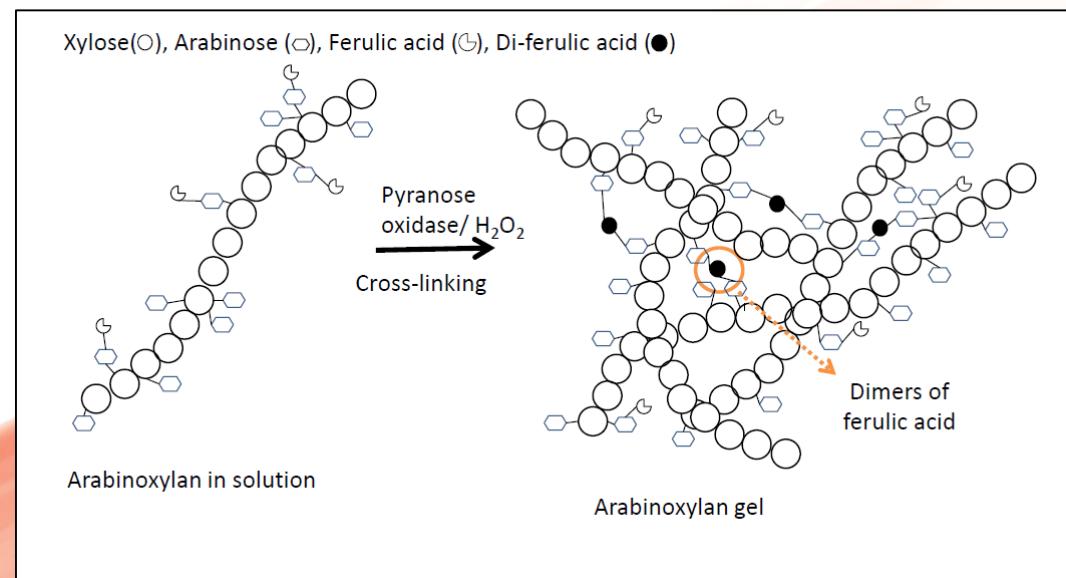




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Improving gluten-free bread by novel arabinoxylan networks

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Introduction



Gluten

vs.

Gluten-free



- Baking quality
- Viscoelastic properties



Nutritional properties



Technological properties



Sensory properties

- Mainly composed out of starch and rice flour → nutrient deficiencies
- Poor viscoelastic properties → resembles a cake “batter” rather a dough
- Low volume, firm crumb and fast staling





Batter/dough stability & ingredients

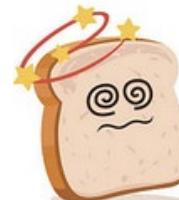
Wheat bread

vs

Gluten-free bread



- Stable dough
- Controlled by gluten



- Unstable batter
- Controlled mainly by starch



Which/how many ingredients are needed for GF bread?





Problems in GF Bread

No baking additive has been able to **FULLY** match gluten's performance



Alternatives?

Promising: Imitate a rye bread-like structure

Rye

Lower gluten content



→ Baking ability strongly attributed to arabinoxylans (AX)

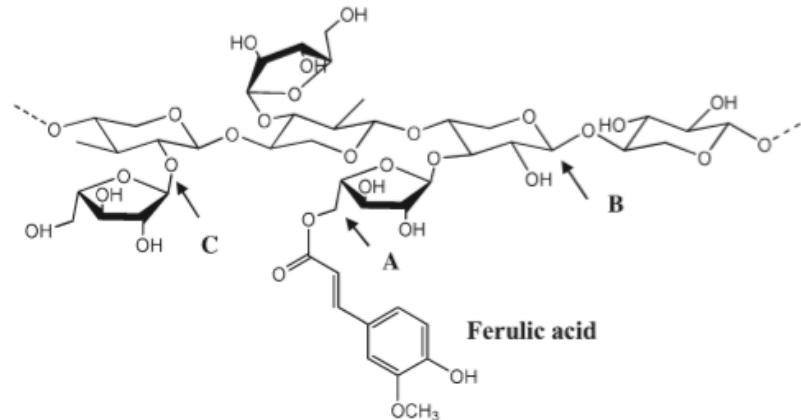
Network formation weaker than gluten formed by endogenous enzymes, AX and low pH (Sourdough)



Arabinoxylans (AXs)

What are arabinoxylans?

