

# ACTIVATED CARBON

*Prepared by the 37th JECFA (1990), published in FNP 52 (1992) superseding specifications prepared at the 31st JECFA (1987), published in FNP 38 (1988). Metals and arsenic specifications reviewed at the 61st JECFA (2003). No ADI was established at the 31st JECFA (1987)*

## SYNONYMS

Activated charcoal, decolourizing carbon

## DEFINITION

A solid, porous, carbonaceous material prepared by carbonizing and activating organic substances. The raw materials, which include sawdust, peat, lignite, coal, cellulose residues, coconut shells, petroleum coke, etc., may be carbonized and activated at high temperature with or without the addition of inorganic salts in a stream of activating gases such as steam or carbon dioxide. Alternatively, carbonaceous matter may be treated with a chemical activating agent such as phosphoric acid or zinc chloride and the mixture carbonized at an elevated temperature, followed by removal of the chemical activating agent by water washing.

Chemical names

Carbon

Chemical formula

C

Formula weight

12.01

## DESCRIPTION

Powder or granules, black, odourless

## FUNCTIONAL USES

Adsorbent, Decolourizing agent

## CHARACTERISTICS

### IDENTIFICATION

#### Solubility

Insoluble in water and organic solvents and all usual solvents

#### Burning

When heated to redness it burns slowly without a flame

#### Adsorption

Place about 3 g of powdered sample in a glass-stoppered flask containing 10 ml of dilute hydrochloric acid (5%), boil for 30 sec, and cool to room temperature. Add 100 ml of iodine TS, stopper, and shake vigorously for 30 sec. Filter through Whatman No 12 filter paper, or equivalent, discarding the first portion of filtrate. Compare 50 ml of the filtrate with a reference solution prepared by diluting 10 ml of iodine to 50 ml with water, but not treated with carbon. The colour of the carbon treated iodine solution is no darker than that of the reference solution, indicating the adsorptivity of the sample.

#### Ignition

Ignite a portion of the sample in air. Carbon monoxide and carbon dioxide are produced, and an ash remains.

## PURITY

#### Adsorption power

Within the range 90 to 110% of the declared value  
See description under TESTS

<u>Loss on drying (Vol. 4)</u>	Not more than 15% (120°, 4 h)
<u>Sulfide compounds</u>	To 1.0 g of the sample in a conical flask add 5 ml of 1 N hydrochloric acid and 20 ml of water. Heat to boiling. The fumes released do not turn lead acetate paper brown. (Lead acetate paper is prepared by saturating filter paper with lead acetate TS and drying the paper at 100°).
<u>Acid soluble substances</u>	Not more than 3% To about 1 g of the sample, accurately weighed, add 25 ml of dilute nitric acid TS and boil for 5 min. Filter whilst hot through a sintered-glass filter (10) and wash with 10 ml of hot water. Evaporate the combined filtrate and washings to dryness on a water bath, add to the residue 1 ml of hydrochloric acid, evaporate to dryness again and dry the residue to constant weight at 100-105°. The residue weighs not more than 3% of the sample weight.
<u>Sulfated ash</u>	Not more than 5% Heat a silica or platinum crucible to redness for 30 min, allow to cool in a desiccator and weigh. Place the sample in the crucible and add 2 ml of sulfuric acid TS. Heat at first on a water bath, then cautiously over a flame, then progressively to about 600°. Continue the incineration until all black particles have disappeared and allow the crucible to cool. Add a few drops of dilute sulfuric acid TS, heat and incinerate as before and allow to cool. Add a few drops of ammonium carbonate solution (15.8 g in 100 ml). Evaporate and incinerate carefully, allow to cool, weigh, and repeat the ignition for 15 min to constant weight.
<u>Water extractable substances</u>	Not more than 4% Transfer about 5 g of sample, accurately weighed, into a 250 ml flask provided with a reflux condenser and a Bunsen valve. Add 100 ml of water and several glass beads, and reflux for 1 h. Cool slightly, and filter through Whatman No 12 or equivalent filter paper, discarding the first 10 ml of filtrate. Cool the filtrate to room temperature, and pipet 25.0 ml into a tared crystallization dish. (Note: retain the remainder of the filtrate for the Arsenic, Heavy metals, and Lead tests). Evaporate the filtrate in the dish to incipient dryness on a hot plate never allowing the solution to boil. Dry for 1 h at 100° in a vacuum oven, cool and weigh. Calculate the percentage of water extractables in the filtrate, based on the sample weight and fraction of sample taken for gravimetric measurement.
<u>Alcohol soluble substances</u>	Not more than 0.5% The filtrate obtained by boiling 2 g of the sample with 20 ml N sodium hydroxide and filtering shall be colourless.
<u>Alkali soluble coloured substances</u>	To 0.25 g add 10 ml of 2 N sodium hydroxide and boil for 1 min. Cool, filter and dilute the filtrate to 10 ml with water. The solution is not more intensely coloured than a reference solution prepared by mixing 1.90 ml of 1% (m/V) hydrochloric acid and 0.10 ml of a solution containing 9.6 ml of ferric chloride TSC, 0.2 ml of cobaltous chloride TSC, and 0.2 ml of cupric sulfate TSC. (See Volume 4 for TSCs)
<u>Cyanogen compounds</u>	Mix 5 g of sample with 50 ml of water and 2 g of tartaric acid. Distil the mixture, collecting 25 ml of distillate below the surface of a mixture of 2 ml of sodium hydroxide TS and 10 ml of water contained in a small flask placed in an ice bath. Dilute the distillate to 50 ml with water, and mix. Add 12 drops of ferrous sulfate TS to 25 ml of the diluted distillate, heat almost to boiling, cool, and add 1 ml of hydrochloric acid. No blue colour

