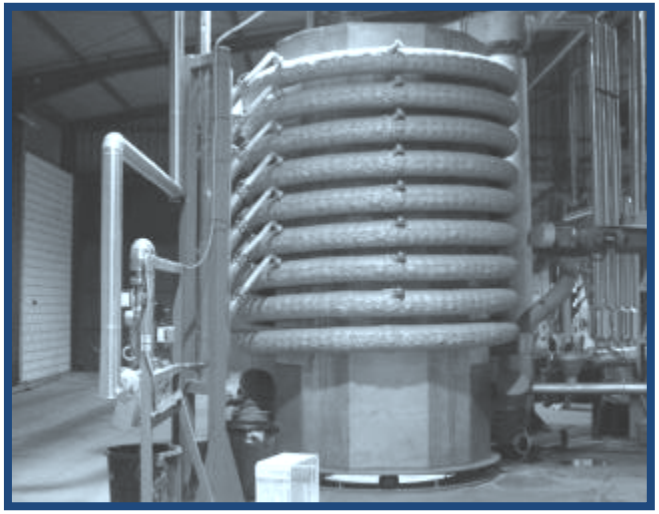




REVTECH PROCESS SYSTEMS

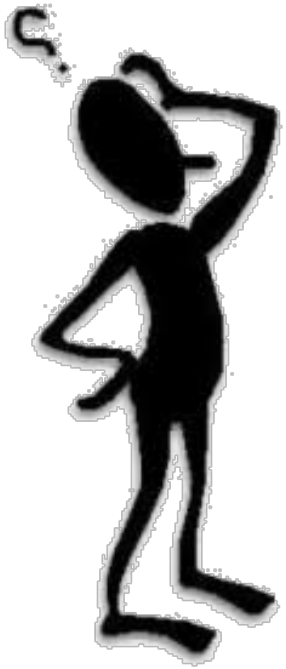
Heat treatment technology

IAOM

July 26th – Branson, MO
August 8th – Brainerd, MN

Celia Schlosser

PRODUCT RECALLS



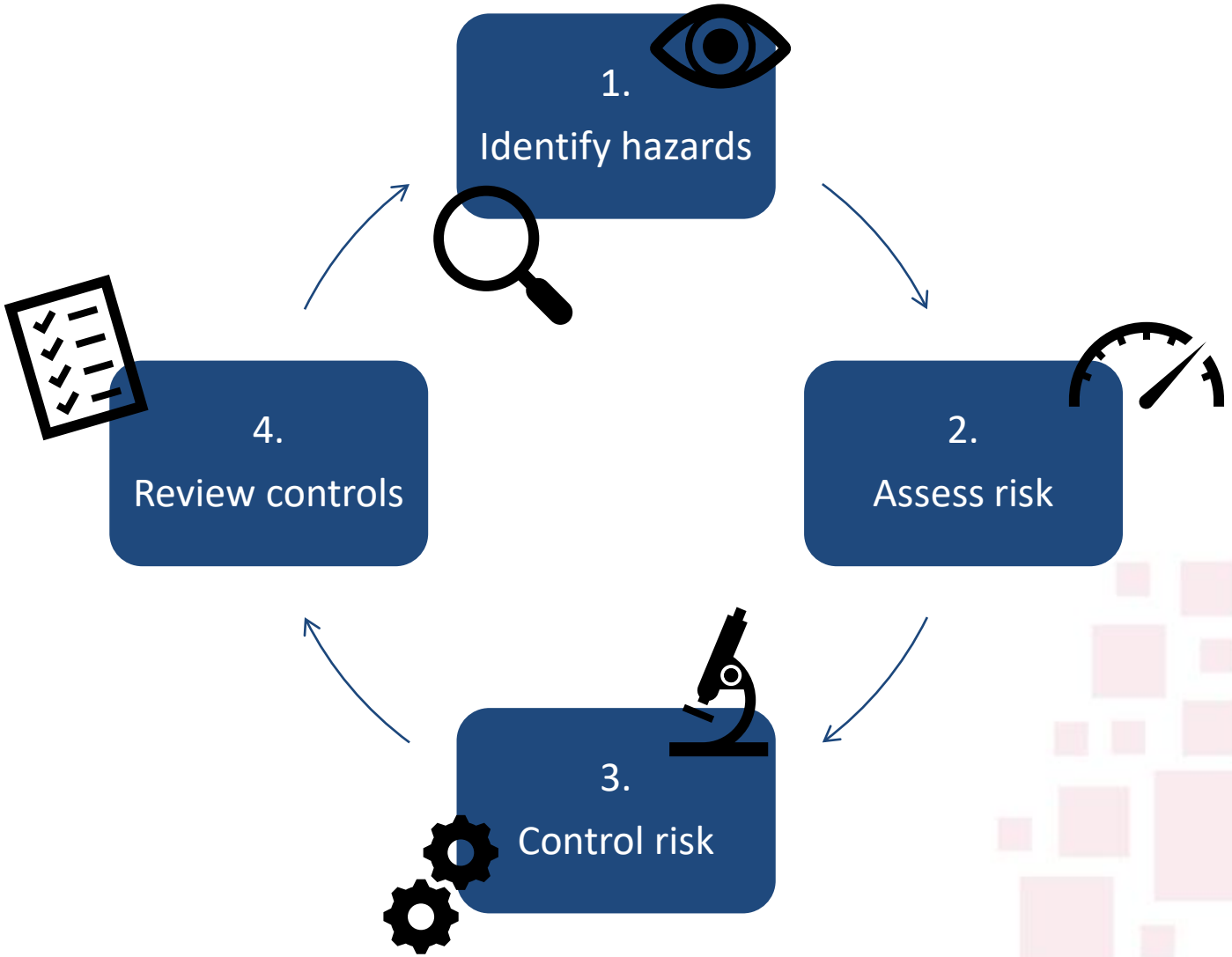
Pathogen	Year	Number of cases	Isolated from product?	Outbreak location(s)
E. coli O121, E. coli O26	2015–2016	63	yes	USA (24 states)
E. coli O121	2016–2017	30	yes	Canada (6 provinces)
E. coli O121	2017	6	yes	Canada (1 province: BC)

What is the common point ?

PRODUCT RECALLS

Product : Flour	Pathogen	Year	Number of cases	Isolated from product?	Outbreak location(s)
General Mills, Kansas City, MO	E. coli O121, E. coli O26	2015–2016	63	yes	USA (24 states)
Ardent Mills, Saskatoon, SK	E. coli O121	2016–2017	30	yes	Canada (6 provinces)
Rogers Foods, BC	E. coli O121	2017	6	yes	Canada (1 province: BC)

RISK ASSESSMENT PROCESS



WHY ? IDENTIFY HAZARDS

Is it ready to eat ?

Yes

No (baked, cooked, fried)

Has it been processed in a manner to eliminate pathogens?

Yes

No

Risk

Acceptable ? Validated ?

Yes

No

Safe

Risk

Instructions given to the consumer ?

Yes

No

Risk

Is there a chance he will not follow exactly the cooking process ?

Yes

No

Risk

Safe

WHY ? ASSESS RICK

Pasteurization

Modification of flour properties

Stabilization

Roasting

2009, 77 people reported as sick, 30 states
Toll House Cookie Dough, Nestle
Was written not to eat before warm up
FDA found E. Coli in chocolate chip cookie dough
> 3.6 million packages recalled

Neil & al., 2011

Survey: 1,032 individuals in the United States
➔ **58%** of consumers have tasted refrigerated rough before baking

ConAgra Mills, 2011

2010 : Nestle, USA decided using only heat-treated flours for refrigerated dought products

IS IT GOING TO EXTEND?

Against

Majority still going through kill step
Low moisture / water activity
Low level of microorganisms
Adverse effect on flour functionnality/quality
Cost

For

Product recalls
Can be exposed to pathogens in soil/water or from birds/animals
Can be impacted by wet harvest period / low harvest temperature
Increase for wholegrain foods (might reduce obesity, cardio vascular disease, diabetes…)
Can be eaten raw
Can be added to foods that will not be cooked (milkshakes, ice cream…)

HOW TO CONTROL THE RISK ?

