maccy biochar

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BIOCHAR for SCHOOLS – Part 1

Introduction:

Biochar is a form of charcoal and is good for the soil, but unlike charcoal, biochar combats climate change by sequestering carbon.

Biochar has a very porous structure that facilitates water absorption and adsorption of water-borne nutrients.

So when biochar is mixed into the soil it helps the soil retain water and nutrients thereby reducing water consumption and increasing plant yields.

The porous structure of biochar also encourages micro-organisms to reside within the structure thereby facilitating the exchange of nutrients between plants and such organisms.

Making Biochar:

Biochar can most simply be made in an open kiln with sloping sides; a so-called flame-capped kiln. So named because the wood in the kiln is mostly capped by a cover of flames. This flame cap prevents air from reaching the lower layers of wood. Why? Because hot air rises. So only a strong downdraft of air (eg by a blast of cold wind) can go beneath the flames.
So what?
What that means is that the wood below the flame cap does not actually burn (i.e. combust). It simply cooks.
The cooking process starts by boiling off all the moisture (H_2O) in the wood when it reaches the boiling point of water (100 C).

Typical flame-capped kiln for school use

By the time the temperature reaches 200C all the moisture has been driven off and some of the oils in the wood start to volatilise (i.e. evaporate as gases). These gases will include some dangerously poisonous gases such as carbon monoxide (CO) which is colourless and odourless but can kill you if inhaled. Other gases that are emitted by the very hot wood include hydrogen (H_2) and methane (CH_4).

Hence the importance of the flame cap!

The flame cap will burn all these dangerous gases and in burning them will convert them to harmless carbon dioxide (CO_2) and steam (H_2O).

This process of volatilisation continues while the temperature of the wood continues to rise to 300C, 400C, 500C and even to 600C.

When the flames eventually die down to nothing this means that all these dangerous gases have been destroyed.
Then all that remains is the mineral content of the wood and the carbon

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content. The minerals in the wood (such as potassium, silicon, manganese etc) remain as so-called ash. The carbon in the wood remains as simply carbon. This combination of carbon and ash is normally called charcoal. However traditionally charcoal has been used as a fuel (a dangerous fuel – remember why?). But we are not making this char to burn it. We are making it to capture carbon from the atmosphere AND to help enrich the soil. So we call it biochar.

Handling: Biochar can have fairly sharp edges so best to use gloves when handling it. Also keep it damp to avoid it becoming dusty or wear a dust mask when handling it. And never try to burn biochar; carbon monoxide (a deadly gas) will be emitted and the captured carbon will escape and return to the atmosphere.

Enriching biochar:

Remember that raw biochar is NOT a fertiliser. It is a soil enabler. So to get the best results from using biochar with plants it is necessary to enrich the raw biochar with an organic fertiliser Eg. Cow or sheep manure; or urine; or some organic fertiliser from your local hardware store.
Simply soak the raw biochar in a diluted amount of the chosen organic fertiliser for a few days.

Using Biochar:

Potting:
Place a handful of raw biochar (approx. 25% by volume) at the bottom of the pot. Use lump biochar in your large pots; and granules in your smaller pots. Add enriched biochar (5-10% by volume) to the potting soil.

Tree Planting:
Mix enriched biochar (5-10% by volume) with the soil from the hole that you have dug for your tree.

Garden Beds:
Prior to planting out apply a layer of 50% compost-50% enriched biochar to the planting zones and mix into the soil.

Finally: Remember that biochar is primarily made up of pure carbon and ash. The latter is locked up in the biochar (i.e. not loose). Typically the percentage carbon content is in the range 70 to 80%. So for every kilogram of biochar made about 750 grams is carbon that has been extracted from atmospheric carbon dioxide by plant photosynthesis. As carbon dioxide is 3.6 times heavier than carbon then each kilogram of biochar represents about 2.75 kilograms of carbon dioxide removed from the atmosphere.

QUESTIONS:

1. What is the difference between absorption and adsorption?
2. What is the main advantage of a flame-capped kiln for making biochar?
3. What is ash? Why does some remain in the biochar?
4. Why should we not burn biochar?
5. Why is carbon dioxide 3.6 times heavier than carbon?
6. Why is biochar porous?
7. Why do we enrich biochar with organic fertiliser?
8. What is your preferred fertiliser?
9. How would you make biochar?
10. Why is carbon dioxide 3.6 times heavier then carbon?

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