- Hemicelluloses
- Outer layer (bran) and endosperm cell walls of cereals



Application in rye bread¹:

Next to gluten ➔ AX plays dual role

Dough
Bread quality



- Increases μ and H_2O absorption in dough
- Cross-linking of AXs

}

Oxidative
gelation



Oxidation of F.A.



Hemicellulose network



Transfer principle to GF-breads

¹Hartmann et al., 2005

AX extraction I- Methodology

Extraction

BOKU



Raw material: Rye bran

Fixed parameters²:

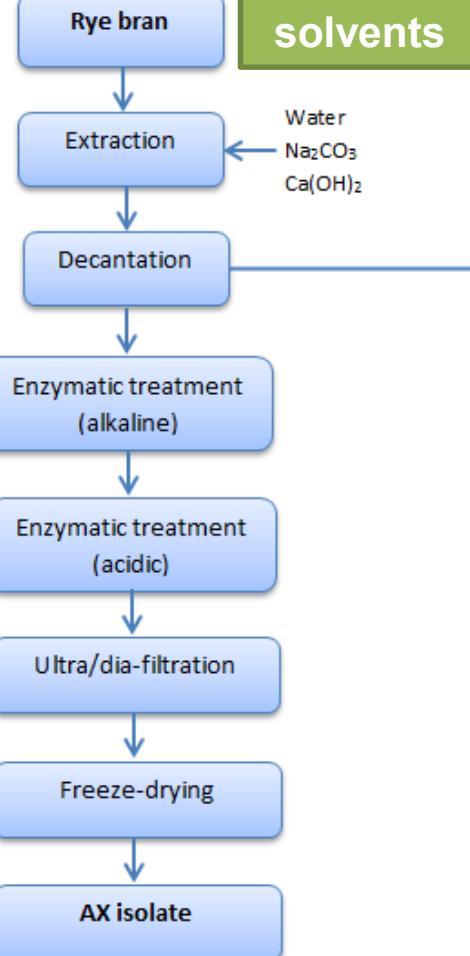
- T= 65°C
- t= 100 min
- Concentration solvent =0.17M

Variables: Solvents, enzymes

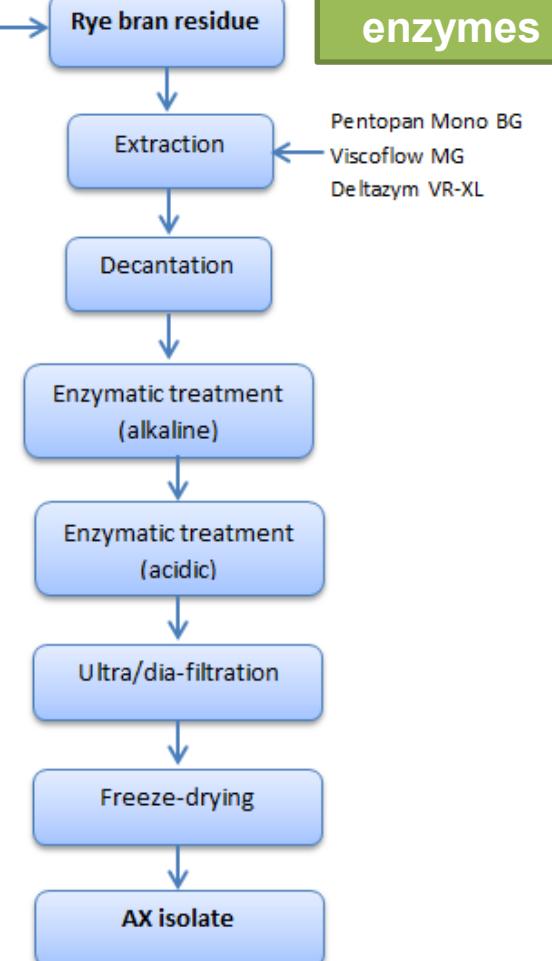
Target output:

- Extraction yield
- Ferulic acid
- Purity

Solvent extraction



Enzymatic extraction



²Bender et al. 2017a. Chem. Biol. Technol. Agric. 4(1).

