

Use of a New GH8 Family Xylanase in Baking and Milling

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Agenda

Arabinoxylan in wheat flour

Xylanase functionality in baking

Substrate specificity

NMR and HPLC results

Naturally uninhibited

Benefits in milling and baking industries

Arabinoxylan in wheat flour

Main wheat kernel components

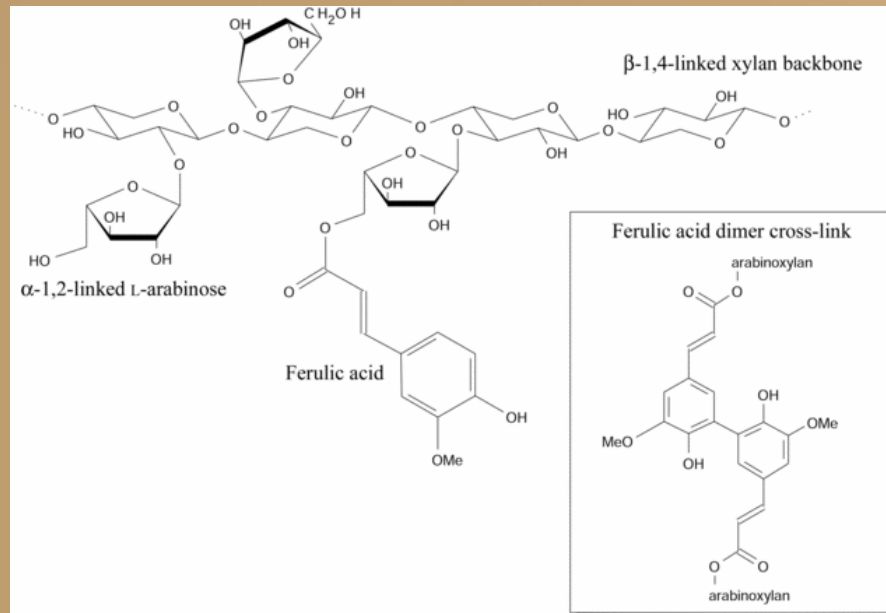
Starch	65-70%
Proteins	10-12%
Non-starch polysaccharides (NSP)	2-3%
Lipids	1.5-2%

Arabinoxylan in wheat flour

AX make up 85% of NSP

25-30% is water extractable (WE)

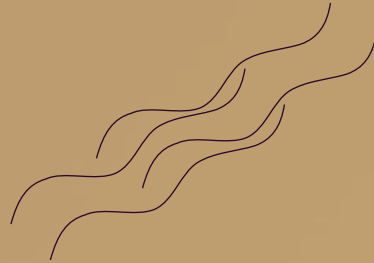
70-75% is water un-extractable (WU)



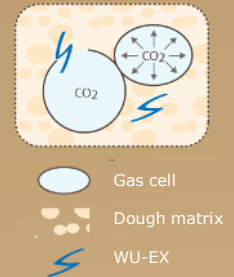
Functionality in baking

Extent of AX degradation

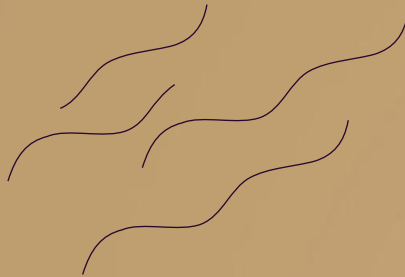
WU-AX



Gas cell perforation
 Coalescence and decreased
 gas retention
 Lower stability of dough
 foam
 Lower loaf volumes with
 coarser crumb



**HMW
WE-AX**



Increase in viscosity
 Redistribution of previously
 bound water
 Better dough foam stability
 and gas retention
 Crumb structure homogeneity
 and increase in loaf volume



**LMW
WE-AX**



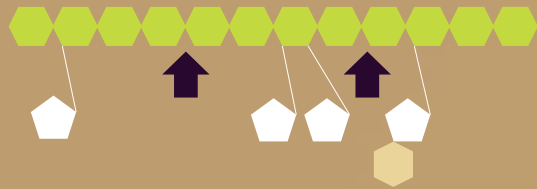
Drop in dough viscosity
 Too excessive water release
 Risk of too soft and sticky
 dough
 Poor machinability



