Biochar Science

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Biochar Now biochar electron microscope images

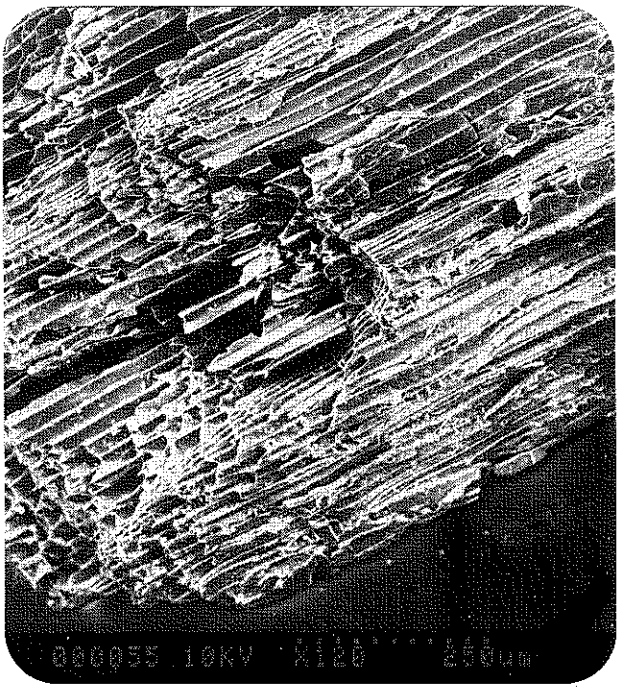


Fig 1 - BN biochar at 120x magnification

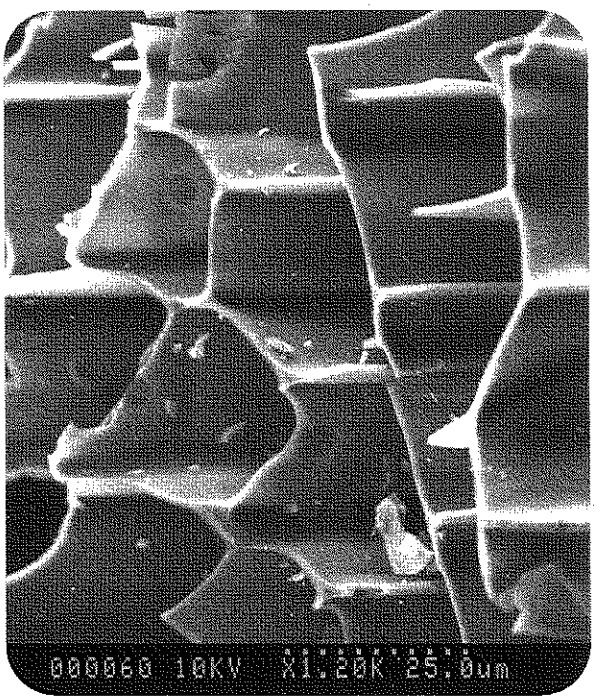
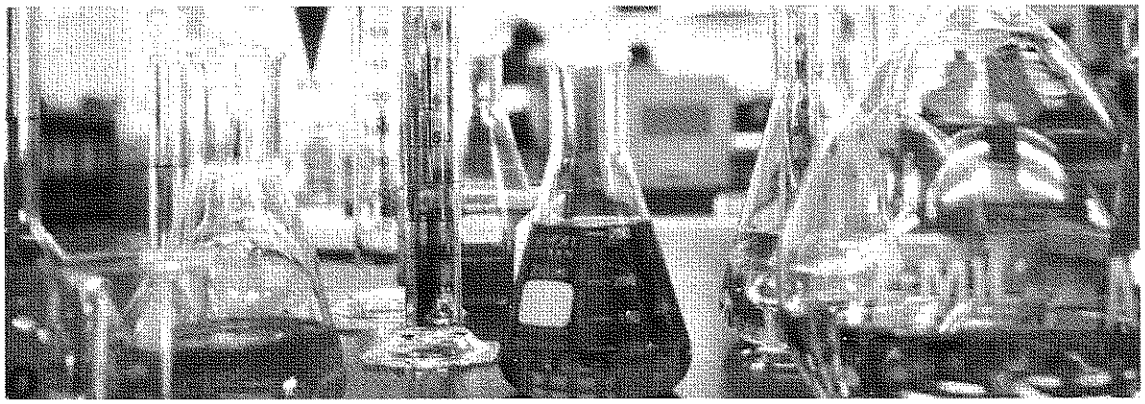


