Understanding and Controlling the Moisture and Ash Content of Biomass Fuel

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Introduction

Biomass is a form of renewable energy obtained from live organic materials or materials that were recently alive. Alcohol fuels, black liquor, refuse, corn husks and wood pellets are typical examples of materials that are categorized as biomass.

Like fossil fuels, these materials are incinerated to generate energy, but are more sustainable. To optimize the fuel efficiency of biomass, it is essential to understand and control the moisture and ash content of the biomass. Moreover, incomplete combustion can produce black carbon, which is a pollutant.

The moisture content of biomass materials is typically determined with a conventional oven and ash content with a furnace. Although these traditional techniques are reliable, they often take a long time, which make manufacturers incapable of addressing problems arising during processing.

The development of a new approach for moisture and ash analysis enables accurate moisture and ash determination. This method uses an instrument that provides results in real time, correlating final water and ash concentrations to standard test procedures currently utilized for multiple materials in various industries. The significant reduction in analysis time allows manufacturers to make necessary process changes rapidly in order to achieve optimum output.

Moisture and Ash Analysis

Moisture and ash analysis was performed on a device utilizing the linked testing option, which allows performing a moisture test and subsequent ash test devoid of any user input or interface. Testing parameters were set up before testing and in situ monitoring was performed. Preconditioning of waffle pans before analysis was done to avoid film formation.

For each test, the sample was uniformly distributed on the sample pan. The testing conditions may vary for different materials in order to optimize results, and it may not be possible to use the idle temperature because the ash analysis begins immediately after the moisture analysis.

Based on the testing criteria, the user may use the sample mass taken before the moisture analysis or after the moisture analysis if the moisture content is not required in the determination of ash content. The pan tare is not desired because the pan mass remains unchanged after being removed at the beginning of the moisture analysis.

Analysis Results

The mean results for the moisture analysis of the biomass material samples are summarized in Table 1 (overleaf), showing a strong agreement between the oven reference and the MAX® 5000XL and the repeatability of the MAX® 5000XL. However, there is a significant difference in analysis times between the two techniques.

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Testing Conditions	Moisture Test	Ash Test
Idle Temperature	50°C	125°C
Test Temperature	125°C	600°C
Ending Criteria	0.5000%/minute	0.0500%/minute
Sample Size	7g +/- 1g	7g +/- 1g
Pan Tare	Standard	Standard
Sample Tare	5 seconds	5 seconds

Figures 1 and 2 depict the test graphs showing the progress of moisture and ash analysis in real time using the Computrac® MAX® 5000XL. It is possible to adjust the test criteria based on the characteristics of the graph. This, in turn, enables changing the criteria to optimize the analysis time if it is desired.

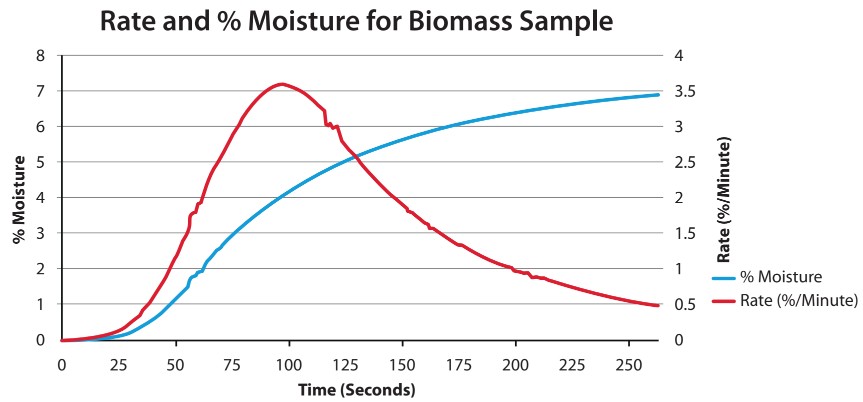

Figure 1. Test graph for moisture analysis of wood pellets

Conclusions

Rapid loss-on-drying and ash content analyzers are essential for manufacturers of biomass materials as they significantly reduce analysis times when compared to conventional testing methods.

This capability of rapid loss-on-drying and ash content analyzers enables manufacturers to achieve improved productivity and market-reach time. Further, these devices save money by removing testing variables, improving employee output, and lowering energy costs.

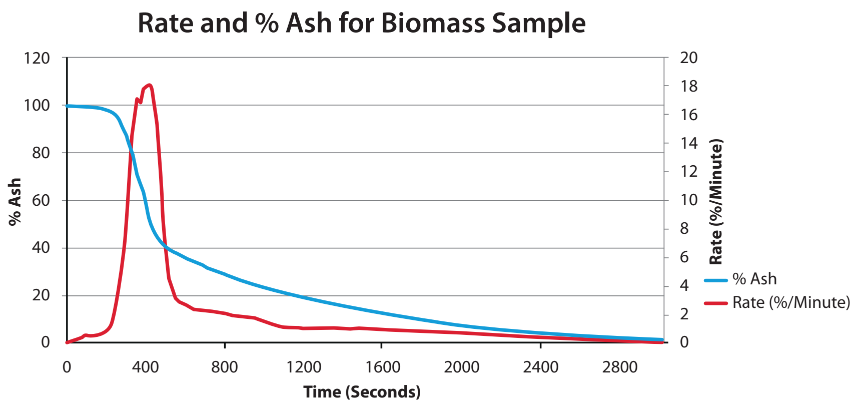

Figure 2. Test graph for ash analysis of wood pellets

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