

Measuring Moisture in Sugar Process Optimization and Lab Efficiency

Keeping the moisture content of sugar and its co-products strictly within specifications is key to the operational excellence of sugar plants.

This application note describes how METTLER TOLEDO Halogen Moisture Analyzers expedite the analysis of sugar and its co-products (pulp, pellets, bagasse) and deliver precise data on moisture content within minutes. For accurate process control of factories processing sugar beet and sugar cane.



HR83
Halogen Moisture Analyzer

Introduction

This application note illustrates the fast moisture determination of sugar and its co-products (pulp, pellets) in the sugar factory. The use of METTLER TOLEDO Halogen Moisture Analyzers is exemplified with white sugar.

Moisture analysis in sugar factories

Fast and accurate information on moisture is crucial for optimal control of sugar production plants and for the safe storage and transportation of the final product. Typical measurement points for moisture in the processing of sugar cane and sugar beet are illustrated below. METTLER TOLEDO offers the full range of analytical equipment required, including refractometers, balances, titrators and moisture analyzers.

Table 1: Overview of measurement points and applicable methods (ICUMSA).
LOD: Loss on Drying,
RE: Refractometers

Product	Method
Juice (Raw, Thin, Thick)	RE ³
Molasses	RE ³
Pulp, Pellets	LOD ^{1,2}
Bagasse	LOD ^{1,2}
Sugar (Raw, White)	LOD ^{1,2}

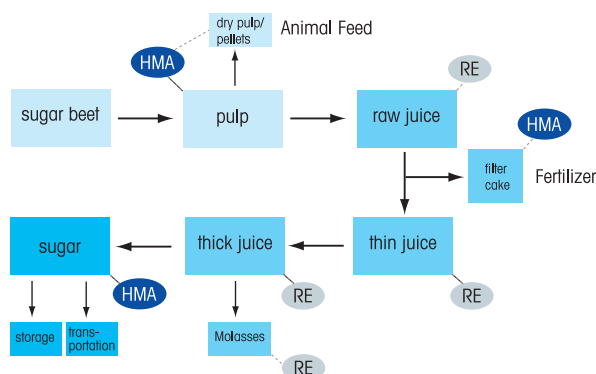


Figure 1: Measurement points for moisture content during the sugar manufacturing process. HMA: Halogen Moisture Analyzer, RE: Refractometry

Moisture in sugar – it's the law.

And key to product quality

Optimal moisture content of white sugar is typically between 0.02 and 0.05%, of raw sugar between 0.25 and 1.10%.

International guidelines such as Codex Alimentarius⁴, EU sugar policy⁵ and national guidelines (e.g. animal feed and fertilizer regulations) state quality requirements for sugar and sugar co-products (pellets, bagasse, pulp). For example, refined or white sugar may have a maximum of 0.06% moisture according to EU sugar policy⁵. Adjusting the moisture content to optimal levels during the drying process and keeping it within tight tolerances optimizes the production for best quality.

HR83 – quick and accurate results

The drying oven^{1,2} is the reference method for crystalline sugars and co-products (see Table 1). However it requires 3 hours and more for results to become available. Many sugar laboratories do not have this time. Karl Fischer titration could be an alternative with measurement times around 5 minutes. However the cost of this method is rather high due to the use of expensive reagents⁶.

The moisture determination of white and raw sugar with the HR83 only takes 4-6min, without the need for reagents. You obtain the same results as with the standard method drying oven. The results are automatically calculated and documented⁷.