Pasteurization

Modification of flour properties

Stabilization

Roasting

Wheat → Cleaning → Tempering → Milling

Dhillon et al., 2010
Galeas, 2014

Chlorinated water
Ozone
Acetic / Lactic acid

Hesseltine, 1968 – Sperber & North American Millers, 2007

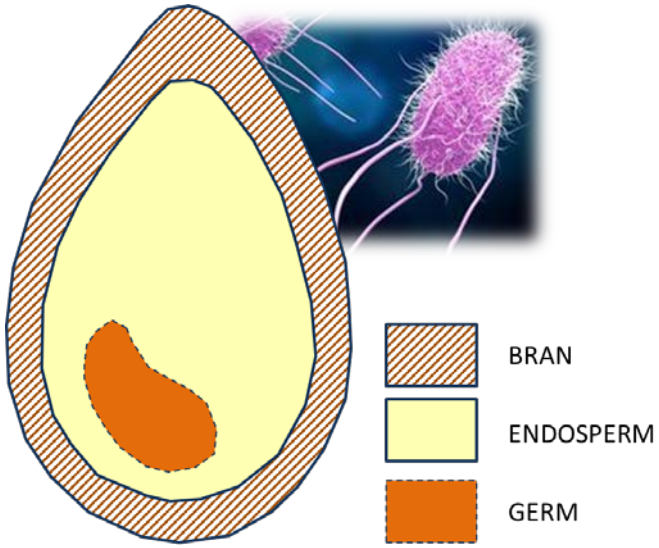
Wheat, 15% moisture → Heat treatment 1h, 60°C

Wheat, 15% moisture

→ Milling → APC: 2.43

→ Milling → APC: 4.69

HOW TO CONTROL THE RISK ?