Fig 2 - BN biochar at 1200x magnification

Major Properties of BN biochar

1. Biochar's long pores provide significant surface area. As a matter of fact, 1 gram of BN biochar has a surface area of about 400m^2.
2. Biochar has a cation exchange capacity that electrostatically attracts certain types of molecules including Nitrogen and Phosphorus nutrients from the soil, air and water. The molecules are lightly bonded to the biochar walls where roots can access them during the entire growing season. The biochar becomes a nutrient-rich, time-release capsule for plants and it's a major reason why biochar is so effective at enhancing plant growth.
3. Biochar has been tested for water sequestration and found to hold 5.6 times its weight in water. And, with pores that are very long compared with their openings, there is very little evaporation (see fig 1). When roots do not consume the sequestered water, it is held in the biochar for long periods of time.
4. To soil microbes, the cleaned out biochar pores look like concrete condominiums (see fig 2) so they move in to set up community. Once embedded, they are protected from precipitation that would otherwise disperse them. With biochar, microbes flourish and create living soil.

Biochar Now Biochar Third Party Test Results



Removing Metals From Water and Soils

Biochar Now commissioned extensive third party testing for its biochar. Below are the sequestration results of several metals including some that are highly toxic. Due to its cation exchange capacity, the biochar removal rates are often exceptional.

Interestingly, once toxic substances are attracted and bonded to the pore walls, they are considered to be encapsulated and will not leave on their own or even with plant root activity.

Metals and Other Materials Removed from "Dirty Water Solutions" Using Biochar Now biochar [Independent Test Results]

Metals		Starting mg/L	% Removed
Aluminum	Al	638	100%
Arsenic	As	203	100%
Barium	Ba	0.17	66.0%
Beryllium	Be	0.16	99.0%
Cadmium	Cd	0.015	100%
Chromium	Cr	166	100%
Cobalt	Co	219	100%
Copper	Cu	1.0	99.7%
Iron	Fe	66	99.6%
Lead	Pb	45	100%
Lithium	Li	0.17	39.0%

Magnesium	Mg	3	69.2%
Molybdenum	Mo	96	100%
Nickel	Ni	211	100%
Selenium	Se	215	100%
Tin	Sn	0.17	100%
Vanadium	V	0.15	75.0%
Zinc	Zn	75	99.7%

Table 1 – Metals removal from water

Nutrient Sequestration

Nutrients are an important adsorptive category for biochar. The data is important to know how much can be available for plant growth and at other times for nutrient pollution removal from field runoffs and waterways. As seen below, BN biochar is an excellent performer.

Ag Nutrients Removed from "Dirty Water Solutions" Using Biochar Now biochar [Independent Test Results]			
Nutrients		**Starting mg/L**	**% Adsorbed**
Phosphorus	non-soluble P	27	99.9%
Phosphorus	P	27	99.8%
Phosphate	PO4-P	284	86.6%
Ammonia	N	1.1	89.7%
Nitrate	NO3-N	52	64.3%

Table 2 – Nutrient removal from water

Removing Turbidity and Solids from Water

When BN biochar is loaded in porous bags and placed in nutrient polluted lakes, ponds or rivers, natural currents will flow the water through the bag and biochar. The nutrients are attracted by the biochar's cation exchange capacity but solids, such as those listed below, are not attracted. However, they will be physically and effectively filtered due to the jagged exterior of biochar. (See figure 3 below).

