IAOM Western District

Spokane, WA July 22, 2021

With Washington Grains Commission

A NEW APPROACH FOR BLENDING FLOUR STREAMS TO ENHANCE FUNCTIONALITY

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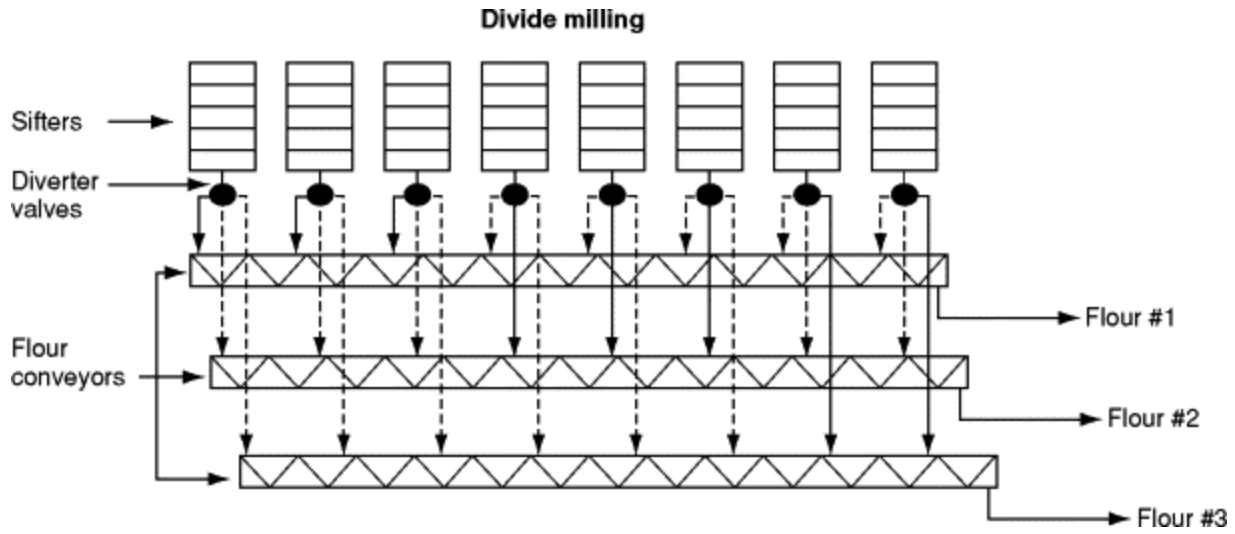
To Begin:

- Millers do not set out to make “bad” flour
- “Bad” flour, for the most part, simply describes flour that is unsuited to the type of product being produced
- Every flour stream in the mill has a potential ideal use
- In North Asia, mills produce 200 – 300 flour types; not just SKUs, but functionally different flours
- Identifying the attributes that describe end-uses can help manage milling and functional flour production

What do we mean by ‘streaming’?

- Streaming of flours in the mill means selecting one or more flour streams in the mill based upon one or more attributes that correspond to functionally specific performance of flours for one or more specific end uses.
- This is not new technology – since the advent of the industrial flour mill skilled millers have performed “Divide Production” producing multiple flour types from a single grist.
- The aim of this exercise is to create multiple, functional flours as we can – because this is where the highest margins exist in most (free market) environments.
- More dependent on number of flour conveyors than bin space (already making several flours based on ash; change over to other stream management doesn’t necessarily imply more bins)