Higher contamination
on the outer layers

Miskelly & al., 2010

Higher risk
for **whole** wheat flour

Heat treat wheat kernels outer layers

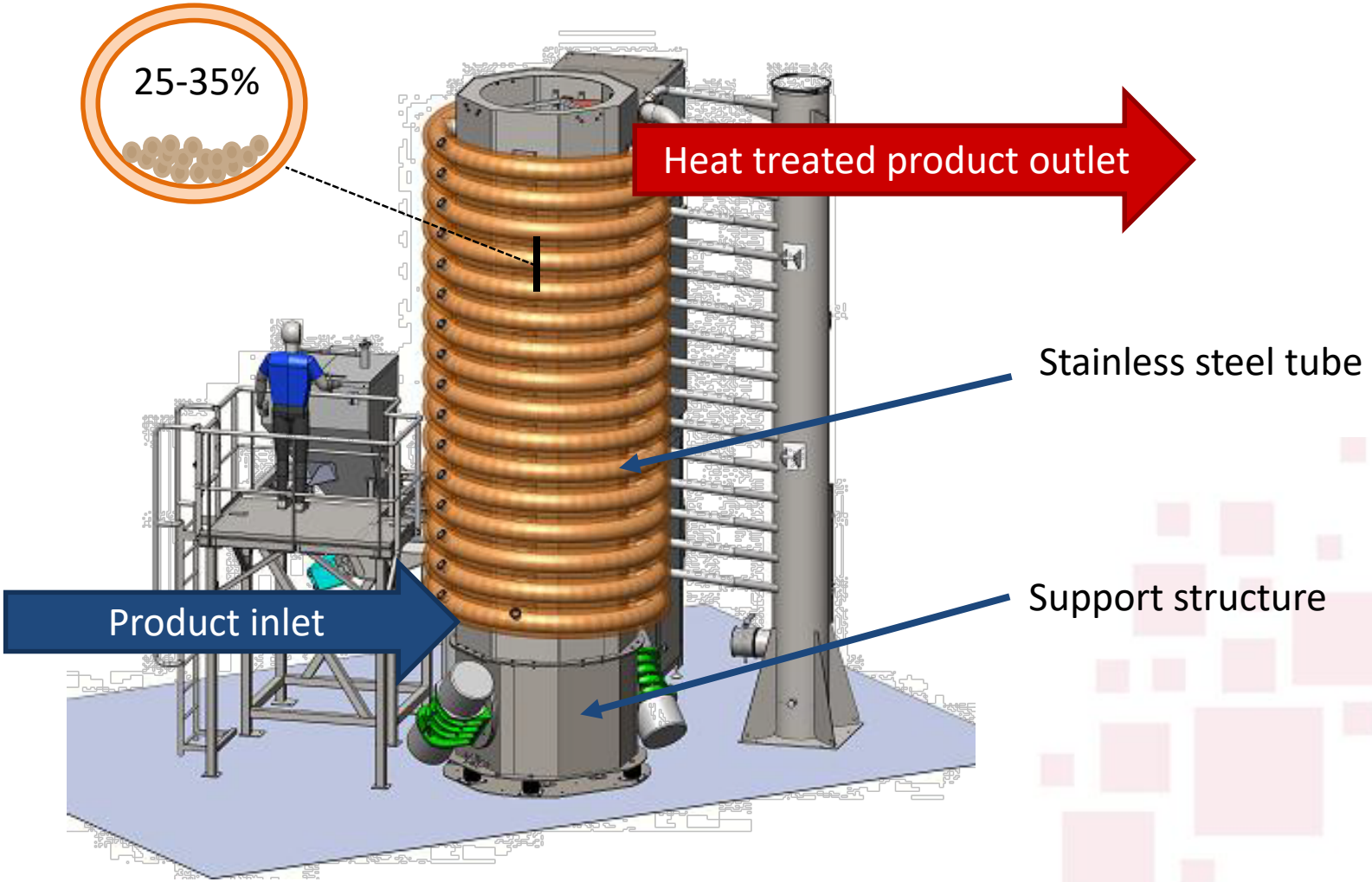
Reduce microbiological load

Mill into flour

THE REVTECH TECHNOLOGY

4 in 1

- Pasteurization
- Modification of flour properties
- Stabilization
- Roasting



THE REVTECH TECHNOLOGY

4 in 1

- Pasteurization
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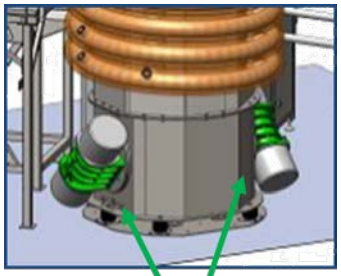


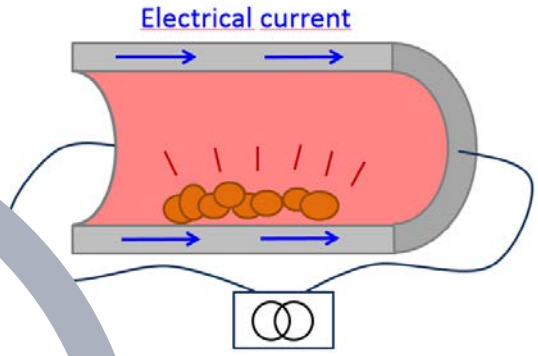
Off balanced motors

Frequency: ~ 12 Hz
Amplitude: ~ 4 mm
Acceleration: ~ 4 g

1. Transportation / mixing by vibrations

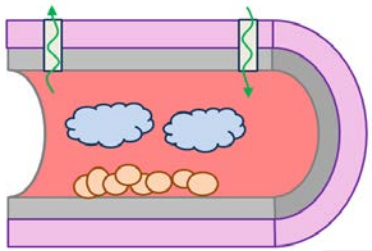
2. Heating by direct contact with a hot surface

