of the powdered activated carbon is achieved by filtration in appropriate filter systems (press-filter, centrifuges and cartridge filters).

When using granular activated carbons, depending on the type and concentration of the substances to be adsorbed, reactivation of spent activated carbon is possible.

## Selection of activated carbon

The various grades of activated carbons available from Donau Carbon offer a wide variety of adsorption properties for different applications like liquid, waste air or water treatment.

Selection of the suitable grade is done by extensive know-how, based on more than 100 years' experience in the production, processing and characterization of activated carbon dealing with customers specific requirements.

### Selection activated carbon from – Overview of advantages

Powdered activated carbon	Granular activated carbon
Low invest cost	Possibility of environmental friendly & cost-saving reactivation
Temporary usage	Compensation of concentration fluctuations
No preloading	Security Level
Low space needed	Few analytic needed
Multiple use	Easy Handling

# Food / Groceries

## Treatment of Glucose

Glucose and starch solutions like dextrose, fructose are treated for removal of colour and high molecular weight substances which result from the production process. In particular, colour precursors like Hydroxymethylfurfural (HMF) are known to induce a later recolourisation in the solution.

When the main target is elimination of residual colour, chemically activated carbons will be chosen. If removal of HMF is intended, a steam activated carbon will be applied. A desired combination of these properties is possible with our mixed product Carbopal EP. The pH value mostly should be kept acidic, and therefore the activated carbon should not impact it in the liquid to be treated.

Thanks to laboratory tests, Donau Carbon can determine which product quality is optimal for the specific application and what dosage will be needed to achieve the desired bleaching. Granular activated carbons are employed for plants producing large quantities of one sole product on a continuous basis. It brings lower operating costs and the possibility to reactivate and reuse of the spent carbon environmentally friendly.

DC – product qualities:

**Carbopal**® PA 4, EP or MB 4 S

**Epibon**® Y 12x40 spezial

## Treatment of sugar syrups

The main focus here is the decolouration and purification of liquid sugars obtained for instance from cane sugars, fructose or others saccharides. The intensity of colour will guide the customer in choosing an adequate product. In general, steam activated carbons will only be suitable for light coloured solutions. Chemically activated carbons will suit to darker syrups.

The pH value of the activated carbon will be adjusted to buffer to neutral as it will avoid the formation of invert sugar.

When granular activated carbon is used in continuous processes, i.e. in a column process, the possibility to reactivate the activated carbon offers an economical and environmental advantage.

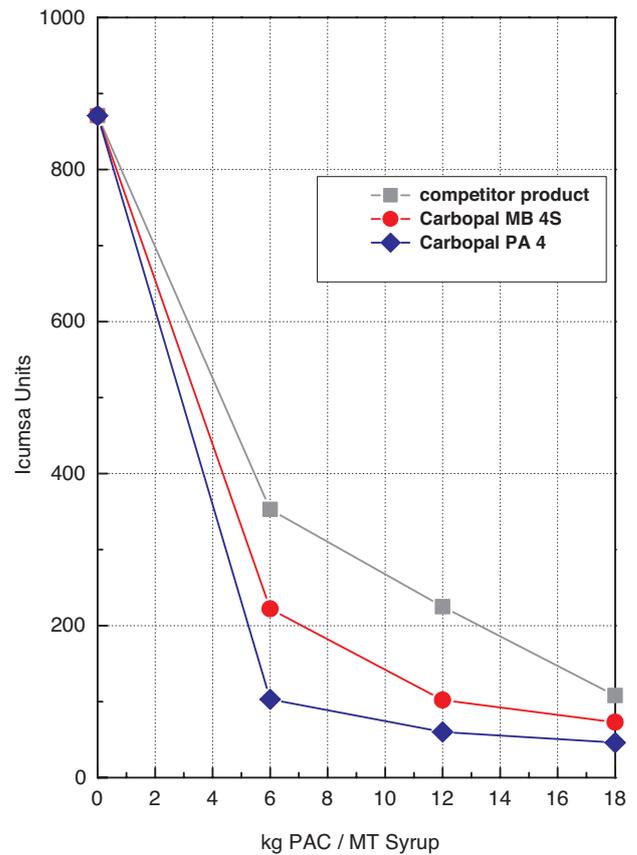
DC – product qualities:

**Carbopal**® PA 4 N or MB 4 N

**Epibon**® Y 12x40 spezial,

## Decolourisation of Syrup

Analysis 420 nm, 1 cm



## Treatment of lactose and gelatine

In the production of lactose – milk sugar, activated carbon will be applied for decolourization (usually measuring at 400 nm) and for the removal of endotoxins (280 nm). The characteristics of the product should be compatible to the pH of the solutions and exhibit the pore structure that will allow ideal removal of the undesired substances.

The use of activated carbon for the processing of gelatine works similarly. Here, apart from decolourization, it additionally is necessary to remove flavourings. Due to the discontinuous procedure typically used for this, increasingly powdered activated carbons are applied.

DC – product qualities:  
**Carbopal®** Gn-P, PA 4 N or MB 4

## Purification of edible oils and fats

For the treatment of edible oil and fats, powdered activated carbons are used in combination with bleaching earths for the removal of polycyclic aromatic hydrocarbons (PAH) like benzo(a)pyrene and the reduction of natural colouring substances.

For the selection of an optimal product quality, it is important to know the type of oil to be treated. For example coconut and palm oil have an increasing part in the European market and need adequate activated carbon qualities. On the other hand, there are very tasks in treating fish oil, where dioxins must be removed, but no decolourization should take place.

DC – product qualities:  
**Carbopal®** AP, P800 (LC) or MB 4 (B)

## Treatment of soup spice, caffeine and glutamate

The main aspect for the treatment of flavouring agents mostly is the decolouration. The hydrolysed vegetable proteins are dark starting materials that require the use of chemically activated carbons, more cost effective due to the high decolouration capacity. The optimisation of dosage and contact time shall be determined in preliminary tests under conditions as close to the real production processes as possible.

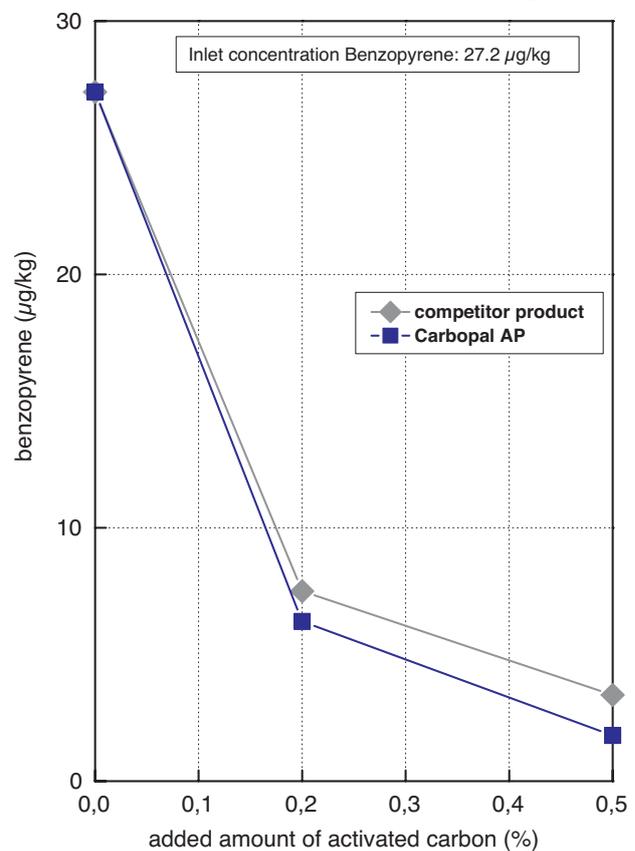
DC – product qualities:  
**Carbopal®** PA 4, Gn-P or MB 5

### Activated carbons with improved filterability

In addition to good PAH separation, the filterability of the used activated carbon is an important criterion. Donau Carbon's product **Carbopal®** P800 C LC is very suitable by holding a high adsorption capacity and short filtration times.

