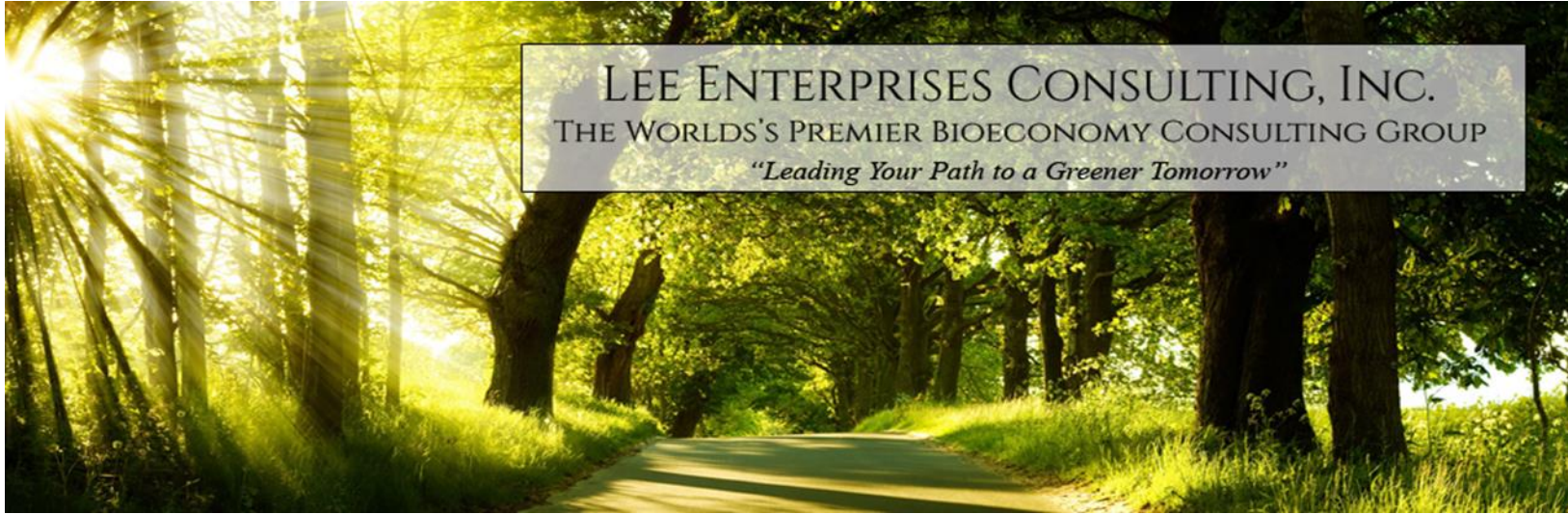


# Biochar vs. Activated Carbon

William F. Naylor



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THE WORLD'S PREMIER BIOECONOMY CONSULTING GROUP  
*"Leading Your Path to a Greener Tomorrow"*

**Expertise: World's largest bioeconomy consulting group - over 100 subject matter experts (SME's)- all areas of the bioeconomy.**

**Approach: Project interdisciplinary teams to meet exact needs of specific projects.**

**POC: Handle projects with one agreement and single point of contact.**

**Cost Advantage: Single POC = lower administrative costs = lower project cost.**



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# Biochar or Activated Carbon?

- ▶ **Similarities & Differences between Biochar and Activated Carbon**
- ▶ **Markets / Applications**
- ▶ **Advantages of Biochar**
- ▶ **Suggestions for Biochar Manufacturers**

# Similarities of Biochar and Activated Carbon

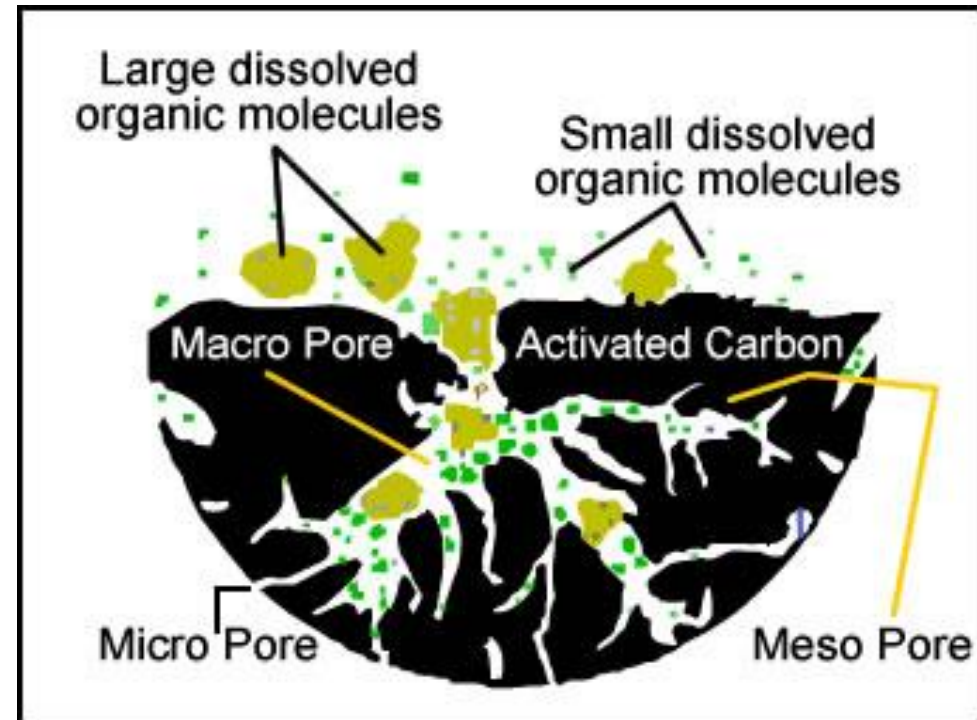
- ▶ Carbon-based porous material
- ▶ A purification media (liquid and gas)
- ▶ The active agent in a separation process