3. Treatment in a confined atmosphere

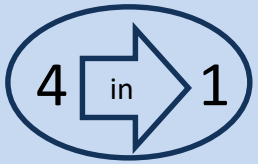


High current

Low voltage < 40V



REVTECH PROCESS SYSTEMS



Pasteurization

Modification of flour properties

Stabilization

Roasting

THE REVTECH TECHNOLOGY

Flowrate

200 lbs/h to 4,000 lbs/h

Temperature

100 to 800°F

with 2 to 4 independent heating zones

Residence time

1 to 40 mn

Atmosphere

air, steam, nitrogen…

4 in 1

Pasteurization

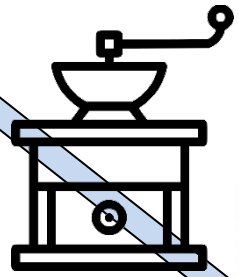
Modification of flour properties

Stabilization

Roasting

REVTECH RESULTS

Product	Conditions	Residence time	Steam	Tube temperature	Average of 3 Samples: TPC (cfu/g)	Enterobacteria (cfu/g)	Yeasts & Molds (cfu/g)
Wheat grains	Raw material				140 000	12 000	1 600
	Revtech 1	5 min	10%	210°F	< 10	< 10	< 10
	Revtech 2			240°F	< 10	< 10	< 10
	Revtech 3			265°F	< 10	< 10	< 10



Reduced TPC
Elimination Enterobacteria / Yeasts & Molds
Safer wheat flour !

REVTECH PROCESS SYSTEMS

REVTECH RESULTS

Pasteurization

Modification of flour properties

Stabilization

Roasting

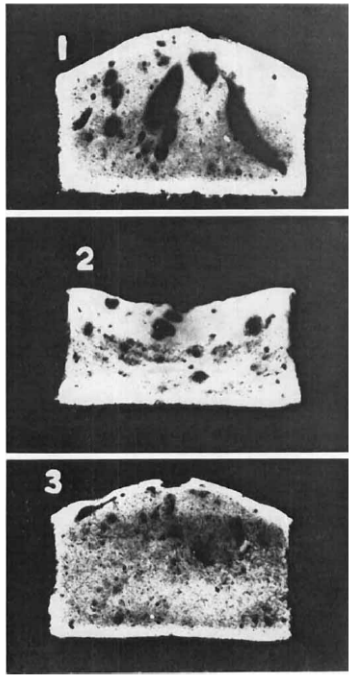
Product	Conditions	Residence time	Tube temperature	TPC (cfu/g)	Enterobacteria (cfu/g)	Yeasts & molds (cfu/g)
Wheat flour	Raw			2 000	510	320
	Raw			5 000	1 500	300
	Raw			2 300	120	150
	Low temp	5 min	160°F	750	250	100
		10 min		610	< 40	< 40
		15 min		720	~ 40	< 10
	Medium temp	5 min	175°F	430	< 40	~ 40
		10 min		170	~ 40	< 10
		15 min		150	< 10	< 10
	High temp	5 min	190°F	< 400	< 10	< 10
		10 min		< 40	< 10	< 10
		15 min		< 40	< 10	< 10

Pasteurization works on wheat flour as well !

But higher surface/volume ratio
➔ Higher contact with heat
➔ Might change flour properties

REVTECH RESULTS

Russo et al., 1970



Chlorinated flour

Untreated flour

Heat treated flour (Drum, 250°F)