Xylanases are vital for bread making

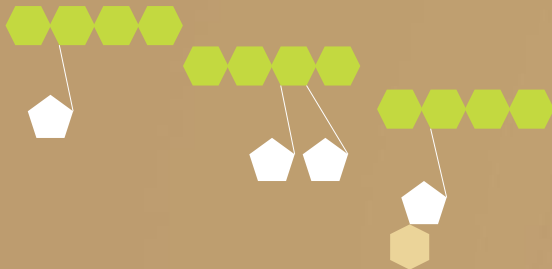
General mode of action for xylanases

Water-unextractable arabinoxylan (WU-AX)



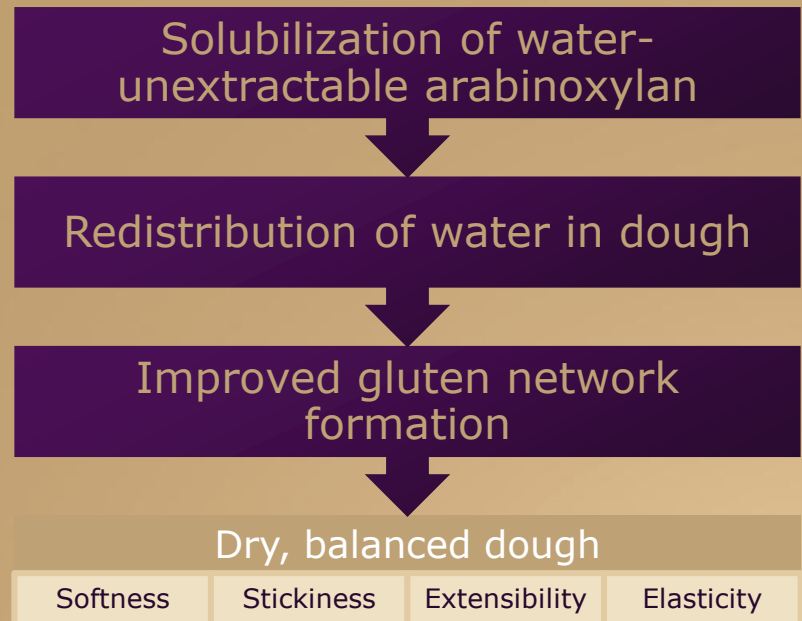
Endoxylanase

Water-extractable arabinoxylan (WE-AX)



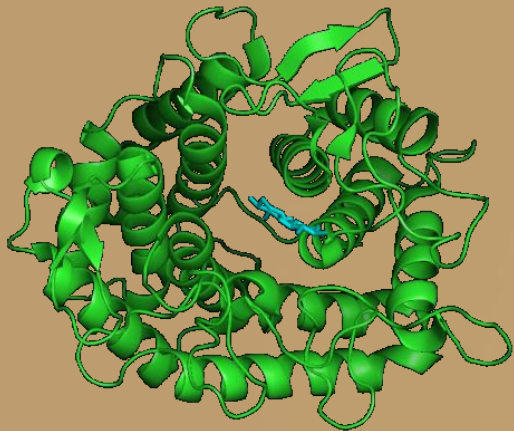
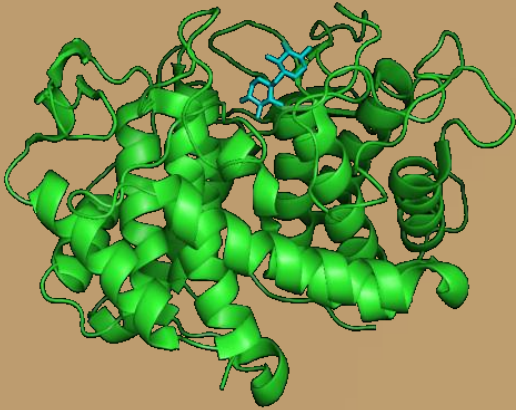
 Xylose  Arabinose  Ferulic acid