**Biochar raw material:**

- ▶ Cellulose biomass

**Activated carbon raw materials:**

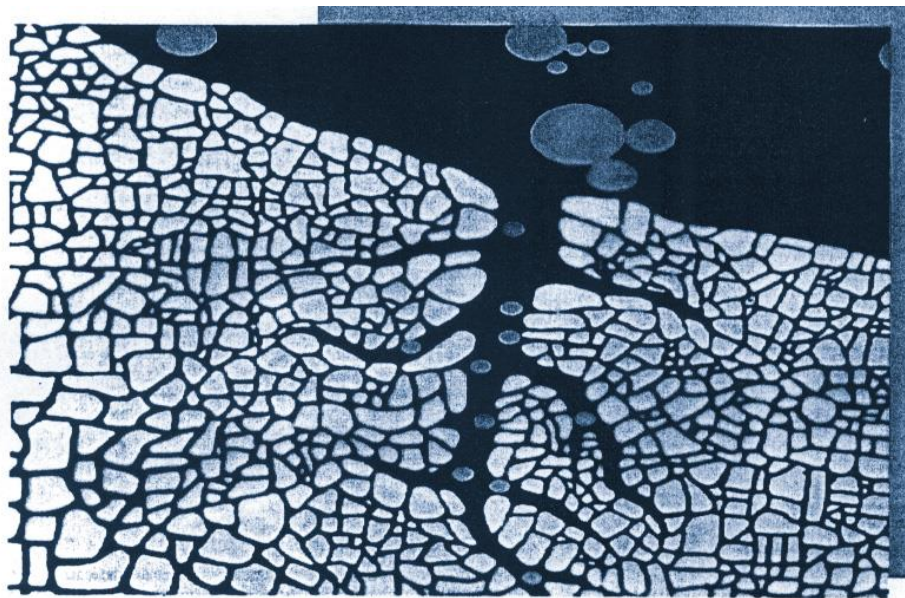
- ▶ Primarily bituminous and lignite coal





# Biochar and Activated Carbon Comparison

Analysis	Biochar	Activated Carbon
Iodine Number	500-600	500-1000+
Pore Size	Macro- and Mesoporous	Macro-, Meso-, and Microporous depending on raw material
Density (Lbs/Ft3)	5-7	22-28
Ash	10% max	10-25% Coal 10% Coconut



**Micropores:**  
<2nm

**Mesopores:**  
2-50nm

**Macropores:**  
>50nm

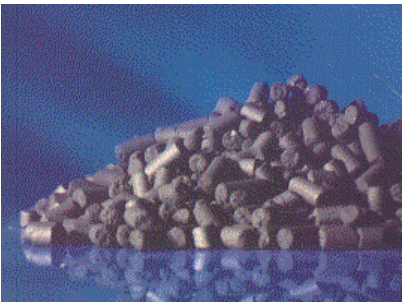
# Forms of Biochar and Activated Carbon



- ▶ **Powdered (PAC) - 100% Less Than 180 Microns**



- ▶ **Granular (GAC) – US Std. Mesh Sizes**



- ▶ **Extruded – Pellets in Mm Diameter Sizes**

# Examples of Applications for Biochar

- ▶ **Wastewater / Produced water / Remediation**
  - Toxicity reduction – landfill leachate
  - PACT process (addition to aeration basin)
  - Oil and gas
- ▶ **Odor control – Hydrogen Sulfide** (may require post processing)
  - Wastewater plants
  - Oil and gas companies
  - Asphalt plants
- ▶ **Groundwater**
  - Arsenic As(III)/As(V)
  - Nucleotide / Uranium
- ▶ **Watershed protection and potable water treatment**
  - Pesticides/herbicides / Agricultural runoff (atrazine, etc.)
- ▶ **Aquariums / Aquaculture**
  - Organic pollutants (Fish food, waste, color, etc.)
  - Ammonium

# Advantages of Biochar

- ▶ **Good porosity = faster adsorption**
- ▶ **High purity / low ash**
- ▶ **Lower density = lower cost on volumetric basis**
- ▶ **Metal adsorption is superior in certain conditions**
- ▶ **Well suited for biological systems, i.e., high COD reduction**
- ▶ **Can be certified 'Organic', i.e., CDFA, etc.**
- ▶ **Renewable and sustainable raw material**
- ▶ **High cation exchange capacity (CEC)**





# Suggestions for Biochar producers

- ▶ **Continuous production**
- ▶ **Reliable raw material**
- ▶ **Consistent quality**
- ▶ **AC properties testing**
- ▶ **Patience**
  - Gain customer interest – Green technology, etc.
  - Benefits – economics, performance
  - Testing and evaluation – typically months
  - Acceptance



# William F. Naylor

**Activated Carbon / Biomass**

**Accredited Member**



LEE ENTERPRISES  
CONSULTING, INC.

**Over 25 years of experience in working with environmental protection technologies having established expertise in activated carbon for water and gas phase systems**

**Consulting services to biochar and activated carbon manufacturers and investors both in the US and internationally**

**Advisor to the EPA and former Chair of the AWWA Activated Carbon Standards Committee.**



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