Streaming is optimizing value from all flour streams



Streams selected: Cumulative ash <= 0.5%

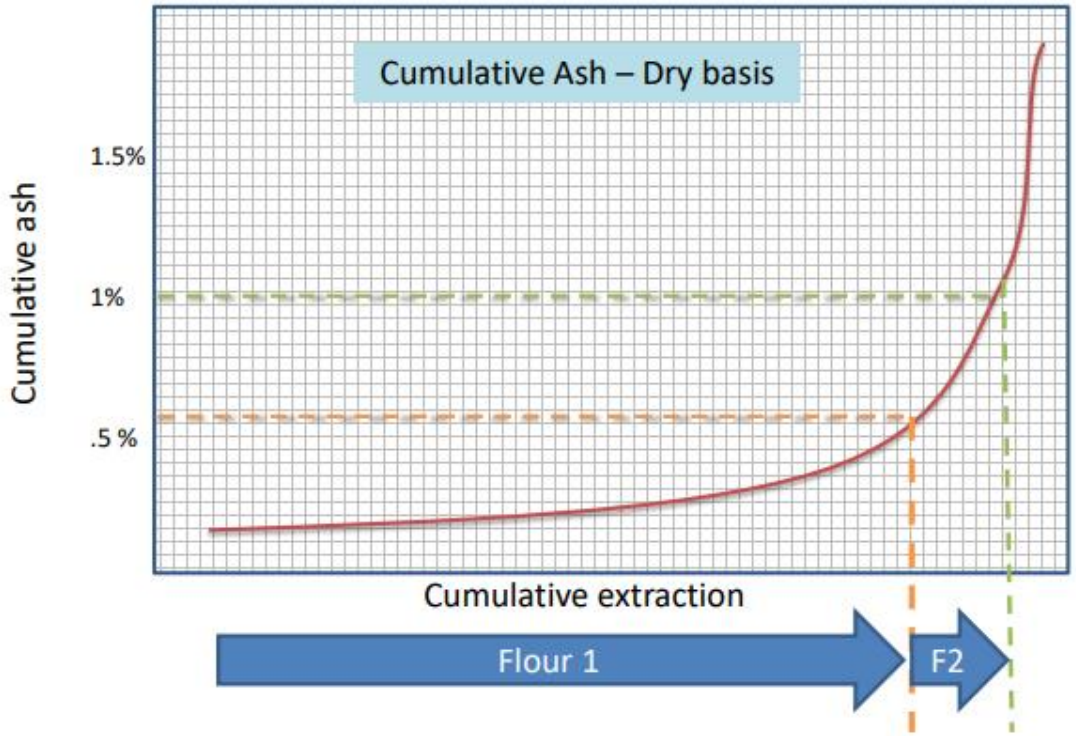
Flour 1

Streams selected: Cumulative ash 0.5 – 1.0&

Flour 2

Flour 1

Flour 2



This is streaming to cumulative ash.

Very basic 'single attribute' streaming – selecting streams on ash content. We all do this now on ash (or color). Many different products can be made from Flour 1, fewer from Flour 2. **There are limited opportunities to gain a premium from these flours.**