Principles of desired xylanase impact on dough properties

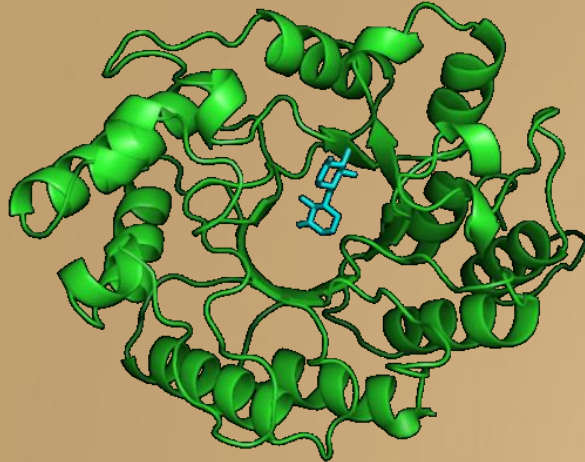
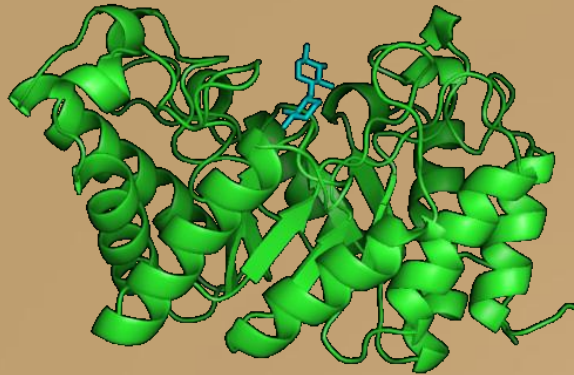


Xylanase families used for baking

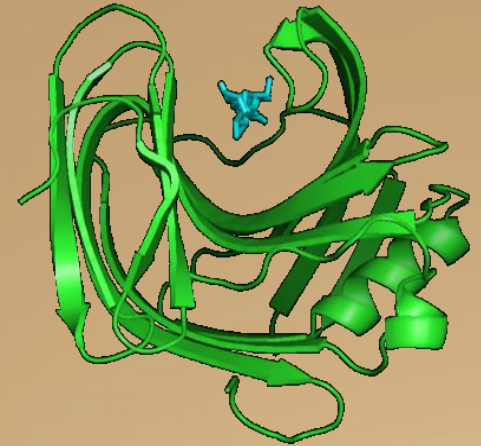
GH8



GH10



GH11

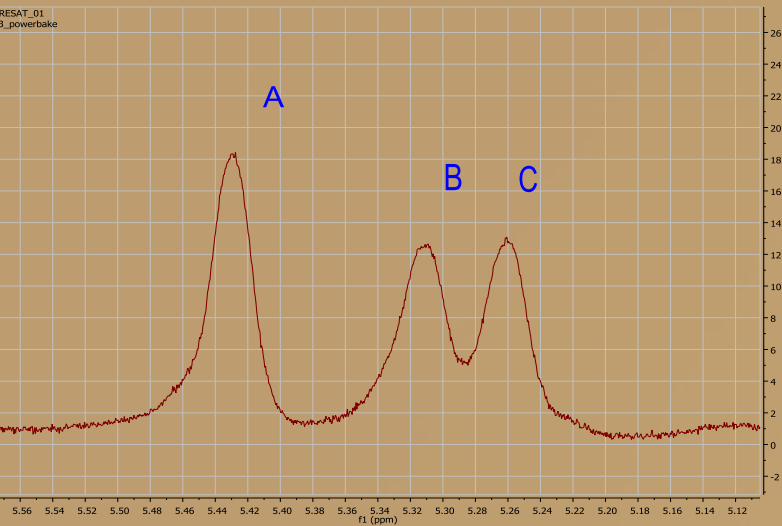


Substrate specificity?

