

International Congress and Expo on **Biofuels & Bioenergy**

August 25-27, 2015 Valencia, Spain

Bioenergy produced from plant waste

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Direct carbon fuel cell (DCFC) is a type of fuel cell which produces electricity through electrochemical oxidation of solid carbon into carbon dioxide, without involving combustion reaction. The most promising advantage of DCFC is its remarkably high theoretical efficiency in converting chemical energy into electricity which is close to 100%. Its overall system efficiency taking into account of auxiliary losses is in the range of 60-70%, as compared to less than 40% for a Carnot Cycle. In this work, palm waste was tested as a sustainable carbon source for DCFC while carbon black was used as a reference for comparison. Palm shell was pyrolyzed at different temperatures (400, 600, 800 and 1000 °C) to produce palm shell biochar. Analytical techniques including XRD, microporous CO₂ adsorption, proximate and ultimate analyses were employed to characterize the palm shell biochar. The electrochemical performance of all samples in DCFC was also evaluated. The results showed that palm shell pyrolyzed at 600 °C yielded the highest power density, almost 19 folds of that achieved by carbon black. This superior performance was attributed to its abundance of carbon available as fuel source, and large numbers of active sites available for the electrochemical reaction.

Biography

Siek-Ting Yong obtained her PhD degree in Chemical Engineering from the National University of Singapore. She is a senior Lecturer in Monash University Malaysia Campus. Her research interests include fuel reforming, direct carbon fuel cell, carbon capture, and membrane separation.

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