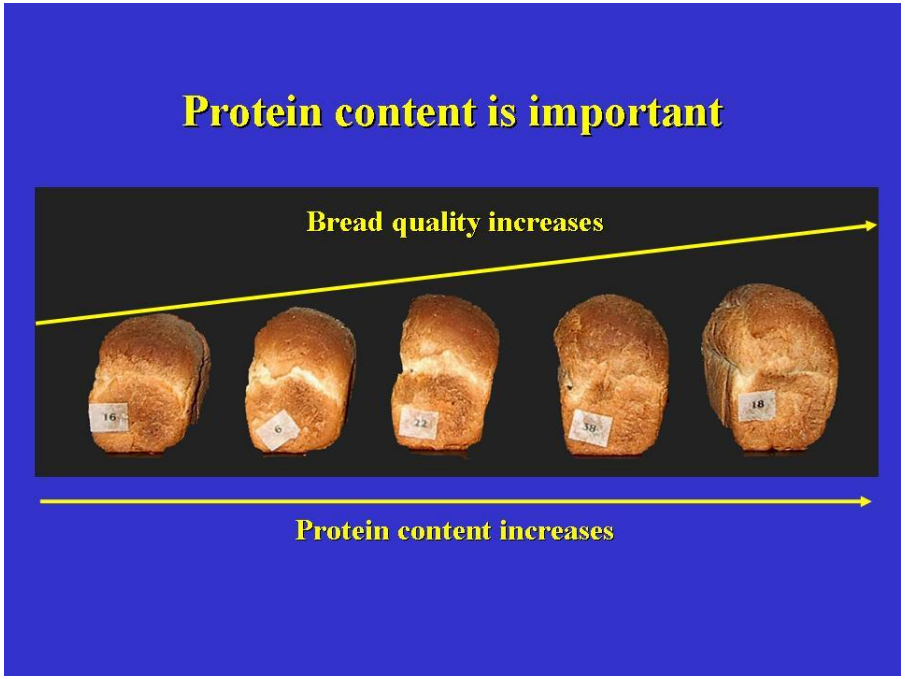
Ash

- Ash = mineral content
- Acts as proxy for bran contamination and, by extension, milling performance
- Ash widely used as marketing specification, and everyone thinks they know what “ash” means
- Flour ash depends on total wheat ash, which depends on growing environment, e.g. irrigated vs dry land, wheat variety, heat, etc.
- Dependent on particle location within the kernel that become flour – more ash toward aleurone; less in the center of the kernel and the location does have some functional meaning. But not a lot
- Aleurone, despite mineral content, has great nutritional value that is missed when ash content is a flour specification
- Loss in sales value results when wheat, regardless of end-use functionality, must meet an ash standard (e.g. 0.52)

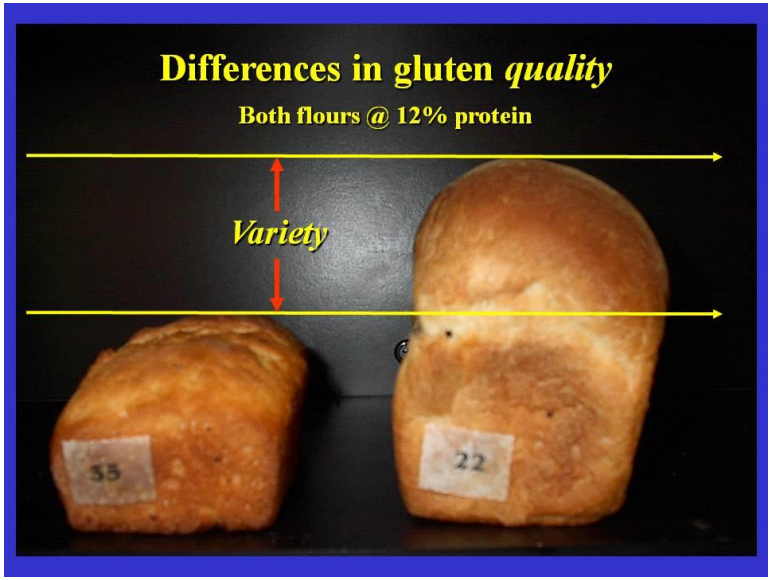
Alternatives to ash curves in mill management

- Cumulative protein curves
  - Widely used in Europe, S.Africa
  - Same as ash curves, but with protein
  - When only one class of wheat is available (e.g. France), use of protein can provide flours of varying end-use functionality
  - Very approximate and with differences in protein quality, and grain hardness, the result may not be satisfactory
- Presented here is an alternative to creation of more functionality in flours

Protein content dictates price (Hard Wheat)



Other factors actually control protein quality



Better means to produce functional flours are needed beyond ash or protein quantity to manage mill flow and stream combination

Solvent Retention Capacity (SRC)

- Solvents chosen to swell polymeric components of flour without dissolving them
  - Gluten-forming proteins
  - Non-starch carbohydrates (arabinoxylan, pentosan, hemicellulose)
  - Damaged starch
- All contribute to overall water absorption and mixing and baking properties
- Now AACCI Approved Method 56-11.02

Solvent Retention Capacity (SRC)

AWRC used sodium bicarbonate buffered water only (pH 8.1)

All analyses are on a weight-weight basis (not volumes or molarity)