- How does the GH8 family differ in degradation of arabinoxylan compared to GH11?
- The specificity of GH8 has been investigated by ^1H NMR spectroscopy and HPLC and compared to GH11

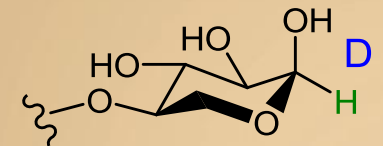
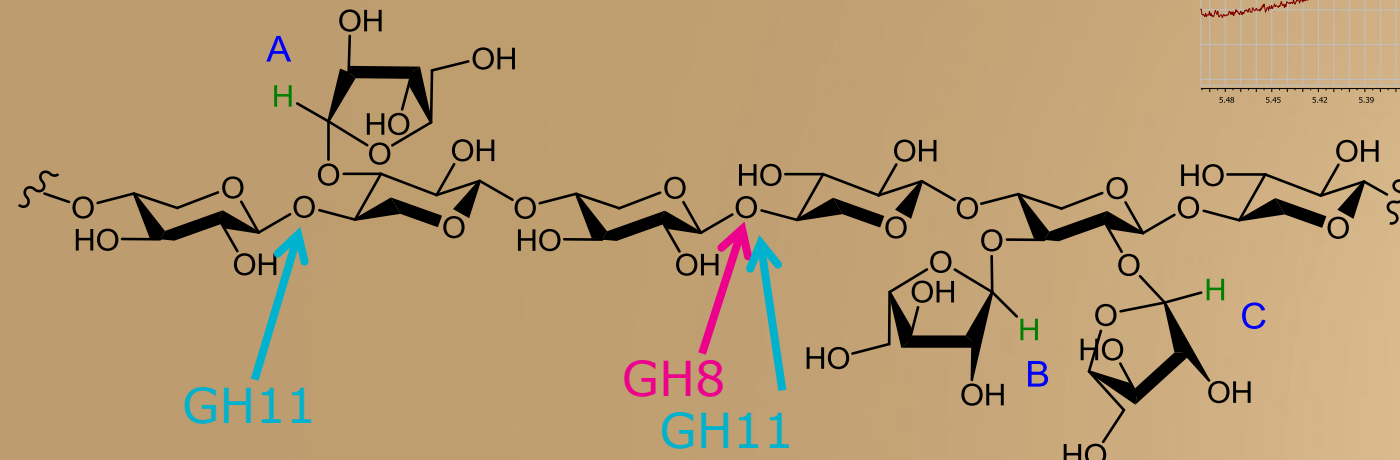
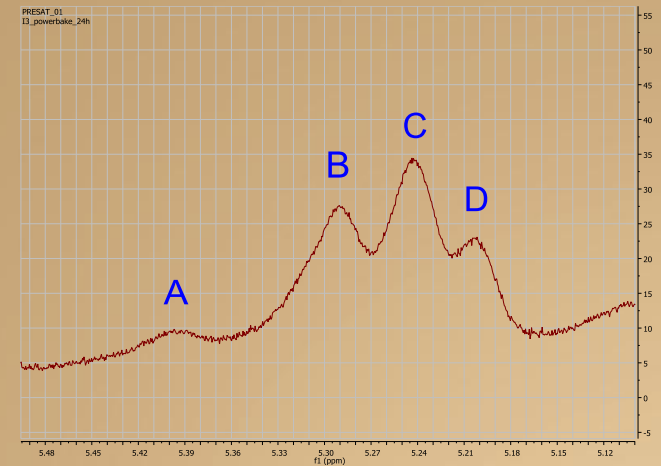
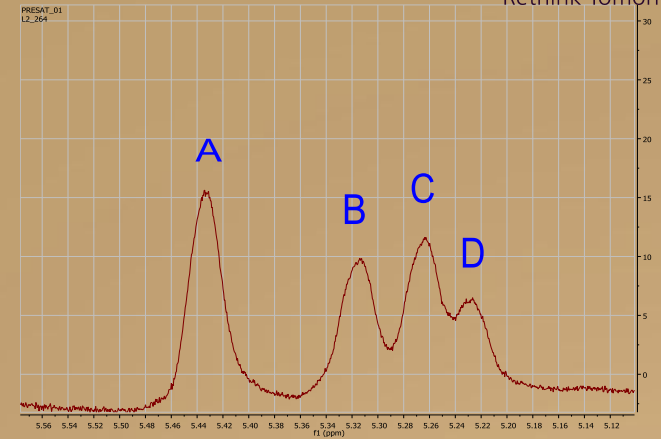


