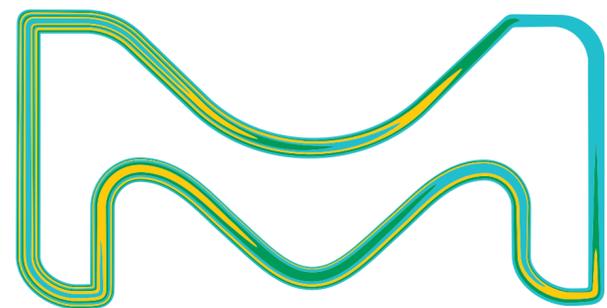


Specialty Carbon Adsorbents

Advanced materials for
industrial purifications and separations



The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the U.S. and Canada.



Supelco®
Analytical Products

Our Company has more than 40 years of experience in carbon adsorbent research and product development.

The unique characteristics and superior performance of our Supelco highly engineered specialty carbon adsorbents warranted their inclusion in experiments onboard various NASA missions, such as Voyager 1, Galileo, Cassini-Huygens and Phoenix.

The adsorption qualities of our specialty carbon adsorbents make them ideal for use in the following applications:

- Adsorption and desorption of targeted analytes in water, air, soil and serum
- Bulk-scale purification of gas and liquid streams
- Recovery of synthesized compounds from reaction mixtures
- Catalyst support in chemical reactions

Benefits

Activated Charcoal

Low cost, wide availability

Natural source

Non-specific, low-tech

Our Specialty Carbon

Highly customizable

Higher quality

Highly pure synthetic source

Highly engineered

Our customers have successfully used our specialty carbon adsorbents for:

- Recovery of PAHs in water analysis
- Recovery of dissolved metals during manufacturing.
- Freon/CFC capture
- Hydrocarbon vapour recovery

Specialty Carbon Adsorbents

Our specialty carbon adsorbents are highly engineered materials, manufactured from highly pure synthetic polymers. These products are then activated by physical means, avoiding the use of chemicals to activate. This differentiates them from common non-specific, low-tech carbon black and activated carbon adsorbents.

Our Carboxen® products are molecular sieve adsorbents, ideally suited for industrial manufacturing processes.

Our Synthetic Carbon Adsorbents can be designed with:

- Customizable surface chemistry, e.g. pH adjustment from 2.5 up to 10.5
- Spherical shape for easy flowability
- Customizable pore structure:
 - Non-porous or multi-porous morphology to serve a specific purpose
 - Macro-porous to enhance adsorption of large molecules
 - Tapered pore sizing (from macro- to meso- to micro-), to increase thermodynamic and kinetic efficiency
- Thermal, radiation, and pH stability
- Attrition resistance
- Regeneration capabilities

Do you know the difference between aD sorption and aB sorption?

aD sorption is the retention of molecules of a gas, liquid or dissolved solid at the surface.

aB sorption is the uniform distribution of a gas or liquid throughout the bulk of a material.

Physical Characteristics

- Size** : 2-1,000 microns
- Shape** : Spherical
- Pores** : Non-porous to multi-porous
(macro-, meso-, micro-pores)
- pH** : 2.5 up to 10.5
- Surface area** : 1 – 3,000 squared meter

Pore structure influences physical characteristics:

- A pore can be defined as any cavity present on a solid surface with a depth: width ratio of $\sim 10:1$.
- There are three types of pores relevant to carbon adsorbents. A macropore has a $>500 \text{ \AA}$ diameter, a mesopore has a $20\text{--}500 \text{ \AA}$ diameter and a micropore has a $<20 \text{ \AA}$ diameter. Controlling pore composition is very important, as it determines the adsorption and desorption characteristics of the particle.