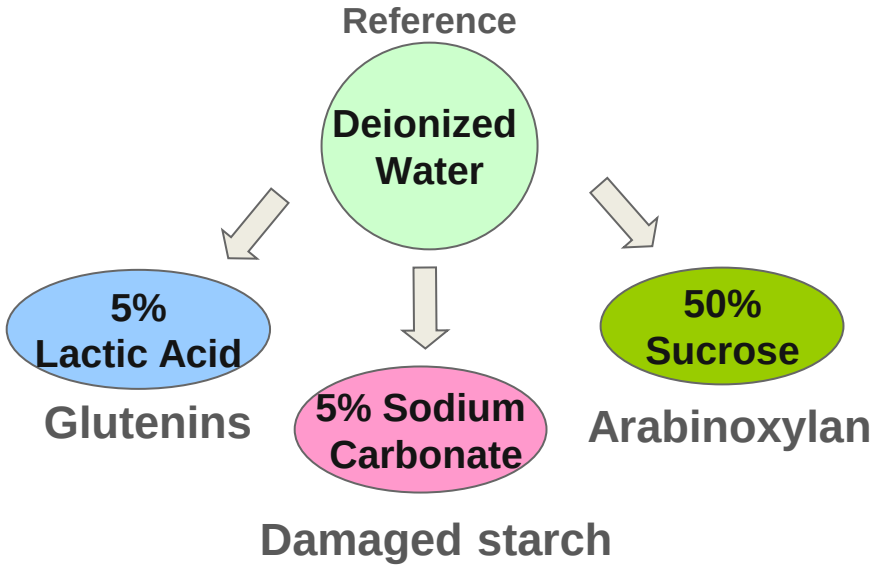
SRC uses four solvents:

-water

-sodium carbonate (pH 12)

-lactic acid (5%; pH 2)

-sucrose (50%)



SRC Procedure
(AACC Method 56-11.02)