Degradation of arabinoxylan



GH8

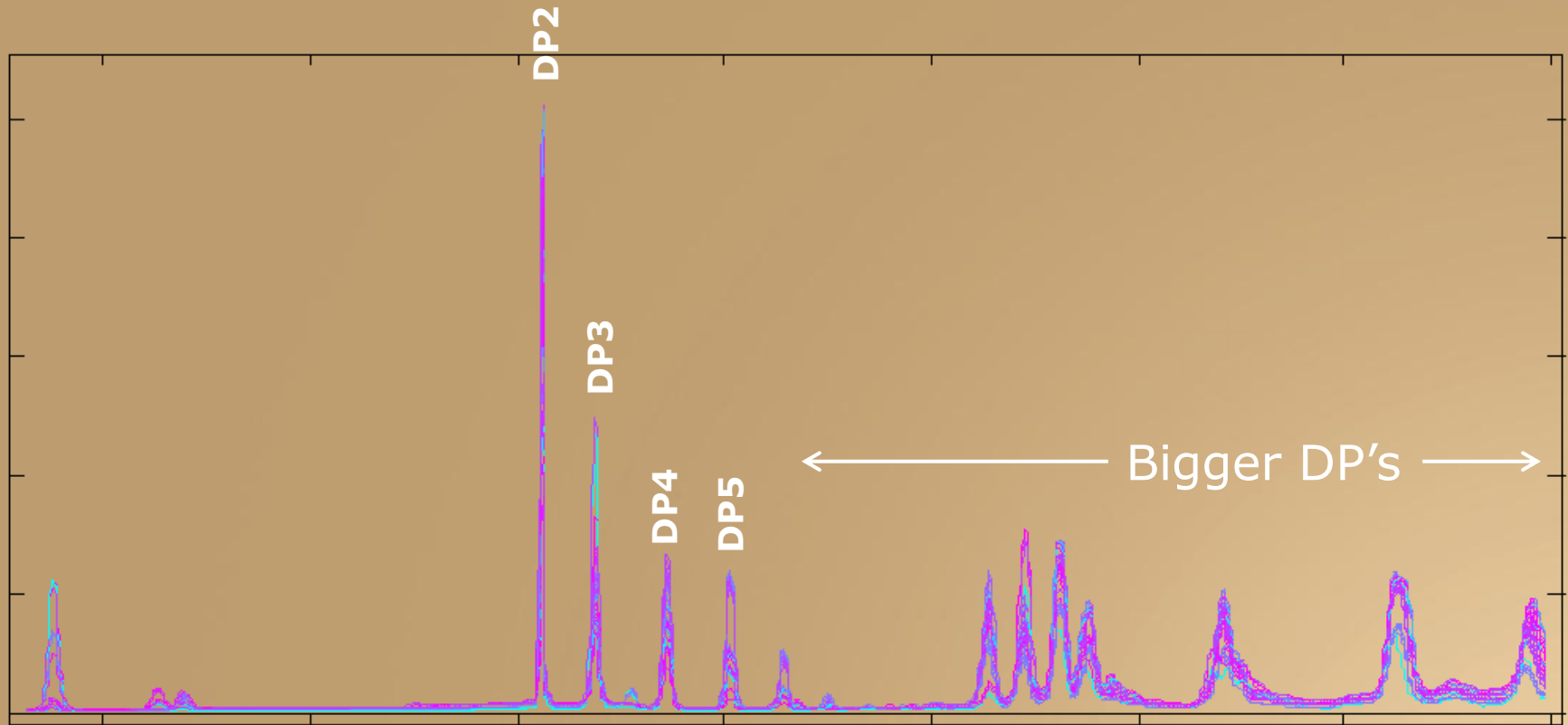
GH11



HLPC measurements

HPLC:

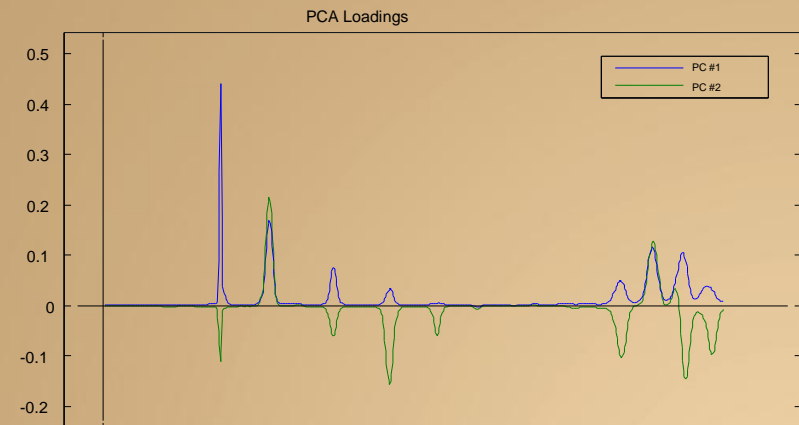
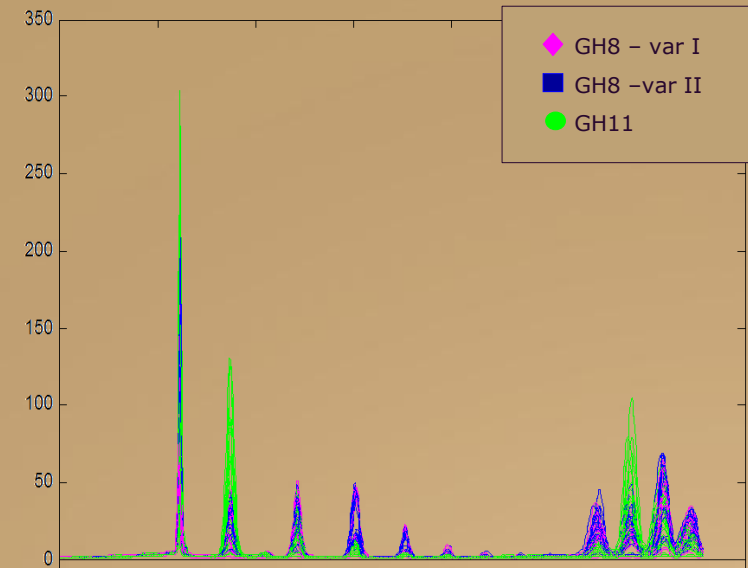
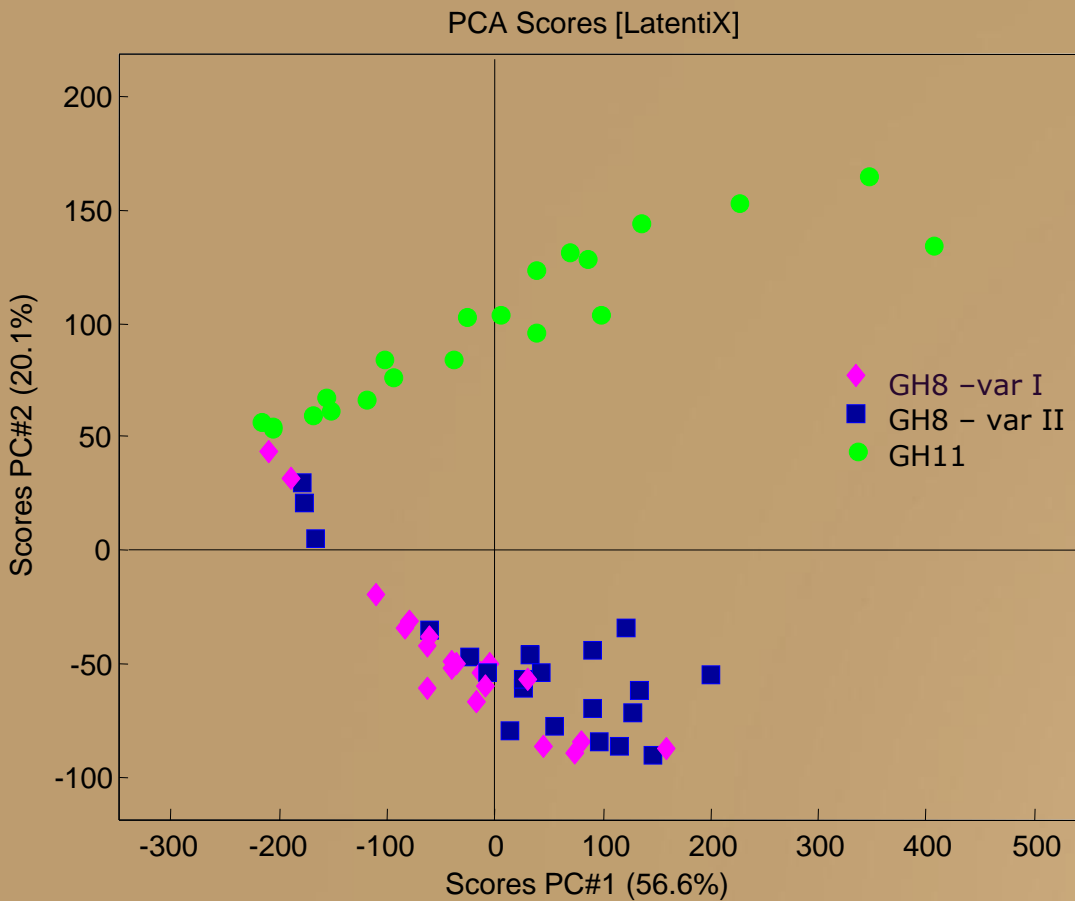
LW- and HW AX and Insoluble AX
0-1-2-4-6-8-24h
2 GH8, 1 GH11



