

## A research into the microbial hydrolysis and bioconversion of coal

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### Abstract

**Background and Research Problem:** Coal is an abundant and economical feedstock for the production of energy globally. In Australia, coal is mined primarily in Queensland, New South Wales and Victoria. The predominant use for coal is to generate electricity, with the 430.9 million tonnes of coal mined 2013/14; 375.1 million tonnes was exported to Asia (Australian Office of the Chief Economist, 2015). In 2013, Australia was the world's fifth-largest coal producer, after China, the United States, India, and Indonesia (WCA, 2014). Victoria hosts 430 billion tonnes of brown coal, representing a significant proportion of the world's brown coal resource. Burning coal for fuel is economically important worldwide, but decades of production and emission of Green House Gases such as CO<sub>2</sub> and CH<sub>4</sub> have contributed to Climate change. The research at QUT focuses on cleaner alternative methods for the conversion of feedstocks such as lignocellulosics and coal to energy. Emphasis for this research is on understanding the complex bioreactions during microbial hydrolysis of coal, in order to design more cost-effective bioconversion processes for different coal types from different parts of Australia.

**Methodology:** Different coal types (eg. Brown, Black and Shale) were treated with microbial consortia using Batch and Fed Batch controlled conditions, with gas samples removed and analyzed using gas chromatography. Different samples of microbial consortia were tested, for their contribution during the bioconversion reactions.

**Findings:** So far, up to 30 % CH<sub>4</sub> and 60% CO<sub>2</sub> have been generated over a period of 5-10 days, with a mass reduction of around 35% (Figure 1). Identifications of different microbial consortia have been achieved, with the genus *Bacillus* and *Lysinibacillus* found important during the production of CH<sub>4</sub>.

**Conclusion & Significance:** Microbial bioconversion of coal to bioproducts such as biogases offer a cleaner alternative for energy production, but importantly, more cost effective bioprocess designs are needed that relies on a critical fundamental understanding and subsequent application of the microbial activities.

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### Biography

Junior Te'o employed at Queensland University of Technology has extensive experience in microbial biotechnological bioprocess applications such as bioremediation, and biofuel production from different feedstocks such as lignocellulosics, coal and shale, under

controlled fermentation conditions. He also has experience in microbial strain improvement, enzyme production and fermentation bioprocess method development and optimization from laboratory scale (1-20L) to industry scale, > 1000L.