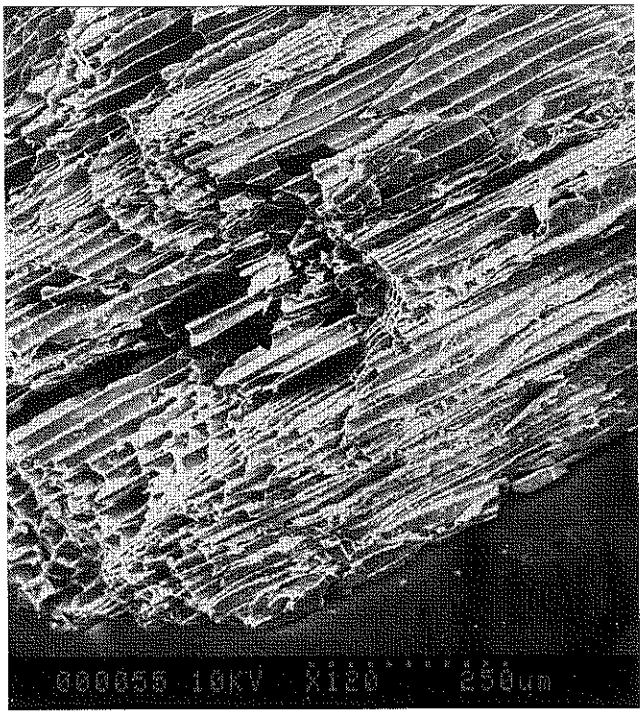


Figure 3 - BN Biochar magnified 120X

Biochar's physical removal of algae blooms (turbidity) and clay (solids) is very high. (See Table 3 below).

Solids Removed from a Dirty Water Solutions Using Biochar Now biochar Independent Test Results			
Solids		**Starting mg/L**	**% Removed**
Turbidity	NTU*	68 NTU	99.9%
Phosphorus	Non-soluble P	27	99.9%
Solids	SS	506	80.2%

Table 3 – solids physically removed from water by biochar

Water Sequestration

Water holding is a very important property of BN biochar because of drought conditions in California and other states. The biochar holds 5.6 times its weight in water and always makes it root-available. Evaporation is negligible due to the long, narrow pores with very small openings at the ends as seen in Figure 3 above.

Water holding capacity = 5.6 x the weight of biochar

Biochar Now, llc – Who We Are

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Who We Are

Biochar Now is a pioneer in the biochar industry with strong engineering, manufacturing, sales and administrative personnel focused on making and selling quality biochar at very large scale.

History

Biochar Now incorporated Nov 2011 with three primary goals:

1. Fully understand biochar's beneficial properties and potential markets
2. Fully understand how to make biochar at very large scale
3. Meet the EPA's production emissions standards

To accomplish these goals, the company turned to existing research, consultants, science and engineering. However, because the industry is so young, there were many questions that could only be answered by Biochar Now's own research and development. The company knows it was worth the investment to have the strong knowledge foundation that it acquired.

Key Management

Bill Beierwaltes, Co-Founder and CEO
Bill's degrees are BSElectrical Engineering, BSMath, and MBA and he started his career at Hewlett Packard during the '60s. He later became a serial entrepreneur having started 6 companies with the largest being Colorado Memory Systems (~$200M/yr). CMS developed and manufactured tape backup systems for the PC market during the 1980/90s. The company had a 65% world market share before it was sold to HP.

James Gaspard, Co-Founder and EVP, Business Development
James's degrees are BSPoliSci, JD and MBA and he started his career in finance. He then moved to the alternative-energy bus industry where he started an electric bus company. Later, he switched fields to develop kiln-based biochar manufacturing technology. Leveraging that knowledge, he and Bill partnered to start Biochar Now with the application of more advanced engineering and scientific principles.

Dave Parks, COO
Dave's degrees are BSChemical Engineering and MBA and he joined Biochar Now after a distinguished career at Praxair where he served as Global Director of new and existing hydrogen manufacturing sites. Earlier at Praxair, he served as Global Processing Improvements Director where he and his team reduced corporate spending by $500M/year through innovation.

Vision

Company Vision

Make and sell high quality biochar at very large scale

Operating vision

Change the world with scalable, cost-effective and portable manufacturing sites