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SPECIALISED THERMO BALANCE FOR PELLET RESEARCH

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INTRODUCTION

The University of Jyväskylä (JYU) and the Technical Research Centre of Finland (VTT) have begun open collaboration in the field of bioenergy research. JYU has taken on loan a specialised thermo balance from VTT. Thermo gravimetric analysis (TGA) is an important technique of thermal analysis for understanding the combustion behaviour of fuels. The device is to be used in experimental research on the upgrading of solid biomass and in biofuel combustion research. Experiment work with the device will also form part of the laboratory component for Masters students in the Renewable Energy Programme.

MATERIALS & METHODS

The thermo balance is a unique and versatile device because it allows thermo gravimetric analysis and combustion of large samples (i.e. whole fuel pellets). Also, the furnace section of the apparatus can be used to produce bulk quantities of thermally-treated materials (torrefied biomass and bio char) through controlled pyrolysis reactions.

The thermo balance (Figure 1) consists of a cylindrical furnace which can be positioned vertically using a hoisting system. Process gas enters the furnace at its base within which a three kilowatt electric heating element is installed. Heated gas flows upwards through a quartz tube section and continues out through a flue gas tube. An electronic balance sits atop the supporting frame. A wire, connected to the below-balance weighing port extents radially through the flue gas and quartz tubes. An inert crucible, in which the sample is placed, is attached to the lower end of the wire. Samples are loaded with the furnace in a lowered position and when raised, reactions can be observed through the transparent quartz and glass tubes.

RESEARCH OBJECTIVES

- Pyrolysis reactions for upgrading biomass fuels (torrefaction and carbonisation)
- Combustion and fuel properties of torrefied biomass
- Particle emissions from biomass in upgrading and combustion
- Laboratory course and demonstration for bioenergy education

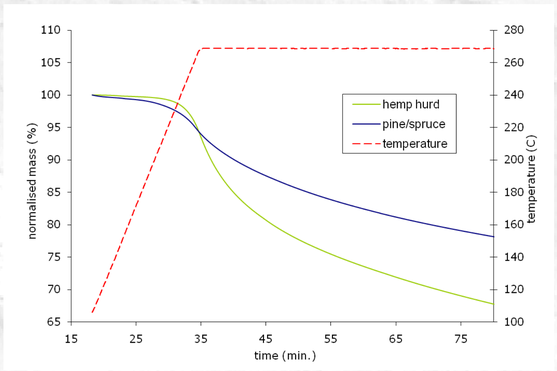
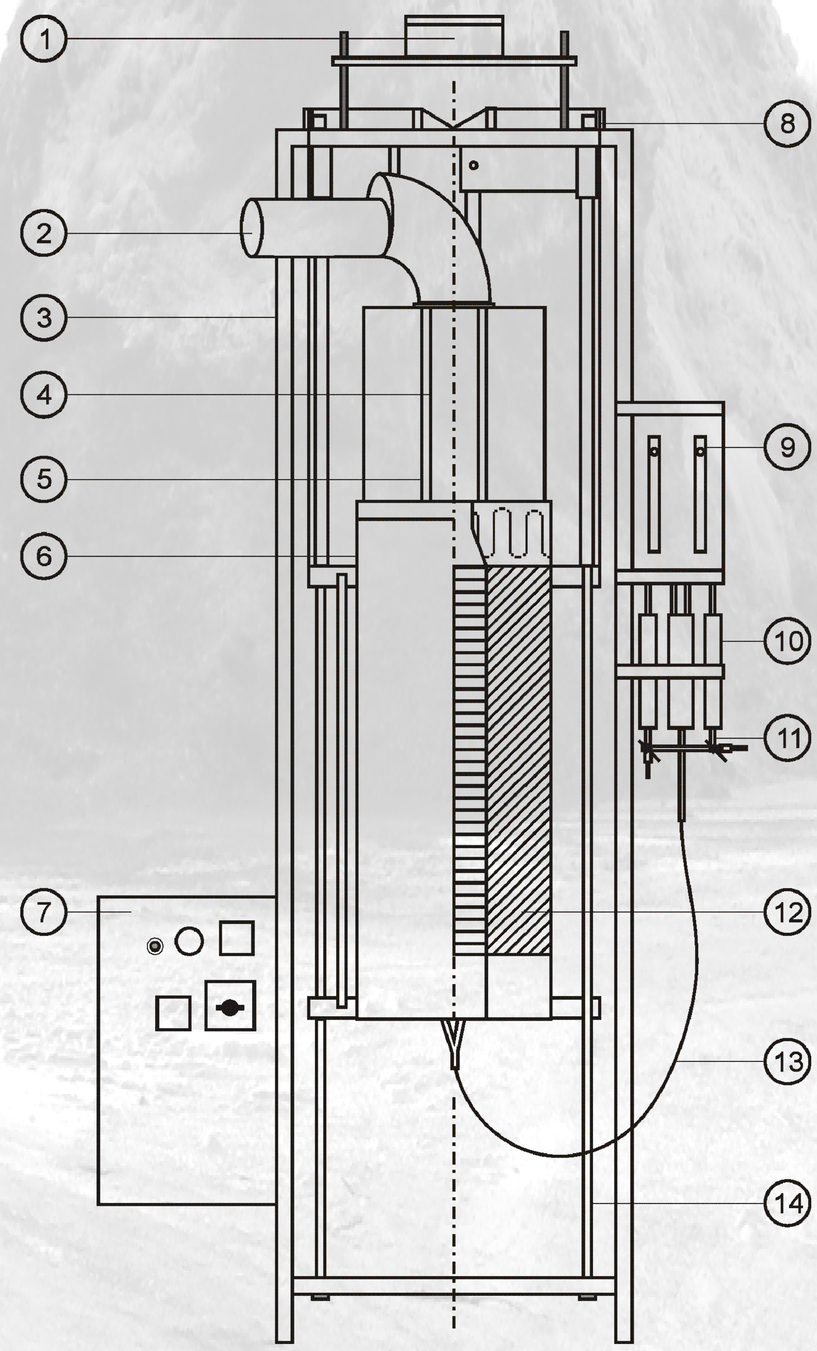


Figure 2. Low-temperature pyrolysis (torrefaction) of two biomass types showing normalised mass loss as a function of time. Samples were torrefied at 270ºC for 50 minutes with a nitrogen gas flow of 50 ml/min.

Figure 1. Main components of the specialised thermo balance: (1) electronic balance (2) flue gas tube (3) supporting frame (4) quartz tube (5) tube of thermally resistant glass (6) cylindrical furnace (7) power supply for heating element (8) hoisting system (9) gas flow meters (10) in-line silica gel drying cells (11) gas mixing connections (12) 3 kW heating element (13) gas line to furnace base (14)



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