Selective solvation

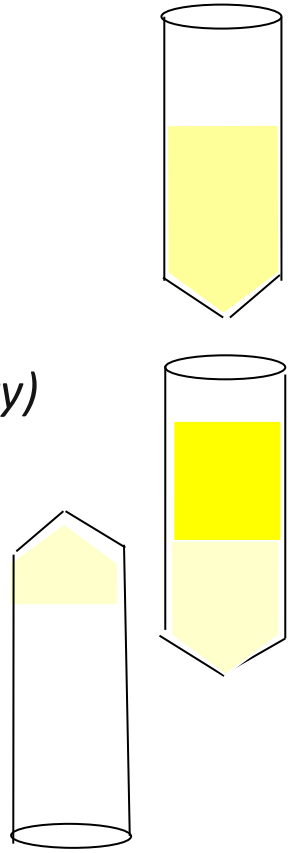
5 g flour
25 g solvent
20 minutes

Centrifugation

1000 X *G (gravity)*
15 minutes

Drainage

180^{o} angle
10 minutes



SRC Testing

Envelopes of SRC Performance

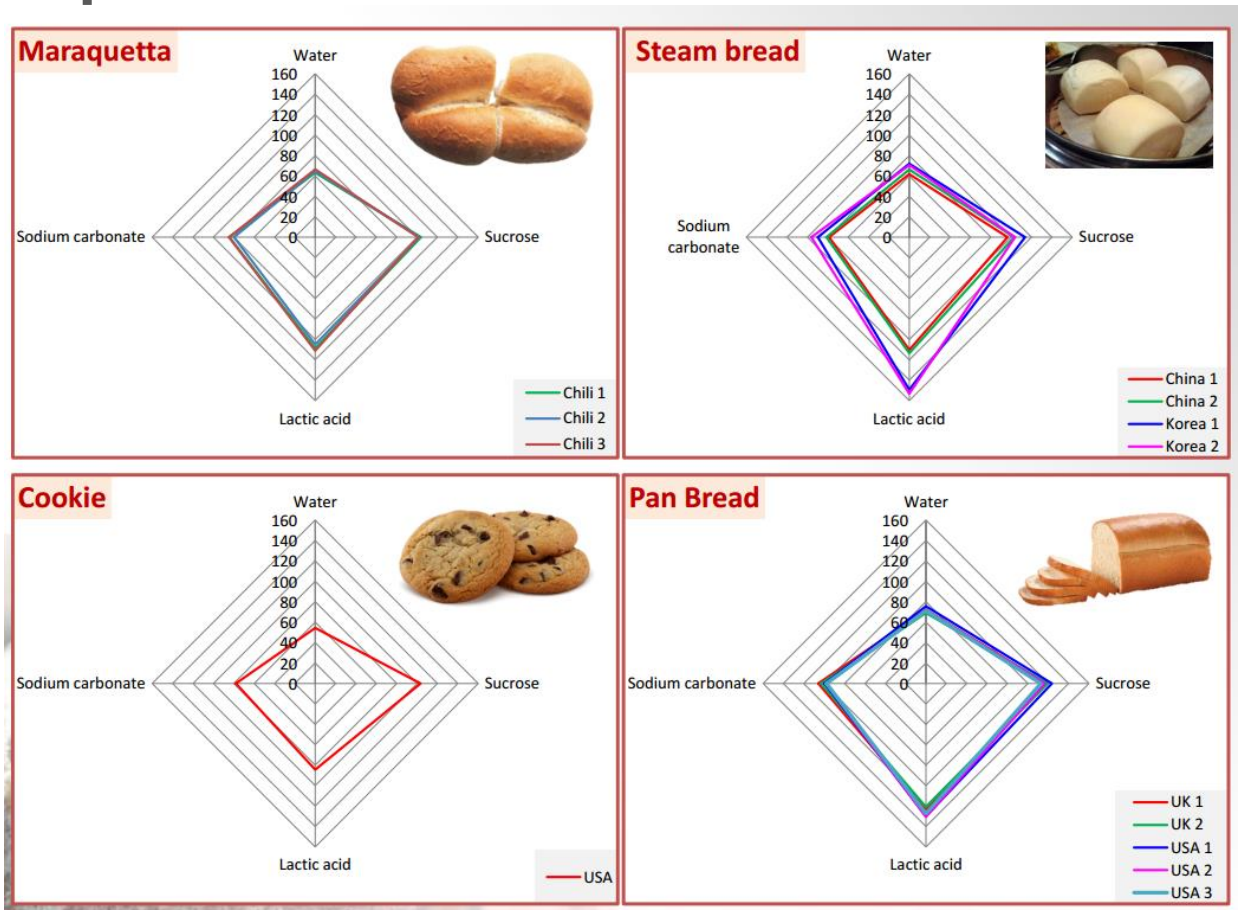