DC – product qualities:  
**Carbopal®** P800 C LC oder MB 4 B

### Removal of benzo(a)pyrene in cocosoil Treatment at 100° C with 2 wt.% bleaching earth



# Beverage industry

## Activated Carbon for wine & beer

Preparation of beverages often implies the use of activated carbon: it can be utilised for dechlorination of the process water used in the bottling plants, to purify the water or to remove unwanted components and impurities, for adjusting taste and colour. The grade of activated carbon will be selected in accordance to the task: chemically activated carbon types for decolourization or steam activated carbon types for taste and odour regulation.

A common example is the use of powdered activated carbon for decolourization of red wine for the production of vermouth or white wine, while issued from dark grapes. Of course, the raw water for production in the beverage industry must meet high purity requirements. Well established companies rely on our product Hydr Raffin CC 8x30.

DC – product qualities:  
**Hydr Raffin**® CC 8x30 & **Epibon**® MC 16x35  
**Carbopal**® PA 4, Gn-P or MB 6 SB30

## Treatment of fruit juice concentrates

In the fruit juice industry, depending on the quality of the raw products, there are increased amounts of undesired secondary components. This is independent of the primary product used (e.g., apple, lemon, oranges). In extensive tests with fruit juice manufacturers, we were able to demonstrate which product quality fits for the different objectives:

- Patuline removal → **Carbopal**® CCP 90
- Colour adjustment → **Carbopal**® Gn-P
- Decolourization → **Carbopal**® PA 4
- Odour and taste adjustment → **Carbopal**® MB 4

For decolourization, it is advantageous to know the predominant colour, for been able to chose the grade of activated carbon in the best possible way.

- pink & brown → coloured polyphenols
- dark brown → coloured melanoidins, colour precursors generated during processing

## Preparation of spirits

High quality activated carbon qualities are used e.g. in the production of the finest vodkas, for the refinement of taste and odour. Here it is mainly about the removal of acetaldehyde and branched alcohols, which arise in the production.

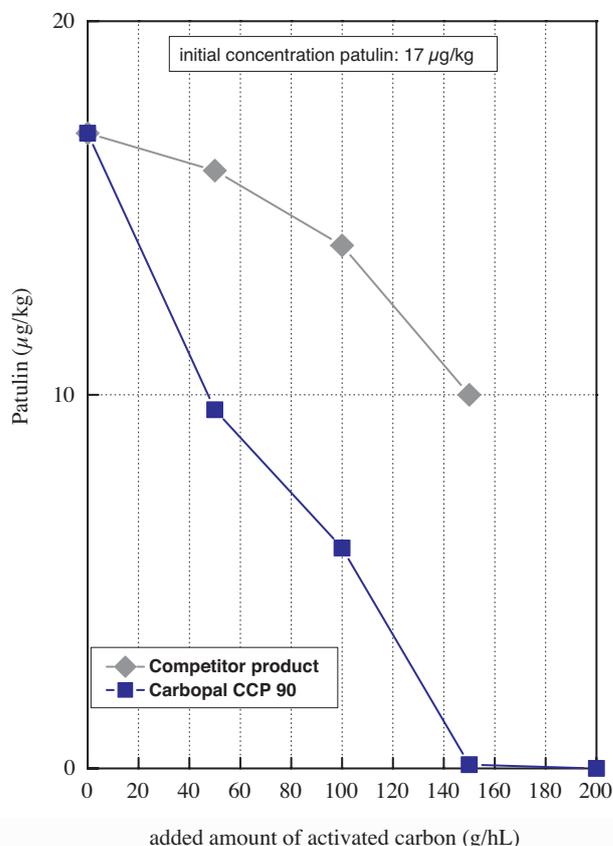
DC – product qualities:  
**Hydr Raffin**®CC 8x30 spezial, in other grain sizes available

## Dust-free powder activated carbon

In addition to the high purity and the good adsorption dust-free addition of powdered activated carbon is an increasingly important requirement on the part of the customer. Accordingly, extruded, water-soluble products such as our **Epibon**® B5 have been developed. In addition to the dust-free addition to the liquids, the rapid dissolution into powdered activated carbon is an important factor.

