

# *Sustainable cement manufacturing*

The combustion of biomass for electricity and heat production is increasing worldwide, and consequently the amount of fly ash produced from biomass combustion is increasing. Fly ash disposal causes a financial and environmental burden, however, leading to an increasing interest in finding novel applications for ash utilization. One interesting option is to use biomass fly ashes in hardening applications such as earth construction<sup>1,2</sup>. Renotech Oy has developed a concept where non reactive biomass ash can be transformed into reactive cement, [www.renotech.fi/rd](http://www.renotech.fi/rd)

**Renotech**  
**R&D**



Valter Wigren, R&D Manager at Renotech Oy.

## *Industrial need*

Renotech Oy has developed a concept where nonreactive biomass ash can be transformed into reactive cement. The process involves modifying the biomass ash in situ by using combustion additives. Now the performed studies are about concept development: getting the ash modification from pilot to industrial level production by implementing a quality control system. Analytical methods are used to gain further insight into the actual effect that the modification has on the biomass ash in comparison to traditional methods of binder modification.

## Experiment

The experiment included the ash modification trial runs which were carried out at a pilot biomass combustion unit. The modified ashes have shown increased compressive strengths, but more insights into the mechanisms of the strength development are required to formulate a more concrete business concept. The experiments were done for sustainable binders made of three different biomass ash types. Samples were in their different dehydration states.

The applied methods were thermogravimetric analysis (TGA) at the University of Turku, Finland and synchrotron based X-ray diffractometry (XRD) at beamline P02.1 (powder diffraction and total scattering) of the synchrotron PETRA III of Deutsches Elektronen-Synchrotron (DESY) in Hamburg, Germany.

## Findings?

The performed analysis gave more insights into the mechanisms of the strength development during the ash modification trial runs. The received results help to make a transformation from the ash modification pilot to concrete industrial production level.

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Figure 1. Mobile processing pilot unit based on mechanical activation

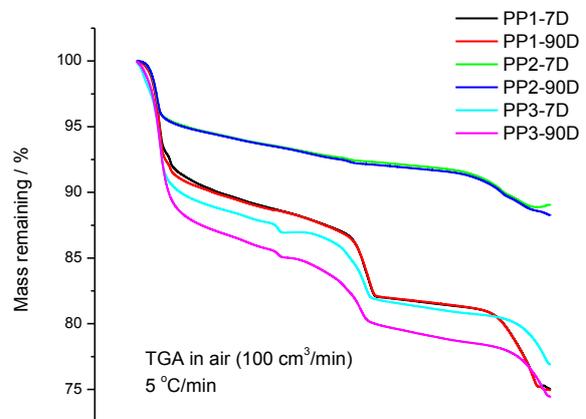


Figure 2. Thermogravimetric analysis graph of different kinds of biomass ashes, measured by University of Turku.

- 1 Fuel 135 (2014) 69-75, Mirja Illikainen, Pekka Tanskanen, Päivö Kinnunen, Mika Körkkö, Olli Peltosaari, Valter Wigren, Jan Österbacka, Bob Talling, Jouko Niinimäki
- 2 Fuel 165 (2016) 440-446, Katja Ohenoja, Pekka Tanskanen, Valter Wigren, Päivö Kinnunen, Mika Körkkö, Olli Peltosaari, Jan Österbacka, Mirja Illikainen