

Process Control for the Pulp and Paper Industry



Summary

CEM equipment has been trusted for almost 40 years as a source of dependable process control. The SMART 6™ microwave and infrared moisture analyzer and Phoenix™ microwave muffle furnace can provide precise moisture, total solids, and ash content for pulp and paper applications, up to 80% faster than other techniques.

To demonstrate the ability of the SMART 6 and Phoenix to accurately and reliably determine the moisture, total solids, and ash content throughout the pulp and paper manufacturing process, an assortment of in-process and finished product samples were obtained and analyzed.

Introduction

Ranking among the world's largest industries, the manufacturing of pulp and paper products produces over 400 million tons of product per year. Pulp and paper processing mills are found in more than 100 countries, with some mills only focusing on pulp or paper manufacturing, and others covering the entire production process from start to finish. Yet, others focus on the processing of recycling paper materials. Regardless of the type or amount of processing that occurs, moisture and ash analyses are necessary to control production time and costs. Whether it is by more accurately calculating the amount of wood required per ton of pulp, controlling the amount of coating or binder used in finishes, or quality checks on incoming materials, these two simple test results need to be delivered quickly and accurately.

The SMART 6 is the fastest direct-moisture analyzer on the market. Using a proprietary combination of infrared and microwave energy, samples are easily analyzed for moisture or total solids in less than 2 min. The Phoenix uses microwave energy to rapidly and efficiently heat an internal furnace. When used in conjunction with CEM's quartz fiber crucibles, typical test times are reduced to 10 min, compared to 1–2 h in a conventional furnace.

Experimental

For moisture and total solids analysis, each sample was dried on the SMART 6 until a constant weight was reached. On average, the time required to obtain moisture or total solids results was less than 2 min. Sample sizes ranged from 2–3 g. Each sample was analyzed in triplicate for the reference analyses, as well as for the SMART 6 analyses.

For ash determination, each sample was analyzed according to the ASTM and USP methods. The Phoenix interfaces with an external balance to provide direct results, without the need for manual calculations.

Results and Discussion

The accuracy of the SMART 6 is demonstrated in **Table 1**, where the average reference results are compared with the average of the SMART 6 results. The average difference was 0.32% for moisture and total solids. Repeatability for ash analysis is shown in **Table 2**, where the standard deviations averaged less than 0.04%.

Table 1: Accuracy of the SMART 6 for Moisture and Total Solids in Various Pulp and Paper Process Samples

Sample	Kaolin (% Solids)	Black Liquor (% Solids)	TiO ₂ Slurry (% Solids)	Maple Wood Chips (% Solids)	Aspen Wood Pulp (% Solids)	Paperboard (% Moisture)	Paper (% Moisture)
1	55.25	37.08	71.86	67.86	31.95	9.47	9.20
2	55.31	37.25	71.88	67.22	31.92	9.42	9.14
3	N/A	37.70	71.84	67.77	32.21	9.43	9.11
Average	55.28	37.34	71.86	67.62	32.03	9.44	9.15
Reference	55.34	36.30	71.83	65.00	30.00	10.50	9.50

Table 2: Repeatability of the Phoenix for Ash Content in Various Pulp and Paper Process Samples

Sample	Ground Wood Chips 1 (% Ash)	Ground Wood Chips 2 (% Ash)	Corrugated Medium (% Ash)	Kraft Paper (% Ash)
1	6.67	6.26	4.31	0.74
2	6.63	6.39	4.30	0.68
3	6.58	6.25	4.31	0.72
Average	6.63	6.30	4.31	0.71

Conclusion

These results demonstrate the ability of the SMART 6 and Phoenix to reliably determine the moisture, total solids, and ash content in pulp and paper samples, with accuracy closely matching that of the reference methods. In addition, there are inherent time savings, compared to traditional methods that allow for rapid improvements to process control, which ultimately leads to improved process profitability.

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