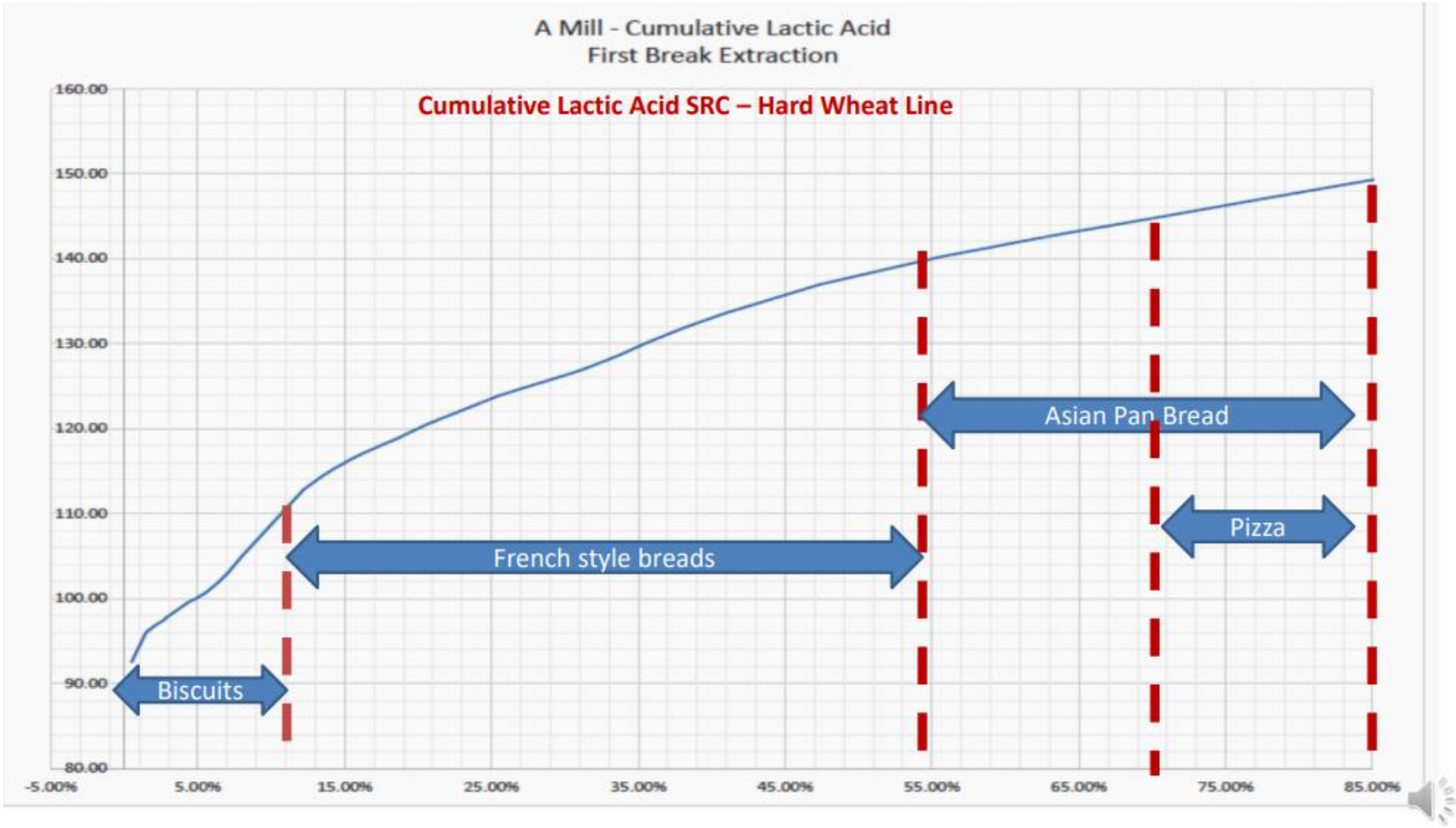
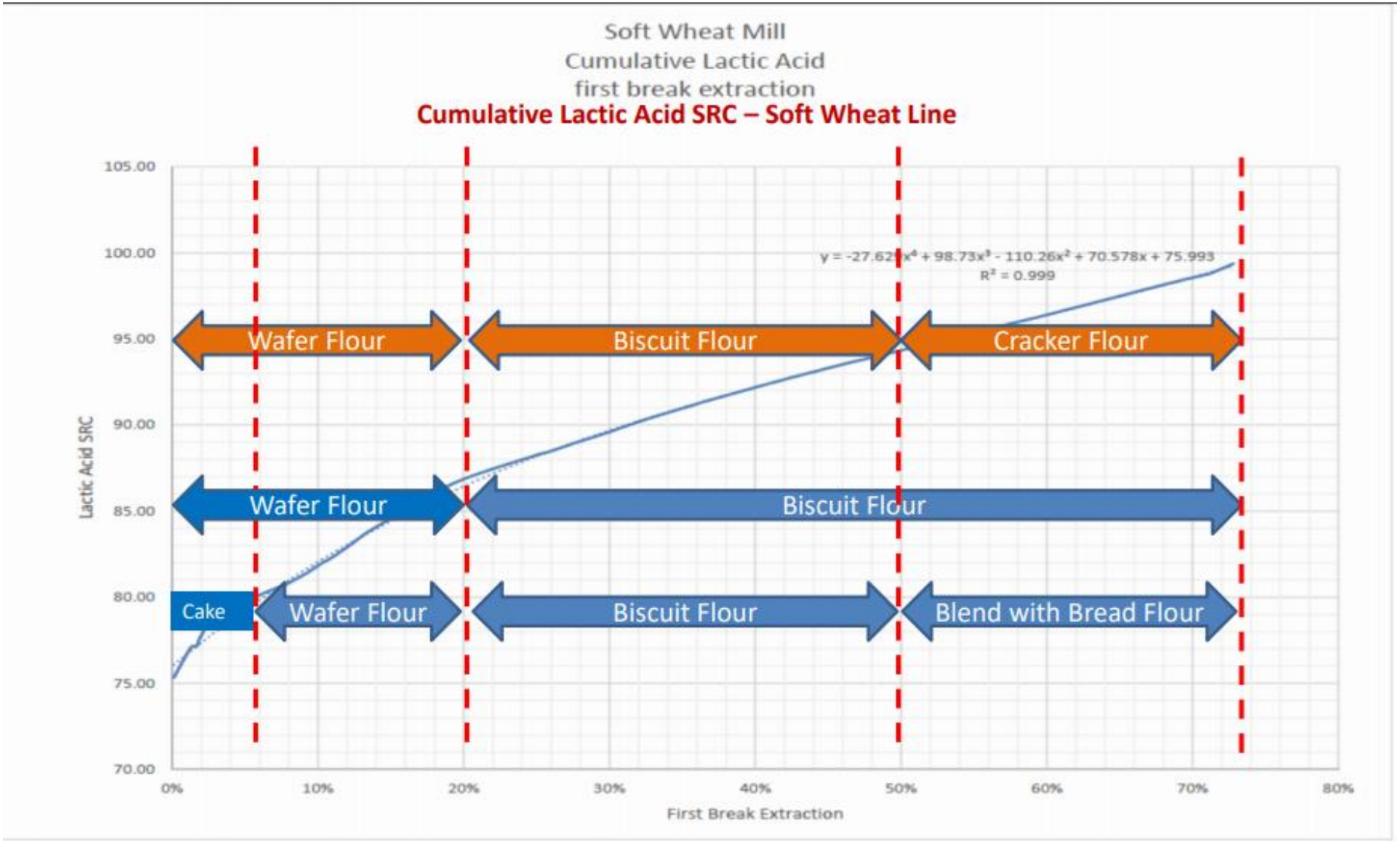
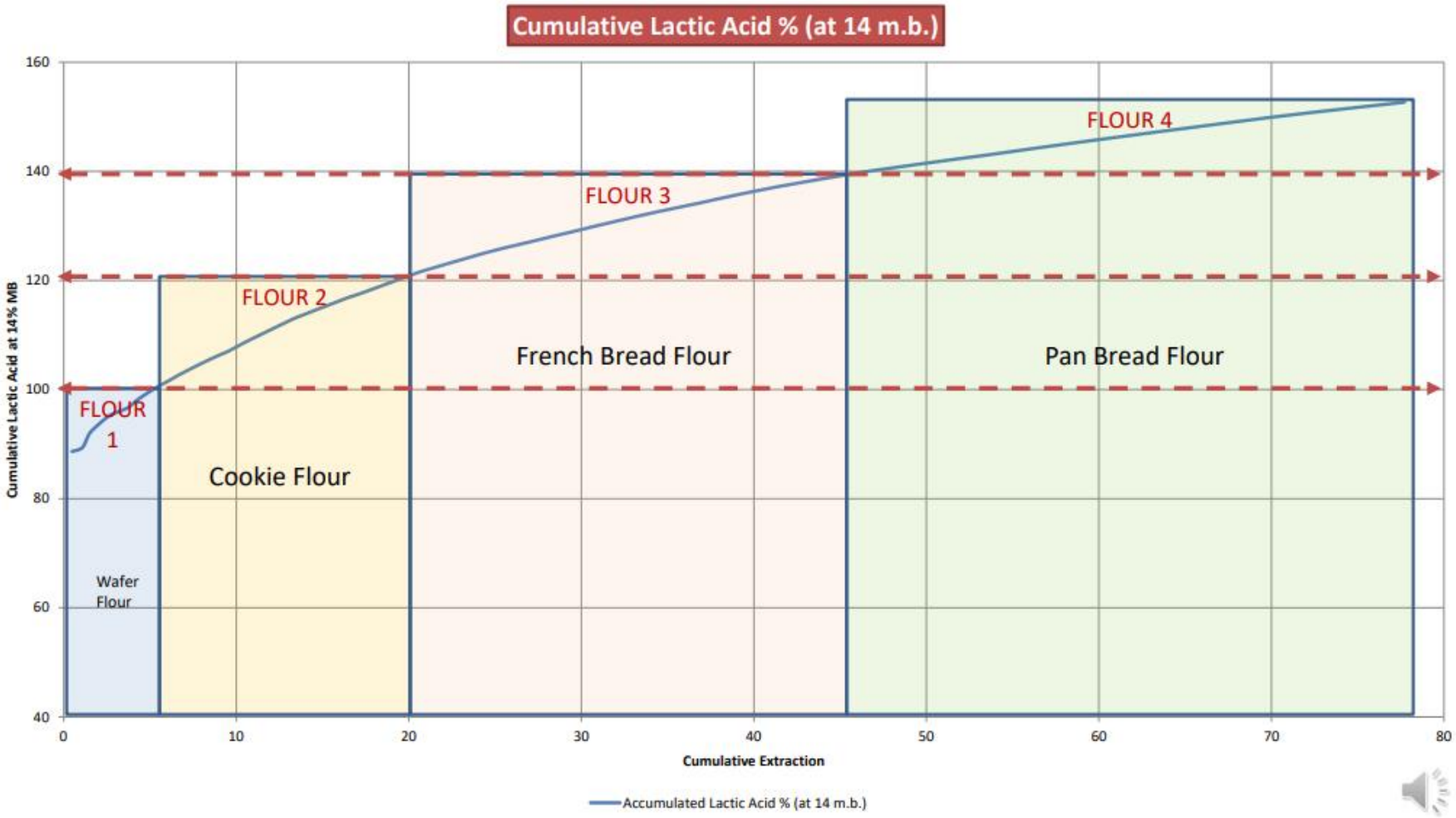