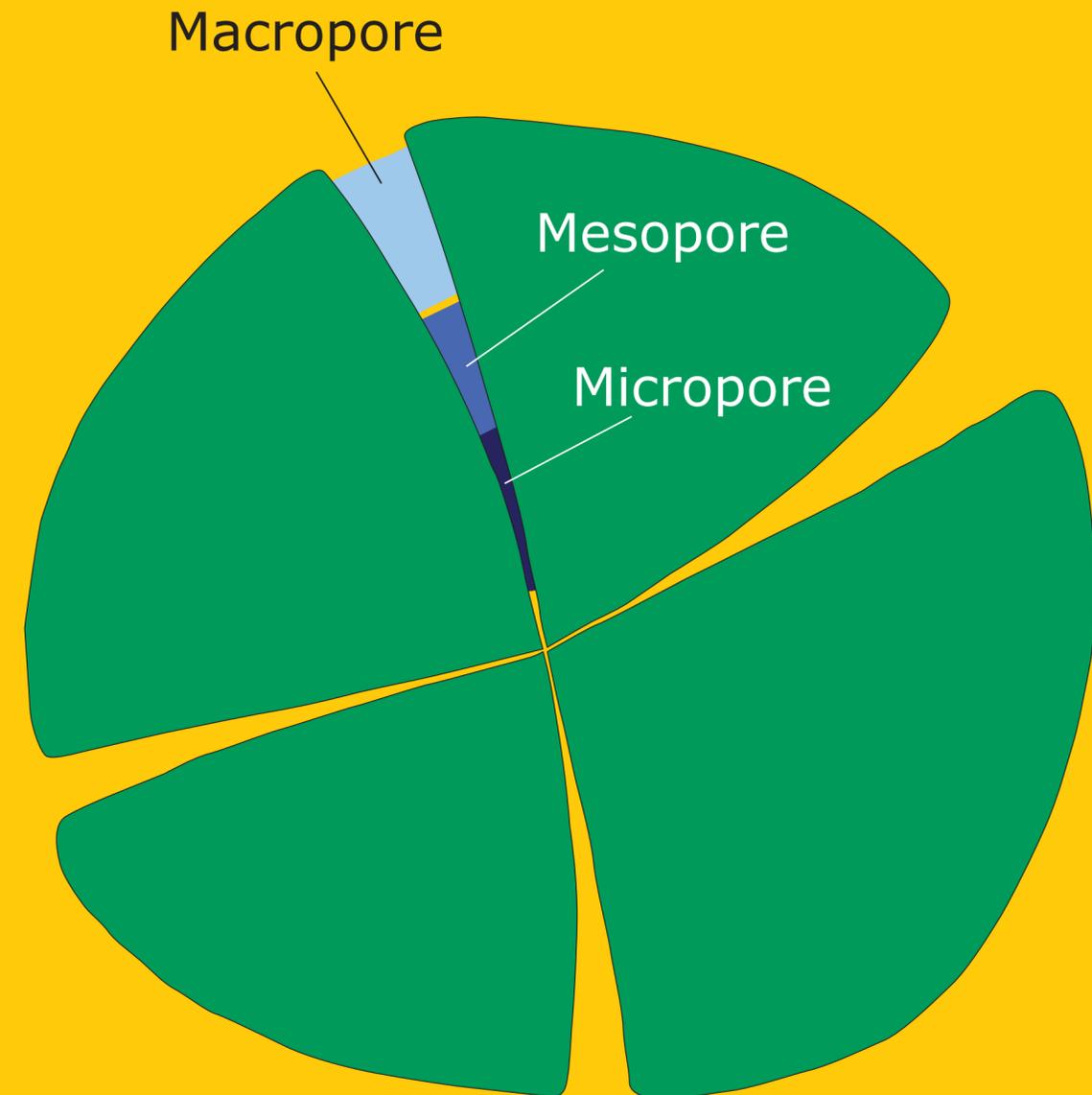


Figure 1. shows visual of multiporous spherical particle with three types of pores

Carboxen® Adsorbents

Their surface chemistry can be tailored for specific target analytes, with each of the existing products having a performance advantage, based on their characteristics:

Carboxen® 563 is slightly hydrophobic and highly multi-porous. It is the carbon choice for water purification due to its capability of collecting volatile organic compounds (VOCs) from both water and air. It can also be used for chemical purification.