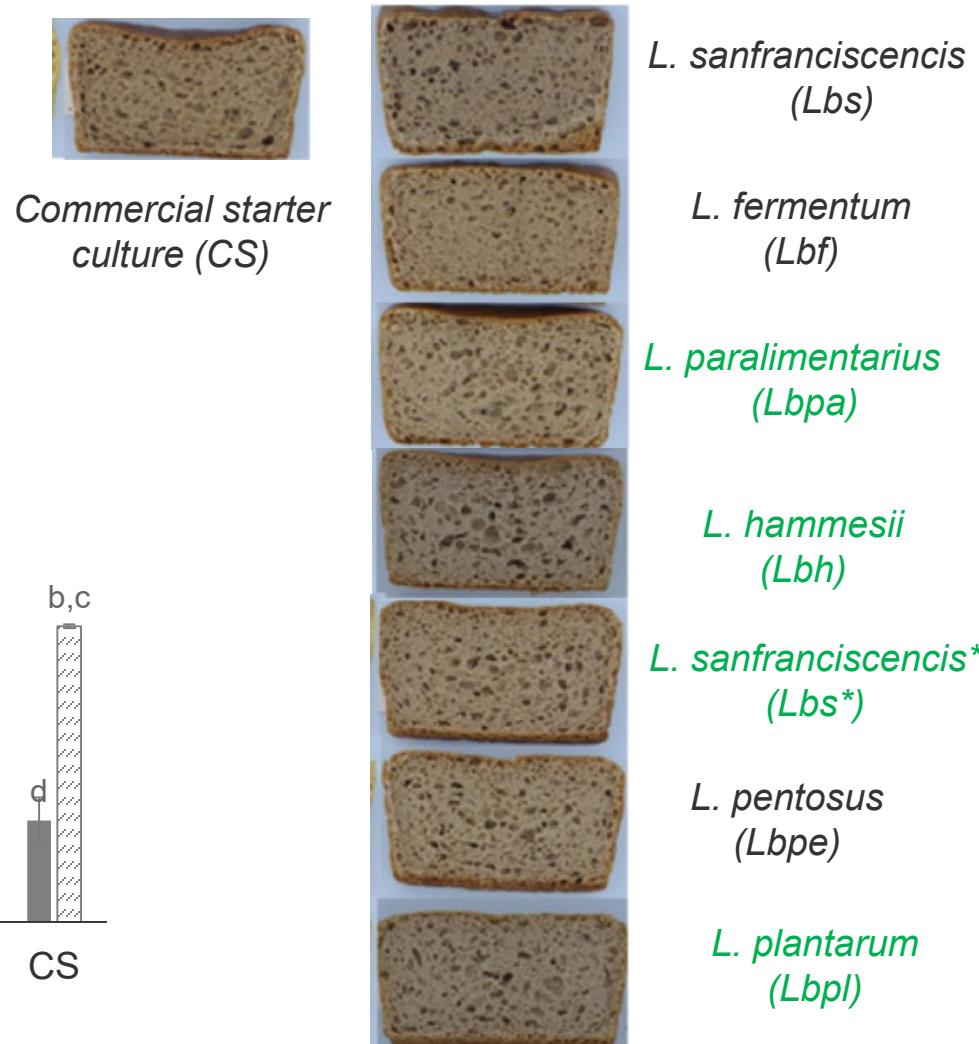
Sourdough Technology- Methodology and Results



Buckwheat bread

Variables:

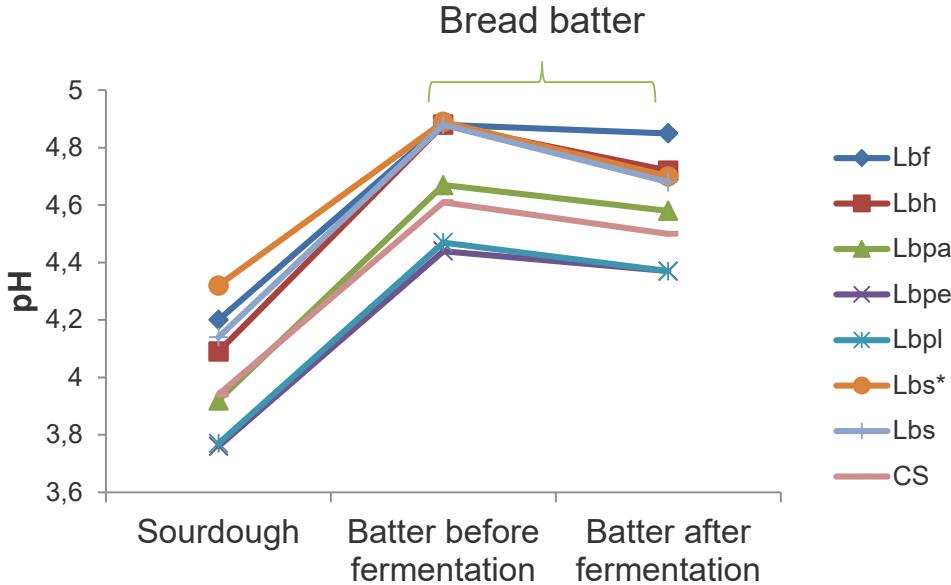
- 7 isolated LAB
- 1 commercial GF starter culture (CS)



* Type strain of the species

Bender et al. 2018a. Eur Food Res Tech. 244(6)

Sourdough Technology- Methodology and Results⁶

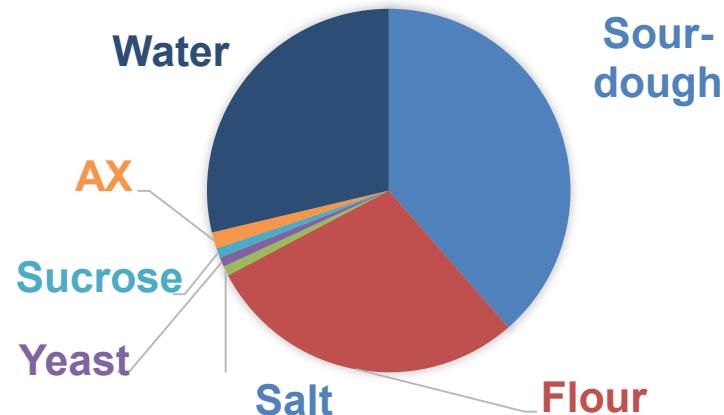


Acids affects

- **proteins**, starch and AXs
- Enzymatic activity of endogenous enzymes
- Softness of bread

Fermentation quotient
→ Important for structure

Formulation:



Effect of different rye AXs – Results



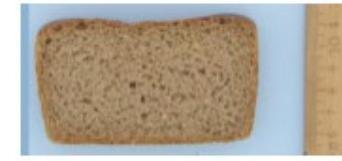
Control



H_2O



Na_2CO_3



$Ca(OH)_2$



Pentopan



$H_2O +$
Pentopan

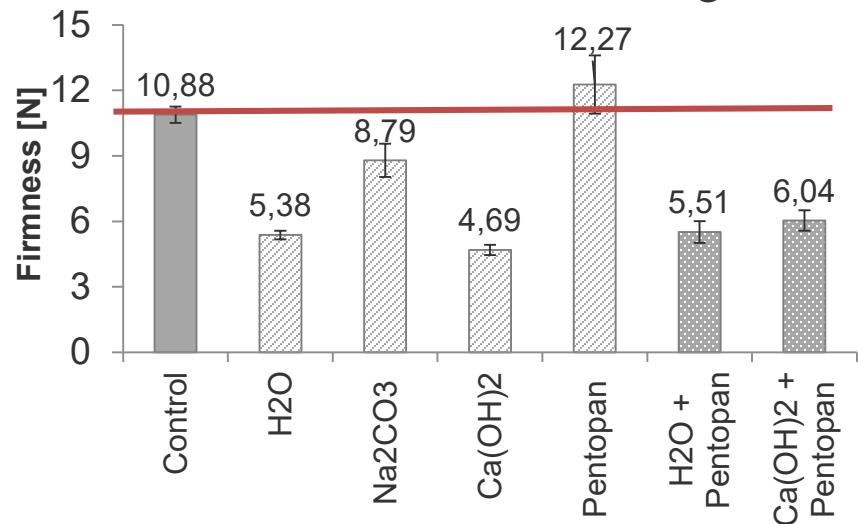
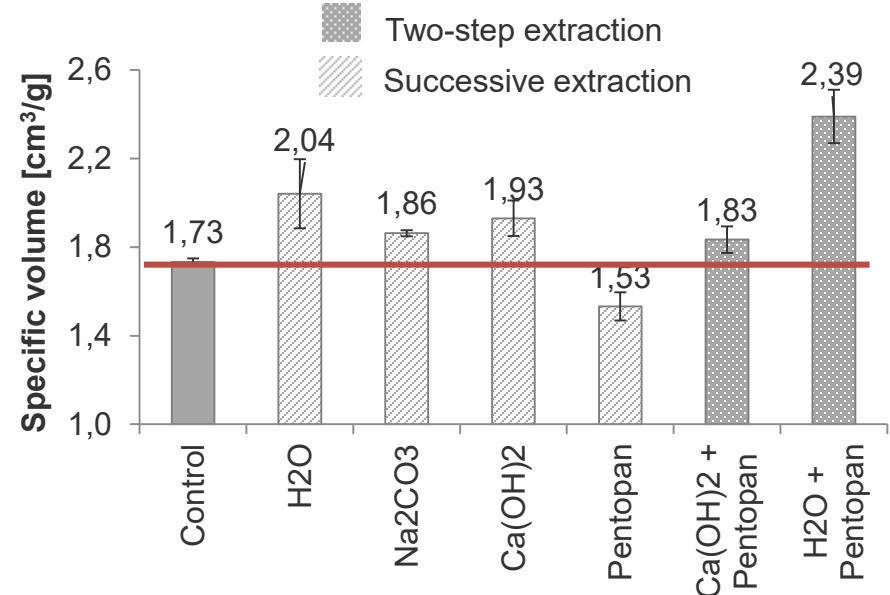


$Ca(OH)_2 +$
Pentopan

Important factors:

AX properties

- FA content
- Molecular size
- Branching degree
- Flour properties





Conclusion



Extraction

- Extraction will affect AX properties



Sourdough Technology

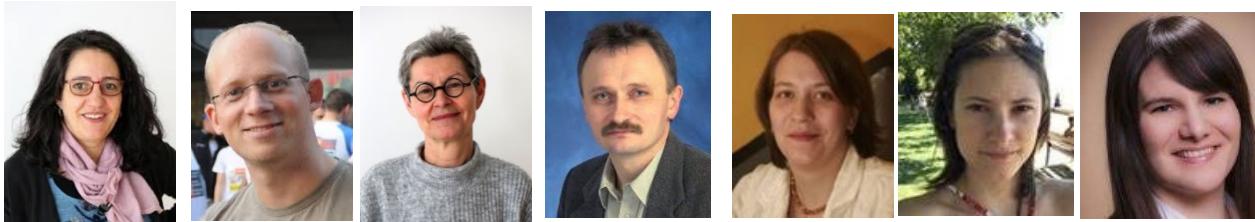
- Strain selection and compatibility with flour are crucial



Baking with AX

- Breads mostly improved with AX addition
- Can be used as a structure-forming agent
- Effect delimited by AX properties

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