

## Valorisation of waste by pyrolysis

Kwapinska M., B.Bonsall, A.V. Piterina and J.J. Leahy

### The problem

The majority of solid waste generated in Ireland is landfilled, 38% is recycled, and only 4% is thermally treated with energy recovery. European legislation has been put in place to limit the amount of biodegradable municipal waste sent for disposal in landfills since they release greenhouse gases to the atmosphere when landfilled. The Landfill Directive also requires that waste is pre-treated prior to disposal in landfill. The pyrolysis of waste streams can serve as a dual purpose technology; sustainable energy generation, and also as an effective waste management tool.

### Pyrolysis

Pyrolysis is considered as an alternative to reduce waste volume and a method for obtaining energy from waste. Pyrolysis can be defined as the thermal decomposition of organic material through the application of heat without addition of extra air or oxygen.

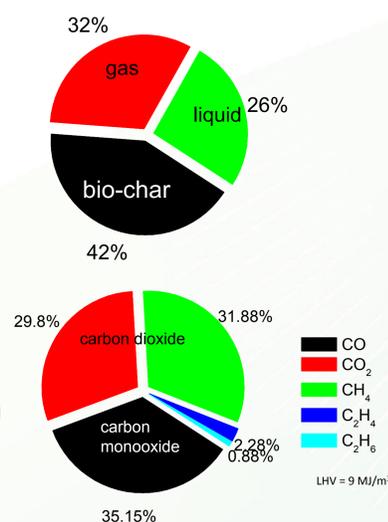
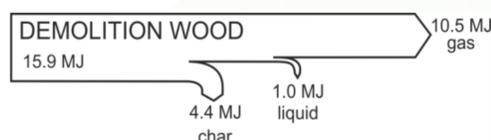
Pyrolysis is a thermal process driven by heating of the fuel in an atmosphere free of oxygen. During pyrolysis the fuel (biomass, waste) is thermally decomposed into a carbonaceous solid called char while it releases gases (carbon dioxide, hydrogen, carbon monoxide, methane) and oil.



The yield of respective products (product distribution) char, oil, gas depends on waste type, the temperature and heating rate at which waste is transformed. The main product from fast high temperature pyrolysis is oil, while low temperature slow pyrolysis produces char.

### Small scale pyrolysis – testing suitability of various solid residues for pyrolysis

The University of Limerick, in collaboration with Technology Centre for Biorefining and Bioenergy, performs pyrolysis at laboratory scale and provides technical assistance to pyrolysis technology developers through analysing pyrolysis products. Intrinsic properties of waste define its usability for thermal degradation with recovery of energy. The types of waste that have been tested to date include: demolition wood, tyres, automotive waste, electronic waste, spent mushroom compost, AD solid residue, meat and bone meal, pig manure, rubber waste and, residues from leather industry, well as biomasses, like miscanthus and coco pot husk.



### Potential advantages of pyrolysis

Potential advantages of waste pyrolysis include reducing disposal requirements and multiplicity of end product application:

gas – in the gas engine for heat and power generation;

oil – energy dens liquid fuel;

char/ash – for disposal or, if heating value is sufficiently high, could potentially be used as a char coal material;

bio-char – from non-contaminated bio-waste or wood could potentially be used as crop and soil fertility amendment, which reduces GHG emissions from soils, prevents phosphate and nitrate leaching from soils.

There would be also a net reduction in the emission of the sulphur, dioxins and particulates.

Pyrolysis allows the energy in the waste to be recovered as a gas to be used for combustion in a gas engine to produce electricity. In addition waste heat is available for the production of, for example, hot water in combined heat and power (CHP) applications.

Chars derived from different fuels/wastes/bio-wastes have different properties. Different applications require specific char properties which can be achieved by selection of appropriate pyrolysis process operating conditions. Value-added materials produced from waste can be a renewable alternative to its problematic disposal.

### Demonstration pyrolysis installation



Within ReNEW a demonstration pyrolysis installation was developed to show the potential of this technology in harnessing inherent waste energy to generate value added products from different type of residuals. The capacity of pyrolysis unit is 50 kg/h of solid residues. The pyrolysis installation allows for process evaluation and scale up of the technology.

### Contact Details

Dr. J.J. Leahy

Chemical and Environmental Science Department,

University of Limerick, Plassey Park

Limerick, Ireland

E-mail: [j.j.leahy@ul.ie](mailto:j.j.leahy@ul.ie)