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Biochar Industry Risk Assessment

Downie, A[a] *; Munroe, P[b]; Cowie, A[c]; Van Zwieten, L[d]; Lau, DMS[b]

[a]School of Materials Science and Engineering, University of New South Wales, Sydney, NSW 2052, Australia; [b]Pacific Pyrolysis Pty Ltd. 56 Gindurra Road, Somersby, NSW, Australia 2250 ; [c]National Centre for Rural Greenhouse Gas Research, University of New England, Armidale, NSW, Australia 2351;
[d]Industry and Investment NSW, 1243 Bruxner Highway, Wollongbar NSW, Australia 2477.
*E-mail: Adriana.downie@pacificpyrolysis.com

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Introduction

Biochar technology has been identified as a geo-engineering solution that has potential to actively reduce the atmospheric concentrations of greenhouse gases and enhance the sustainability of agriculture. However, the risk and reward profile associated with implementing various forms of the technology needs to be assessed and communicated to the global community as industry moves toward commercialisation. The magnitude of the technology's net benefit is only relevant when considered in the context of its associated risks. Measures must be applied to manage identified risks, to ensure the sustainability and viability of the emerging biochar industry.

Hazards associated with biochar technology must first be identified in order for their severity and probability to be quantified, so that the scale of the risks they pose, and therefore the level of management and regulation required to mitigate these risks, can be determined. Mitigation of the risks identified is achieved through the introduction of a barrier that prevents the hazard causing an incident of harm. The barrier may be direct, such as the physical installation of air pollution control equipment or safety guards, or indirect, such as regulation dictating eligible biomass sources.

The discussion is intended to identify key considerations that should be included by researchers conducting lifecycle assessments (LCAs) of biochars, and industry participants undertaking biochar project risk assessments. This paper will initiate discussion for policy makers who are seeking to develop appropriate standards, and certification schemes to oversee and direct the implementation of biochar systems both at local and international levels. The aspects identified in this assessment will provide guidance for legislative frameworks so that they may provide effective coverage of biochar. It may also prove useful for those designing accreditation requirements for carbon offset schemes (voluntary or regulated) under which biochar offsets will be offered as a quality-assured product.

Results and Discussions

The biochar concept, for the purpose of this risk assessment investigation, has been divided into three key stages: biomass feedstock sourcing, conversion technology, and biochar product utilisation. Analysis of the risk assessment strategies that can be applied to each of these stages will be discussed with a focus on identifying the possible risks presented and reviewing management methods that may be effective at mitigating these risks.

Biomass feedstock sourcing for biochar projects should consider the risks posed by non-sustainable and competing uses of biomass. There is a risk that the biomass required for biochar production will not be sourced in a sustainable way, leading to negative environmental, social and economic consequences. It is essential that the complete process chain of the biomass, including the production, harvest, transport, pre-processing, in comparison with alternate uses, be considered in order to assess the true net benefit of the biochar pathway.

Pyrolysis feedstocks may contain contaminants, such as chemical and biological pollutants, that pose environmental and/or health risks. Municipal wastes are examples of biomass resources that exhibit contaminant risk. To mitigate the risks associated with feedstock contamination it is recommended that sources of potential contaminants be identified and analysis procedures established as an industry standard.

The assessment of conversion technology considers engineering controls, regulatory controls, energy efficiency and emissions. Process engineering principles are used in the design and operational optimization of industrial

biochar production facilities. These principles employ several industry standard methods to identify and manage the technical, environmental, health and safety risks posed. The risks posed by elevated temperatures (e.g. hot surfaces and exhausts), mechanical moving parts, vehicle movements, the generation of gases with significant explosion potential, etc. pose human workplace health and safety concerns. These can, and should, be addressed through engineering controls.

Regulatory controls are a proven mechanism for risk mitigation in process industries.

Technology being implemented, especially if it is at a commercial scale (i.e. not home use applications which process typically < 5t biomass/day), will be required to meet the relevant local jurisdiction's planning, consenting, and licensing requirements. Assurance challenges arise when developing biochar technologies fall outside of existing regulatory mechanisms. This may occur with small, mobile operations, which may fall below the threshold for coverage set by regulatory authorities. Alternatively this may occur, with larger operations in countries where environmental regulations are not legislated or are not enforced.

Biochar utilization risk assessment considers storage, transport and handling issues along with the implications of using biochar as a soil amendment. An assessment of whether the biochar product is suitable for use as a soil additive and poses no environmental or economic (through loss of production) risks requires analysis on a case-by-case basis. The range of biochar properties, especially contaminant levels, mean that some are well suited to grow plants for human consumption, whereas others are only suitable for use in forestry or mine rehabilitation applications.

Where product is unsuitable for land application, for example due to heavy metal contamination, landfilling may be the best way to sequester biochar carbon while minimising risk of environmental harm.

It is recommended that the biochar industry establish quality control guidelines outlining rigorous monitoring of all elements identified as posing a risk. A certification mechanism may also be implemented by the industry to provide confidence to consumers that such risks have been adequately mitigated, and that the product can be used without concern.

Conclusions

Effective risk assessment processes should ensure that biochar technology has a positive impact on the environment, with direct social and economic benefits. To ensure the ongoing sustainability and viability of an emerging biochar industry a fully informed and debated review of risks and rewards should be encouraged.

The use of biochar for environmental management is a growing area of scientific and commercial interest. International cooperation, regulations, certification and accreditation mechanisms must be utilised to manage risks of negative environmental and social impacts from biochar production and use.

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