The Challenges of Ash Analysis

International Association of Operative Millers

IAOM Central & Wheat State District Conference
Lake Ozark, Missouri, United States
July 25-27, 2013
The Challenges of Ash Analysis

Ron Lindgren
Industry Sales Manager: Milling and Grain

• Combined 18 Years of Feed, Pet Food, Food Processing and Flour Milling Experience

• Quality, Production and Research Development Roles

• Graduate of Kansas State University Department of Grain Science: Milling

• 1st Ash Analysis completed: 1993
Topics to Be Covered

• Identify what ash is and where it is in wheat
• Why ash is so important to millers and bakers
• How parameters such as grain quality, hardness, kernel size, and the tempering process will influence the milling yield, and how to adjust according to the ash content in the obtained flour
• Reference methods and challenges to produce accurate results consistently
• Translating the reference methods to NIR: How to have the best success at producing a robust calibration and maintaining that calibration.
• Question and Answers
What is Ash?

The Definition of Ash

- Ash is the measure of the mineral content that is left behind after incineration of ground wheat or flour.*

- Where does ash or the mineral content derive from?

*Principles of Cereal Science and Technology, 2nd Edition, R. Carl Hoseney
The Wheat Kernel

Breakdown of the Wheat Kernel

Ash or Mineral Content of Wheat Kernel
Influences on Ash Content in Wheat

- Varietal Differences
- Growing Area
- Environmental Conditions and Crop Year

Source: Economic Research Service, USDA.
How Does Ash Relate to the Milling Process?

- The Miller is trying to gradually reduce the particle size of the grain to a flour or meal: break system
- Separate the components of the kernel: remove the bran
- The miller uses Ash to determine how well he or she is accomplishing this
- Mill balance and control: cumulative ash curve and stream analysis
How Does Ash Relate to the Baking Process?

• Color
• Mix and Absorption
• At generally accepted levels, nothing:
  “In general, the ash itself does not affect flour properties and thus it can be argued that the ash content alone has no meaning.”*
• Great topic to start an argument!

*Principles of Cereal Science and Technology, 2nd Edition, R. Carl Hoseney
Ash Reference Methods

- AACC Official Methods 08-01, 08-02, 08-03
  - 08-01 Basic Method
  - 08-02 Rapid (Magnesium Acetate) Method
  - 08-03 Rapid (2-Hour, 600°) Method
- AOAC Official Method 923.03
- ISO 2171:2007
- TGA: Thermogravimetric Analysis
  - Complying with AACC and AOAC
Ash Method Challenges

- Sample Preparation and Care
- Training, Technique and Consistency: the Human
  - Settle upon a reference method
  - SOP: manage the method
  - Master the SOP and technique
  - Do the same thing, every time all the time
  - Check and proficiency samples, strive to get better
- Equipment
  - Furnace
    - Calibrated
    - Location in Lab
  - Dishes
    - Nickel, Platinum, Fused Silica Quartz
    - Condition
Ash Method Challenges

- Scale
  - Calibrated and maintained
  - Breeze break for scale
  - Location: Separate weighing room
  - 0.0001

- Desiccator
  - Size
  - Seal integrity
• When is the test completed? What is light grey?
• Direct method and indirect method weigh back
• Static issues when weighing back
• Dessicator and drying agent
• Pre heat dishes or crucibles?
• Cool samples before weigh back, room temperature
• Teach the calculation or utilize automation
• Multiple lab technicians?
• What is best for your particular lab set up
• Great topic of conversation for cereal chemists....
Results and What to Expect

![Bar chart showing frequency distribution of ash content levels.](image_url)
Results and What to Expect

Check Sample Ash Results

- Frequency

Dedicated Analytical Solutions
Best Practices for Robust Ash Calibration

• Understand reference method capabilities
• Understand your reference lab precision
• NIR Instrumentation
• Calibration samples
  - How many? Minimum of 10
  - Range? Range that represents product mix your analyzing
  - Samples preparation
• Validate the bias
  - Common samples
  - Wet chemistry to validate bias
• Calibration expansion
  - Only if you are getting GH (Global H) or statistical outliers
  - Wet chemistry used to expand the calibration
• Get help from the experts
• Ash is the accepted measure today
• Ash is not an easy method to master
• Importance of Ash analysis
  • Mill balance and control
  • Overall quality parameter
• NIR: Quick and accurate results to manage business
Thank You and Questions

Thank You!
Ron Lindgren
913.620.7467
rlindgren@fossna.com