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ABSTRACTS

on

PYROLYSIS & LIQUEFACTION

BIODEGRADABILITY OF FAST PYROLYSIS OILS

J. Blin, P. Girard, G. Volle
CIRAD-Forêt, TA 10/16, 73, avenue J.-F. Breton, 34398 Montpellier, Cedex 5, France;
Phone: 33 4 67 61 65 22; Fax: 65 15; E-mail : j.blin@cirad.fr

Fast pyrolysis is a thermo chemical method to provide a liquid with a high heating value named bio-oil. This pyrolysis process occurs under conditions of rapid heating and short reactor residence times of the biomass. The obtained bio-oil can be burned in a diesel engine, a gas turbine or a furnace to produce heat and/or electricity. This liquid is a mixture of a large number of oxygenated organic compounds typically in small percentages, and with a wide range of molecular weights. As this process allows the production of a renewable fuel it has benefited from active research programmes in the last twenty years. With the increasing interest for bio-oils, their safety factors and environmental impacts are utmost significance.

In aerobic conditions, biodegradation is a natural loss process by which organic substances are broken down by micro-organisms to end-products such as carbon dioxide, water, inorganic salts and new microbial cells (‘ultimate’ biodegradation).

Currently, the biodegradability of an oil product is often assessed using a test for so-called ‘ready’ biodegradability. This latter term is applied to a substance that has passed one of the stringent tests for ultimate biodegradability, like those detailed in the OECD 301 Test Guidelines, which are internationally accepted as reference guidelines. These tests were developed to identify substances that would be rapidly and extensively biodegraded in the aquatic environment (freshwater and marine environments), without the formation of persistent and toxic metabolites, and the stringency of the tests lead to good estimation of an oil product's biodegradability.

There is a growing need for information on the environmental fate of bio-oil for the purposes of hazard classification and risk assessment in the event of accidental problems or leaks during transport, storage or their processing.

The goal of this work is to study bio-oil biodegradability in order to provide a basis for the understanding of their environmental impact in case of accidental spillage or release into the environment. This work will provide information on the behaviour to be adopted in case of large quantities of spillage, in order to minimize the impact on nature.

The first step of this study was a bibliographical work about oil biodegradability and discussions with national petroleum institutes in order to identify the most appropriate tests to assess bio-oil biodegradability. Indeed, analyses of bio-oils biodegradability are very difficult due to their low solubility in water and the volatility of some of their components.

The second step was to experiment and to adapt the protocols of the selected tests to measure the biodegradability of three different crude bio-oils and one slow pyrolysis oil.

Finally evolution of this biodegradability has been studied in aqueous solution, in fresh water and seawater. After addition of water on one selected oil, analyses has been performed on the two separated phases (aqueous and organic phases).