Department of Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

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Biochar Factsheet

What is Biochar?

Biochar is a stable, carbon-rich, charcoal-like product made by heating biomass in an oxygen-limited environment. Modern biochar is produced during a process called pyrolysis either as the primary product or as a byproduct of energy or biofuel production.

The type of biomass feedstock used to make biochar significantly impacts the variability of the biochar, while the pyrolysis temperature is the main parameter affecting the characteristics of the biochar end product.

Generally, the optimum pyrolysis temperature range for producing biochar is between 500^0C and 800^0C. The pyrolysis temperature alters the biochar's physicochemical characteristics such as carbon content, pH, ash content, adsorption capacity and pore volume. The end uses for biochar are related to these quality parameters of the product.

Applications

Biochar has potential applications in agriculture as a soil amendment and as a feed additive to reduce enteric emissions in livestock. Some studies[1] have found that adding biochar into soils can increase the water holding capacity of sandy soils, enhance plant-available water, improve cation exchange capacity (CEC) and provide a substrate for microbe persistence and survival. As a feed additive, there is evidence that biochar supplements may decrease enteric methane production in ruminant livestock, but more research is required.

Biochar can have properties which make it suitable for environmental remediation of mine wastes and contaminated agricultural soils as it can adsorb pollutants. It is also used in wastewater treatment and can be used to manufacture activated carbon products for a range of purposes.

Markets are emerging in the heavy industry sector for biochar as a sustainable source of graphene for renewable energy technologies and as a replacement for industrial carbon for mineral processing and green steel manufacturing (metallurgical char) [2].

Biochar production is recognised by the United Nations' Intergovernmental Panel on Climate Change (IPCC) as a carbon dioxide (CO2) removal method. Currently there is no method under the Australian

[1] Singh & Cowie, 2010. Characterisation and evaluation of biochars for their application as soil amendment

[2] Safarian, 2024. To what extent could biochar replace coal and coke in steel industries?

government's ACCU Scheme to generate carbon credits for biochar production, however Western Australian projects are registering on the puro.earth platform to generate CO_2 Reduction Certificates (CORCs) they can sell into the international voluntary market.

The puro.earth methodology requires projects to meet strict sustainability criteria for feedstock, provide a full lifecycle analysis on the biochar production value chain, provide evidence of the biochar's stability and the biochar must be used in applications that preserve its carbon storage property e.g. soil additive, animal feed additive, wastewater treatment.

It is important to note that any use of biochar which involves combustion or oxidation, such as in mineral processing or steelmaking, does not provide CO2 removal from the atmosphere, importantly however it can still reduce new emissions where fossil fuels are displaced/avoided by its use.

Technology Pathways

The main technologies employed for biochar production are fast pyrolysis and slow pyrolysis. Fast pyrolysis and slow pyrolysis differ in the heating rate, reaction time, and main product.

Fast pyrolysis has a high heating rate, and a short reaction time and reactors are designed mainly for bio-oil production as the precursor for advanced biofuels. Biochar is obtained as a byproduct or can be combusted together with the pyrolysis gases to sustain the thermal energy required for the process.

Slow pyrolysis has a low heating rate and a long reaction time and is employed to maximise biochar yield.

Microwave pyrolysis (MWP) is an emerging technology with significant efficiency gains.

Drivers and Opportunities

The production of biochar provides a sustainable opportunity to convert underutilised or waste biomass resources into valuable carbon products. Applying circular economy principles to the production and utilisation of biochar offers short to long-term decarbonisation tools for the agriculture and heavy industry sectors.

Recent estimates indicate that biochar could mitigate up to 6.6 billion tonnes of CO_2 globally per year by 2050[3].

There is currently no large-scale commercial supply of biochar in Western Australia. A few small businesses in Western Australia produce biochar as a value-add to a crop processing waste stream e.g. nutshell waste or post-distillation waste. Generating carbon credits from the biochar production significantly improves project economics.

For advanced biofuel projects with biochar as a byproduct, financial viability is increased when the biochar is considered as another revenue stream.

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[3] IPCC 6th Assessment Report, March 2022