SUPERGEN Bioenergy Hub

1.9 Bio-oil Upgrading

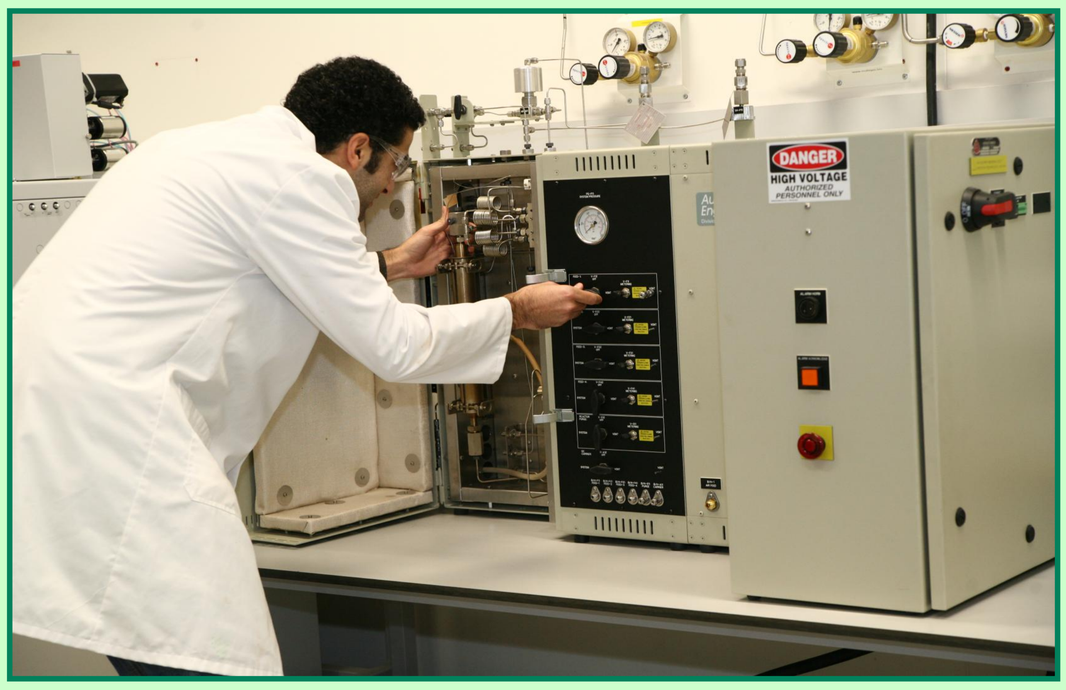
Objectives

To identify the minimum deoxygenation level required to upgrade fast pyrolysis oil so that it is miscible with a refinery input stream.

Background

There is much interest in upgrading bio-oil either catalytically through integration and/or close coupling with a zeolite based catalyst acting on fast pyrolysis vapours; or by hydrodeoxygenation of the liquid using hydrotreating technology and recently red mud from the titania and bauxite industries has given interesting results.

An interesting and poorly explored approach is partial upgrading to either improve stability for direct use in heat and power applications so that conventional engines, turbines and boilers can be used with minimal modification; or to upgrade sufficiently so that product can be safely fed to a conventional refinery to exploit the economies of scale and expertise available to complete the upgrading and produce a completely compatible biofuel.



Continuous pressurised upgrading unit for hydro-deoxygenation (above)

Continuous fast pyrolysis laboratory unit (left)

Method

The research will explore different methods of oxygen removal from fast pyrolysis vapours and liquids to identify the minimum level of deoxygenation required to produce a liquid that is miscible with a suitable refinery stream. Two main methods will be evaluated:

- Hydrodeoxygenation using conventional and novel catalyst systems. This gives alkanes for refining to diesel and kerosene.
- Cracking and shape selection using zeolites. This give predominantly aromatics and olefins which also have applications as aromatic chemicals, one of the largest commodity chemicals sectors.

In addition some of the new and recently developed upgrading methods will be assessed.

Output data will be used to provide input to the modelling in Task 1.10.

Partners

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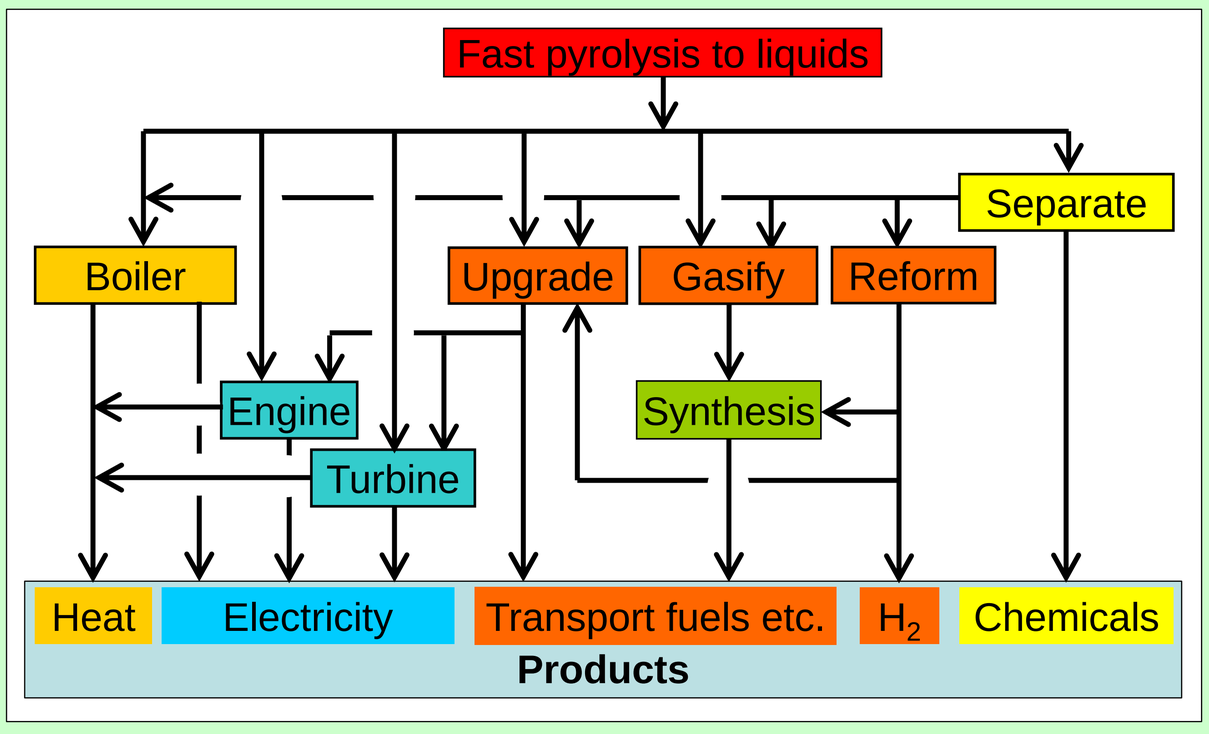

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