DC – product qualities:  
**Epibon**® B5

## Removal of patulin in apple juice



## Fine powdered activated carbon

In the field of fruit juice production, more and more membrane processes are used, which require a specific particle size distribution of the powdered activated carbon. Products as our **Carbopal**® Gn-P F provide these features, allowing increased production speed while protecting the sensitive membranes.

DC-Produktqualität:  
**Carbopal**® Gn-P F

## General Information

### Laboratory / Application Technology Department Support

Evaluation and control of new and used activated carbon will be done in our own laboratories in compliance with national and international standard test processes. Our application engineers have decades of experience in the field of water & liquid treatment and will be pleased to support our customers.

Donau Carbon is offering a comprehensive service:

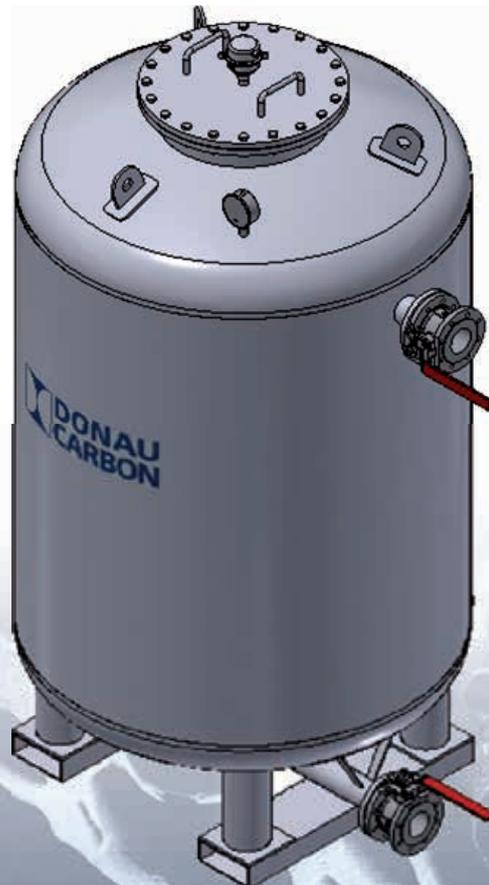
- analyses of adsorbents (mechanical, chemical and physical properties)
- determination of isotherms
- separation experiments based on the requirements
- support for selecting an optimal activated carbon for your application
- mobile activated carbon filters used as pilot plants for on-site tests are also provided upon request.

### Thermal reactivation of activated carbon

In many cases, loaded or exhausted granular activated carbons can be reactivated by means of a thermal process which is similar to the original activation process. Donau Carbon provides a thermal reactivation service for granular activated carbon as a cost saving and environment-friendly alternative to disposal at two locations in Frankfurt/Main, Germany, and Pischelsdorf, Austria. Using the latest technologies, the reactivation plants (rotary kiln) guarantee an optimum of quality of the reactivated product. Quality control and analyses in the company's own laboratory ensure the quality of the reactivated carbon and its suitability for reuse. The plants are equipped with state-of-the-art off gas cleaning systems meeting stringent European emission standards.

### Service and Mobile Compact Systems

In addition to its activated carbon sale and reactivation activities, Donau Carbon offers mobile and stationary adsorption units e.g. for ground water rehabilitation and soil vapour treatment. These compact, containerized units are available for sale or for rent and come with a complete service package from delivery, collection, replacement and refill to the disposal of spent carbon, as requested by the customer.



# Donau Carbon world-wide



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- Vertretungen / Representative offices, Agents & Distributors

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