

# Activated carbon classifications properties and applications chemical enginee

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Activated Carbon: Properties, Types, and Applications\*\*

### Introduction to Activated Carbon

Activated carbon is a highly porous material derived from various sources, such as wood, coal, and coconut shells. It possesses remarkable adsorption capabilities and is widely used in various industrial, environmental, and medical applications.

### Classification of Activated Carbon

Activated carbon can be classified based on:

- **Raw Material:** Natural (wood, coconut shells) or synthetic (petrochemical-based)
- **Activation Method:** Chemical (using chemicals like phosphoric acid) or physical (using steam)
- **Shape and Size:** Granular, powdered, or monolithic

### Properties of Activated Carbon

The key properties of activated carbon include:

- High surface area (up to 2,600 m<sup>2</sup>/g)
- Extensive internal porosity (micropores, mesopores, and macropores)
- Ability to adsorb a wide range of molecules (gases, liquids, and solids)

- Excellent chemical stability and inertness
- Good thermal conductivity

### **Chemistry of Activated Carbon**

Activated carbon is primarily composed of carbon atoms arranged in a hexagonal lattice structure. The surface of activated carbon is highly reactive due to the presence of oxygen-containing functional groups, such as carboxylic acid (-COOH), hydroxyl (-OH), and carbonyl (-C=O) groups. These functional groups enhance the adsorption capacity and selectivity of activated carbon.

### **Applications of Activated Carbon**

Activated carbon finds numerous applications in various industries, including:

- Water and wastewater treatment (adsorption of contaminants)
- Air purification (removal of pollutants and odors)
- Food and beverage industry (decolorization, taste and odor improvement)
- Pharmaceutical industry (drug delivery systems, adsorbents in chromatography)
- Medical applications (wound dressing, poison control)

### **Methods of Activated Carbon Manufacture**

Activated carbon can be manufactured by:

- **Chemical Activation:** Treatment with chemicals like phosphoric acid or zinc chloride
- **Physical Activation:** Pyrolysis followed by steam or carbon dioxide activation

### **Benefits of Activated Carbon**

- High adsorption capacity and efficiency
- Wide range of adsorption capabilities
- Regenerable and reusable

- Cost-effective compared to other adsorbents
- Environmentally friendly and sustainable

## Characterization Techniques

The properties and performance of activated carbon can be characterized using techniques such as:

- Surface area analysis (BET)
- Pore size distribution (BJH)
- X-ray diffraction (XRD)
- Scanning electron microscopy (SEM)

## Supplier of Activated Carbon

Several suppliers offer activated carbon for various applications. It is important to select a reputable supplier with expertise and quality control measures in place.

## Classification of Carbon C

Carbon (C) is classified as a member of:

- Group 14 (carbon group) of the periodic table
- Tetrels (elements with four valence electrons)
- Pnictogens (elements that can form five covalent bonds)

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