Carboxen® 564 is highly multi-porous carbon. It is effective for collecting VOCs from air. It is similar to Carboxen® 563 but it is more hydrophobic in nature. It can be used for the purification of water and gases.

Carboxen® 569 more hydrophobic than Carboxen® 563 and Carboxen® 564 making it useful for work in high humidity environments. Its ability to trap small molecules makes it useful for purification of air and gases.

Carboxen® 572 has a high surface area and through-pore structure, giving it higher kinetic efficiency. It is typically used as a catalyst support because of its available pore volume.

Carboxen® 1005 is a very hydrophobic carbon with a through-pore structure and a high surface area. It is used in hydrocarbon traps for purification of carrier gases due to its two-fold hydrocarbon capturing ability compared to active charcoal.

Carboxen® 1032 is designed as an adsorbent with high surface area, large pore volume in the mesoporous region, and acidic pH for purification and removal of basic organic compounds from air and water.

Carboxen® 1033 is designed as an adsorbent with a neutral pH. It has a moderate surface area similar to the ones in 563, 564, and 569 series but is more hydrophilic in nature. It wets better in aqueous and polar solutions for purification and recovery applications.

Carboxen® 1034 has a high surface area. It is designed to provide a basic and very hydrophilic surface, ideal for purification and recovery applications.

Carbon Molecular Sieve (CMS) Adsorbents

A carbon molecular sieve (CMS) is the porous carbon skeletal framework that remains after pyrolysis of a polymeric precursor.

Carboxen® - Carbon Molecular Sieve (CMS) Adsorbents

Sample sizes available to purchase for evaluation

Product Name	Pack Size	Product Code
Carboxen® 563	10 g	10263
Carboxen® 564	10 g	10264
Carboxen® 564	144 ampules of 290mg each	11324-U
Carboxen® 569	10 g	10269
Carboxen® 569	500 g	11048-U
Carboxen® 572	10 g	11072-U
Carboxen® 1005	5 g	8849-U
Carboxen® 1032	5 g	8858-U
Carboxen® 1033	5 g	8859-U
Carboxen® 1034	5 g	8861-U

Contact one of our experts at Supelco_Quotes_SIAL@milliporesigma.com for more information on larger quantities or custom containers



Carbon Adsorbent Sampler Kits

Choosing the right adsorbent or combination of adsorbents can be a challenge. Let us help you in selecting the appropriate adsorbent based on your specific application.

We offer a small samples (g) for evaluation. In addition, we also offer several convenient sampler kits, allowing a cost-effective evaluation of several of our specialty carbon adsorbents.

Description	Product Code
Carbon Adsorbent Sampler Kit	13369-U

Custom Capabilities

All our specialty carbon adsorbents are developed and manufactured at our facility in Bellefonte, Pennsylvania (USA).

Our capacity levels and extensive knowledge allow us the possibility to offer:

- Filling of containers to provide finished goods (air sampling devices, SPE tubes, purge traps, etc.) which contain specialty carbon adsorbent
- Different package sizes of a stock adsorbent
- Different mesh size for an existing adsorbent
- A new adsorbent – designed to meet your specific needs.

Our R&D group can investigate:

- Target physical specifications (surface area, porosity, pore diameter, particle size range, etc.)
- The need to perform a specific task (variables such as liquid or gas sample, what you want to remove, or need to recover)

Contact one of our carbon experts at
Supelco_Quotes_SIAL@milliporesigma.com
for more information or quote.

Supelco®

Analytical Products

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To place an order or receive technical assistance

Order/Customer Service: **SigmaAldrich.com/order**

Technical Service: **SigmaAldrich.com/techservice**

Safety-related Information: **SigmaAldrich.com/safetycenter**

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