¹ ICUMSA (International Commission for Uniform Methods of Sugar Analysis) GS2/1/3/9-15: The Determination of Sugar Moisture by Loss on Drying

² ICUMSA GS8-6: B – Dry substance in Dried Beet Pulp

³ ICUMSA GS4/3-13: The Determination of Dry Substance of Molasses and Very Pure Syrups (Liquid Sugars)

⁴ Codex Alimentarius is a food standard developed by FAO and WHO

⁵ Commission Regulation (EC) No 1262/2001

⁶ Approx. 10000 EUR per year in a German sugar refinery

⁷ With integrated printer (HR83-P)

Material and Methods

- HR83 Halogen Moisture Analyzer
- White sugar

Instruction how to use HR83 to determine moisture in sugar

1. Press "Method" button and select method for sugar (both raw and white)



- Resolution: High
 - Standby temperature: 100 °C
 - Switch-off criteria F (1mg/ 180sec)
 - Drying Program: Standard
 - Drying Temperature: 105°C
- This method is applicable for white sugar and raw sugar



2. Weigh approx. 20g of sugar into preheated and then tared sample pan



3. Press "Start" button to begin measurement



4. The result shows the moisture content of the sample



Results

The moisture content of white sugar is measured with the HR83. The result obtained is 0.030 %MC. The sugar fulfils the criteria of both EU

sugar policy regime⁵ (maximum 0.06% loss on drying) and the Codex Alimentarius⁴ (below 0.1% loss on drying).

Please refer to **Annex 1** for information on measurement of moisture content in dried sugar beet pulp and pellets.

Correlation HR83 versus Drying Oven

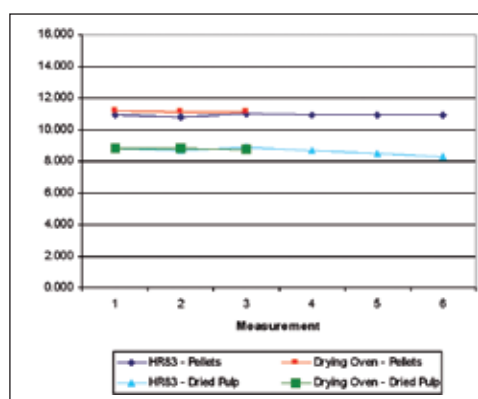
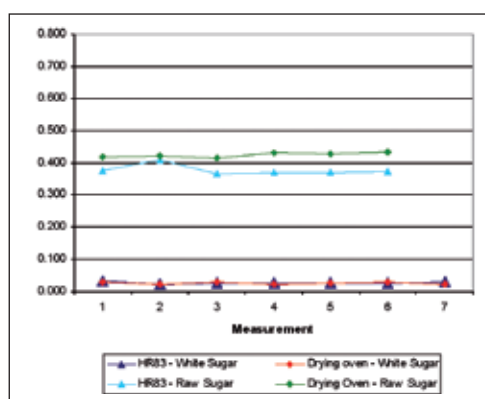
To prove precision of HR83 results, a comparison study with sugars and co-products is performed.

Results are compared to the drying oven method (ICUMSA GS2/1/3/9-15 for sugar and modified ICUMSA

GS8-6 as used in a sugar refinery).

The study shows that the HR83 achieves highly repeatable results fully corresponding to the drying oven in minutes instead of hours.

	HR83			Drying Oven		
	Mean [%MC]	SD	Time [min]	Mean [%MC]	SD	Time [min]
White Sugar	0.027	0.002	4	0.026	0.003	180
Raw Sugar	0.377	0.016	7	0.424	0.008	180
Dried Sugar Beet Pulp	8.753	0.095	23	8.778	0.052	240
Dried Sugar Beet Pellets	10.898	0.080	28	11.142	0.036	240



Conclusion

The moisture content of sugar and sugar co-products is determined fast and accurately with the easy-to-use HR83 Halogen Moisture Analyzer. The results correspond to the reference method. The quick

and precise knowledge of the moisture content can significantly contribute to the operational efficiency of sugar refineries and sugar processing companies.

Annex 1: Measurement of dried sugar beet pulp and pellets

Reference Method Drying Oven

Drying temperature: 105 °C
Drying time: 4h
Sample weight: 10g

Grind the pellets before drying.

Moisture Analyzer HR83

Drying Program: Standard
Drying temperature: 105 °C
Sample Weight: 5g
Switch-off criterion: 3 (1mg/50s)

Grind the pellets before drying.

www.mt.com/moisture

For more information

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