is produced.(See Volume 4 for TS)

Higher aromatic hydrocarbons

Extract 1 g of the sample with 12 ml of cyclohexane in a continuous extraction apparatus for 2 h. Using matched Nessler tubes, the extract shows no more colour or fluorescence than does a solution of 100 µg of quinine sulfate in 1000 ml of 0.1 N sulfuric acid when observed in ultraviolet light.

Arsenic (Vol. 4)

Not more than 3 mg/kg  
Use a 20 ml portion of the filtrate obtained in the test for Water extractable substances diluted to 35 ml with water in the Limit Test (Method II)

Lead

Not more than 5 mg/kg  
Determine using an atomic absorption technique appropriate to the specified level. The selection of sample size and method of sample preparation may be based on the principles of the method described in Volume 4, "Instrumental Methods."

Zinc

Not more than 25 mg/kg  
Accurately weigh about 2 g of the sample into a conical flask, add 50 ml of 2 N hydrochloric acid, and boil gently under reflux for 1 h, filter and wash the filter with 2 N hydrochloric acid. Evaporate the combined filtrate and washings to dryness on a water bath, dissolve the residue in 0.1 N hydrochloric acid and dilute to 50.0 ml with the same acid. Determine the content of zinc in the solution by the use of *Atomic Absorption Spectrophotometry*.

## TESTS

### PURITY TESTS

Adsorption power

To about 0.3 g of sample, accurately weighed, in a 100 ml ground-glass-stoppered conical flask add 25.0 ml of a freshly prepared solution of 0.5 g of phenazone in 50 ml of water. Shake thoroughly for 15 min. Filter and reject the first 5 ml of filtrate. To 10.0 ml of the filtrate add 1.0 g of potassium bromide and 20 ml of dilute hydrochloric acid TS. Using 0.1 ml of ethoxychrysoidine solution as indicator, titrate with 0.1 N potassium bromate until the colour changes from reddish-pink to yellowish-pink. Titrate slowly (1 drop every 15 sec) towards the end of the titration. Carry out a blank titration using 10.0 ml of the phenazone solution.

Calculate the quantity of phenazone adsorbed per 100 g of sample from:  
 $[2.353 (a - b)]/[m]$

where

a = volume (ml) of 0.1 N potassium bromate consumed by the blank

b = volume (ml) of 0.1 N potassium bromate consumed in the test

m = weighed amount (g) of sample

Not less than 90% and not more than 110% of the declared value of phenazone is adsorbed per 100 g of sample, calculated with reference to the dried substance.