



Science in Thermal and Chemical Biomass Conversion

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ABSTRACTS

on

PYROLYSIS & LIQUEFACTION

AN ASSESSMENT OF BIO-OIL TOXICITY FOR SAFE HANDLING AND TRANSPORTATION

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Pyrolysis is one of the three main thermo-chemical routes to convert biomass into useful primary energy products. Fast pyrolysis has benefited from active research programmes since the 1980's in order to obtain bio-oils, which can be used in engines for the generation of electricity or after refining in transport. Today, several demonstration plants are operating in Europe and North America where significant quantities of bio-oils are produced for research and development purposes and several commercial plants are at an advanced stage of planning. Thus, for a commercial development the question of safety procedures for human health and environment preservation is raised.

The aim of this ongoing European Project (Biotox) is to comprehensively assess toxicity and eco-toxicity of a representative bio-oil after preliminary screening of a wide range of bio-oils from different processes and temperatures in order to:

- identify the best operating conditions avoiding or minimising the formation of toxic products from the composition of the bio-oils,
- produce a comprehensive and definitive MSDS with the proper preventive and remedial procedures to adopt during production, transport and use of bio-oils,
- produce fast pyrolysis bio-oils with low impact on human health and environment by avoiding bio-oils production presenting potential toxic characteristics.

In the project, the relation between process parameters on one hand and chemical composition and toxicity for human health and environment on the other hand will be investigated so as to recommend the operating conditions to produce bio-oils with the lowest impacts. Then, the optimised compositions of bio-oils will be submitted to the mandatory tests required by the EU legal authority, the objective being the definition of secure handling and storage procedures, in order to control the risks related to the product for the population and the environment.

The effects of different types of exposure (inhalation, ingestion or skin contact) will be quantified, as well as the effects of long-term exposures. The impacts on the environment will also be evaluated for biodegradability and effects on bio-organisms. A MSDS safety procedure and guidelines for bio-oils use and transport will be published in order to allow oil producers to legally market and transport on the European market.

Bio-oils have been produced from different reactors (fluid bed, rotating cone, circulating fluid bed, ablative pyrolysis, vacuum pyrolysis), under different temperature conditions (450 to 600°C), and from different biomass (forest residue, wood chips, beech...) in order to relate these parameters to oil composition, toxicological characteristics and biodegradability.

Bio-oils analysis and screening tests concerning chemical and physical analyses of the oils, as well as the determination of concentration ranges in each chemical family and the characterisation of the oils versus operating conditions are on going. These analyses will be completed with toxicological screening tests for a first evaluation of bio-oils toxicity and biodegradability. In total 13 bio-oils will be produced :

One of these 13 bio-oils will then be selected for a complete set of analyses. The selection of this bio-oil will be made on the basis of results obtained in screening tests so that it is the most representative oil of all those present on the European market

These results will be used to draw up the MSDS safety procedure and guidelines for bio-oils use and transport preparation, as well as recommendations on the best operating conditions to be used to obtain environmentally friendly products.