



Contents lists available at ScienceDirect

Biomass and Bioenergy

journal homepage: <http://www.elsevier.com/locate/biombioe>

Review

Chemically treated microwave-derived biochar: An overview

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ARTICLE INFO

Article history:

Received 1 December 2016
 Received in revised form
 20 July 2017
 Accepted 7 August 2017
 Available online xxx

Keywords:

Biochar
 Black carbon
 Adsorbent
 Microwave carbonisation
 Pyrolysis

ABSTRACT

Biochar, a carbon-rich material, can be produced *via* microwave pyrolysis, as a more energy and cost saving method compared to conventional externally heated pyrolysis. Biochar has versatile applications, for example, for soil amendment purpose and pollutant removal from wastewater. Chemical treatment has been proven to improve the physical and chemical properties of biochar for better applicability. Thus, extensive amount of research has been conducted on chemical treatment of conventional biochar, and several review articles have discussed published works on the chemically treated conventional biochar. However, there has been no review on works involving the chemically treated microwave-derived biochar, by far. This paper presents an overview of the current development and improvement on chemical treatment methods and applications of microwave-derived biochar.

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1. Introduction

Biochar is a light and highly porous carbonaceous material derived from biomass thermochemical decomposition [1]. In the past decade, there is an increasing attention in biochar-related research due to its versatile applications. There are several types of biochar production methods, such as pyrolysis, carbonisation, and gasification. Conventional biochar production is normally *via* externally heated pyrolysis, carbonisation, or gasification. In most

cases, pyrolysis kilns are indirectly fired with syngas generated by the pyrolysis or by external gas sources or by biomass combustion [2].

Biochar can alternatively be produced *via* microwave assisted pyrolysis, carbonisation or gasification, as a more energy and cost saving method compared to the conventional externally heated pyrolysis, carbonisation or gasification. Microwave offers some advantages such as rapid, uniform and selective heating of biochar *via* microwave radiation. The method involves no direct contact between microwave source and biomass, which is unattainable by conventional carbonisation. Some studies has also found that microwave-derived biochar has better physical characteristics, such as in terms of porosity [3,4] and surface area [5], compared to the

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