Keppler, 2017

Untreated flour

Revtech 230°F, 10:45min

Revtech 300°F, 9:50min

REVTECH RESULTS

Pasteurization

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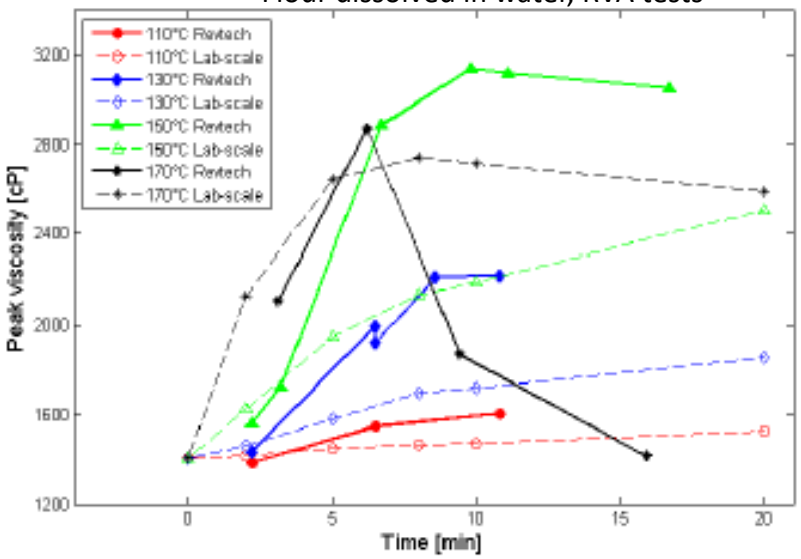
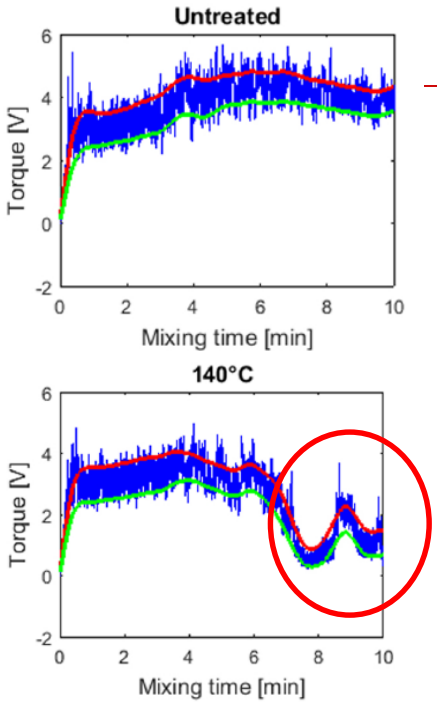
Flour dissolved in water, RVA tests





Rheomixer tests

↗ Temperature

↗ Processing time

Easier for granules to swell ? → ↗ Viscosity

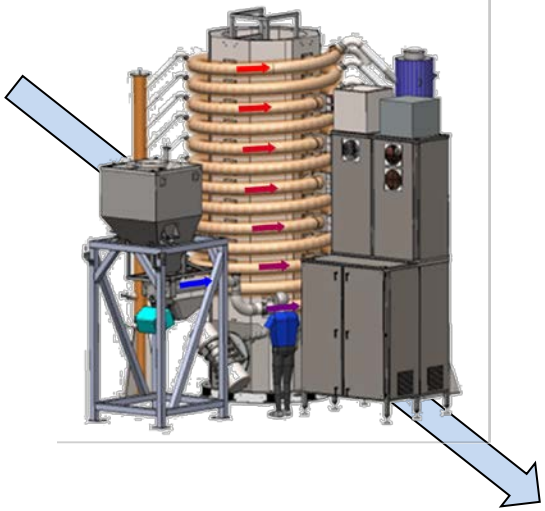
Instability of gluten network

Keppler, 2017

WHAT ABOUT BRANS / GERMS ?

Raw brans / germs

About
250°F, 10 minutes



Source of fibres

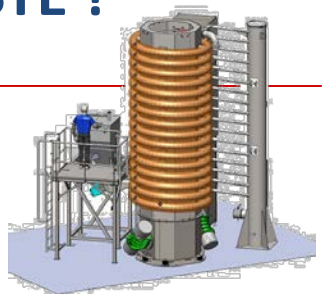
High enzyme activity:
Lipase + Lipoxygenase

Short shelf life

Enzyme inactivation

↗ Shelf life

AND IF I WANT TO CHANGE COLOR/TASTE ?



Temperature around 150 to 250°C / 300 to 480°F

Residence time around 10 to 20 mn

Wheat flour - 430°F , 0 – 3 – 6 – 9 – 15 – 30 mn

Milled wheat bran: 430°F , 0 – 3 – 6 – 12 – 18– 24 mn

Wheat germs: 350°F , 0 – 6 – 9 – 12 –21 mn

CONCLUSION

4 applications, 1 equipment

Great **homogenity**

Only gentle vibrations (no auger, belt mixer)

Works for small **pieces and powders**

Every machine **can be validated** to FDA standards

4 in 1

Pasteurization

Modification of flour properties

Stabilization

Roasting

CONCLUSION

More than **120 units** installed around the world

THANK YOU

Any question ?

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