Image Courtesy of Chopin


A Mill - Cumulative Lactic Acid
First Break Extraction
Cumulative Lactic Acid SRC – Hard Wheat Line
160.00
150.00
140.00
130.00
120.00
110.00
100.00
90.00
80.00
-5.00%
5.00%
15.00%
25.00%
35.00%
45.00%
55.00%
65.00%
75.00%
85.00%
Asian Pan Bread
Pizza
French style breads
Biscuits


Soft Wheat Mill
Cumulative Lactic Acid
first break extraction
Cumulative Lactic Acid SRC – Soft Wheat Line
105.00
100.00
95.00
90.00
85.00
80.00
75.00
70.00
Lactic Acid SRC
y = -27.62[illegible]x⁴ + 98.73x³ - 110.26x² + 70.578x + 75.993
R² = 0.999
Wafer Flour
Biscuit Flour
Cracker Flour
Wafer Flour
Biscuit Flour
Cake
Wafer Flour
Biscuit Flour
Blend with Bread Flour
0%
10%
20%
30%
40%
50%
60%
70%
80%
First Break Extraction


Cumulative Lactic Acid % (at 14 m.b.)
160
140
120
100
80
60
40
Cumulative Lactic Acid at 14% MB
0
10
20
30
40
50
60
70
80
Cumulative Extraction
FLOUR 4
FLOUR 3
FLOUR 2
FLOUR 1
French Bread Flour
Pan Bread Flour
Cookie Flour
Wafer Flour
Accumulated Lactic Acid % (at 14 m.b.)

Implementation

- Equipment is minimal: centrifuge & balance
- Each stream must be characterized
  - Time-intensive, but only need to do this once or twice a year per wheat class
  - Quantity/time probably already known
- After characterization, less labor/time intensive than ash
- Select which SRC result(s) best reflect desired functionality and construct functional flours by blending similar streams
- Work with client bakeries to inform and educate them of flour functionality/quality improvements
- Work with merchandisers to discuss ash specifications
- Makes use of the totality of streams; no waste, just flour directed to the appropriate use
- Enhance mill reputation and decrease customer complaints

THANK YOU

Edit thank you message.

ADB wheat

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