Newsletter – November 2019

Biochar

A profitable way of mitigating global warming

A profitable means to remove CO_2 from the atmosphere

Even if the most ambitious scenarios of global emission reductions of greenhouse gases were implemented between now and 2050, there is still a need for large-scale atmospheric CO_2 removal to prevent overshooting the 1.5°C temperature threshold and keep our Planet habitable. This implies that by then the remaining emissions be compensated by carbon accumulation in the terrestrial system.

In the 2018 IPCC Special Report on Global Warming, biochar is credited as promising negative emission technology for large-scale carbon sequestration (www.ipcc.ch/report/sr15).

Biochar is a soil amendment produced by carbonising unused renewable biomass.

By growing, plants absorb CO_2, producing biomass that contains carbon. Rather than allowing unused plants to decompose and emit CO_2, pyrolysis (heating in oxygen-deprived conditions) converts about half of the carbon into a stable form. Biochar is thus storing carbon in a solid and beneficial form. It also reduces the emissions of other greenhouse gases, including methane and nitrous oxide.

Sustainable biochar systems are carbon negative by transforming the carbon in biomass into stable structures which remains sequestered in soils for hundreds and even thousands of years. It is resulting a net reduction of CO_2 in the atmosphere and biochar is creating a carbon sink.

According to a prominent scientific study, it is estimated that at least 12% of the greenhouse gas emissions from human activity could be offset on an annual basis by sustainable biochar implementation, with 1 tonne of biochar being equivalent to 2.7 tonnes of CO_2 (Woolf et al., Sustainable global biochar to mitigate climate change, Nature Communications, 2010). In total, more than 10,000 scientific papers have been published on biochar over the past 12 years.

Biochar is all the more interesting because it is profitable. Pro-Natura has worked over the past 12 years developing biochar in Africa and the Internal Rate of Return of that type of investment is above 25%.

Ensuring food security while fighting land degradation and desertification

Biochar is also offering major agricultural benefits and has been called the ***Third Green Revolution***. When used in fine particle form, it can be applied to different soil types across a variety of climatic conditions. The poorer the soils, the more spectacular its effect. Biochar is especially effective in Africa where for example, it helps grow vegetables in desert conditions.

Our experience under different climates has shown that a single application, between 5 to 10 tonnes per hectare, **increases crop productivity from 50% to 200%**. Just one application provides and maintains long-lasting soil fertility benefits that enhance carbon sequestration.

Beyond the carbon sequestered in the biochar itself, biochar incorporated in soils also offers numerous other potential benefits:

Rice without vs rice with biochar (Senegal)

- **Soil fertility:** Biochar can improve soil fertility, stimulating plant growth, which then consumes more CO_2 in a positive feedback effect. It enhances the soil biological activity, increases the pH of acidic soils, improves nutrient and water retention in soils, increases organic matter.
- **Reduced emissions from feedstocks:** Converting agricultural and forestry waste into biochar can avoid CO_2 and methane (CH_4) emissions otherwise generated by natural decomposition or burning the waste.
- **Reduced fertilizer inputs:** Biochar can reduce the need for chemical fertilizers, resulting in reduced emissions of greenhouse gases from fertilizer manufacture.
- **Reduced N_2O and CH_4 emissions:** Biochar can reduce emissions of nitrous oxide (N_2O) and CH_4 –two potent greenhouse gases– from agricultural soils.
- **Renewable energy generation:** The heat energy generated during biochar production can be used to displace carbon positive energy from fossil fuels.
- **Effect on animal wellbeing, emission reductions & productivity:** At present most biochar used in Europe goes into animal farming. The use of biochar as a feed additive has the potential to improve animal health, feed efficiency, to reduce nutrient losses, CH_4 emissions, and to increase the soil organic matter.

Most biochar-related activity is linked to the **International Biochar Initiative (IBI)**, an institution based in the US (visit: www.biochar-international.org). IBI provides a platform for fostering stakeholder collaboration, good industry practices, and environmental and ethical standards to support biochar systems that are safe and economically viable.

Pro-Natura 1st Prize for technological innovation from Altran Foundation for biochar and renewable electricity co-generation

Pro-Natura has pioneered the development of biochar in Africa. The innovation, which justified the award, consists in recovering unused agricultural residues or other types of renewable biomass that cannot be used in another way, in order to carbonise them by continuous pyrolysis. For example, wheat and rice straw, cotton stems, corn stalks, rice and coffee husks, can be used to make biochar. Wood residues can also be carbonised with a yield about 3 times higher than conventional processes.

The technology, called CarboChar, can produce between 1 to 10 tonnes of biochar per day depending on the size of the machine.

CarboChar-1

This innovation, designed by Eng. Rachid Hadibi, is based on the use of a heated retort at 550°C through which the biomass flows in the absence of oxygen. The temperature of the retort is kept constant by the combustion of the pyrolysis gases which are recycled and burned in a post combustion chamber, thus avoiding the emission of greenhouse gases. Once the machine is preheated, the process produces its own thermal energy.

Feeding the biomass, obtained by a small electric motor of low consumption, finally constitutes the only external energy demand of the system. This process is therefore virtually autonomous in terms of energy and its yield (weight of green coal produced relative to the weight of the biomass at 15% humidity) reaches 35% to 45% depending on the type of biomass. In addition to the benefits of the retort carbonisation process, the operating cost of the reactor is reduced by continuous production.

CarboChar-3 can also co-generate electricity. It produces 1MW of sustainable heat that can be converted into electricity with an ORC (Organic Rankine Cycle) technology transforming thermal energy into mechanical energy and finally into electricity through an electrical generator.

Example of ORC made by Enertime

An important IBI and Pro-Natura delegation will be attending the COP25 relocated in Madrid

Members of the IBI Board present: Prof. Johannes Lehmann, Prof. Claudia Kammann, Prof. Genxing Pan, Ms. Kathleen Draper, Ms. Lucia Brusegan, Mr. David Wayne, and Mr. Guy Reinaud.

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