icoshift chromatograms

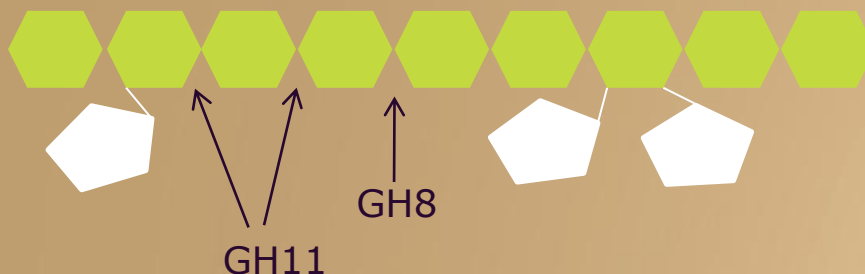
-An *ultra rapid* and versatile tool for the alignment of spectral datasets
Savoranni, et al. 2010

Multivariate approach on HPCL data



Substrate specificity

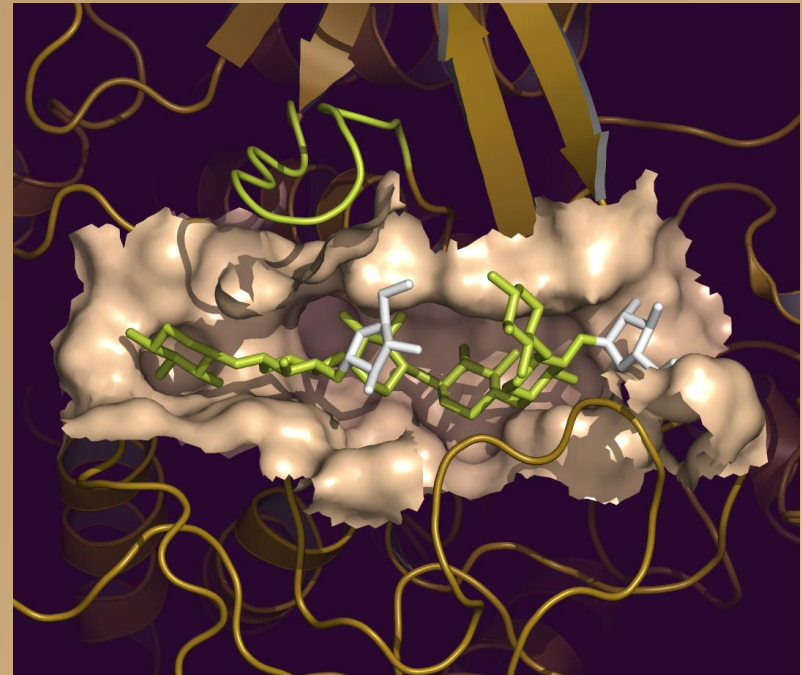
- GH8 is very active and is only cleaving between un-substituted xylose resulting in large amount of AX oligomers and a small amount of free xylose
- GH11 is slower and is cleaving next to un-substituted and mono-substituted xylose resulting in large amount of free xylose.
- The kinetics and the end-products of GH8 differ from GH11



New xylanase technological tolerance

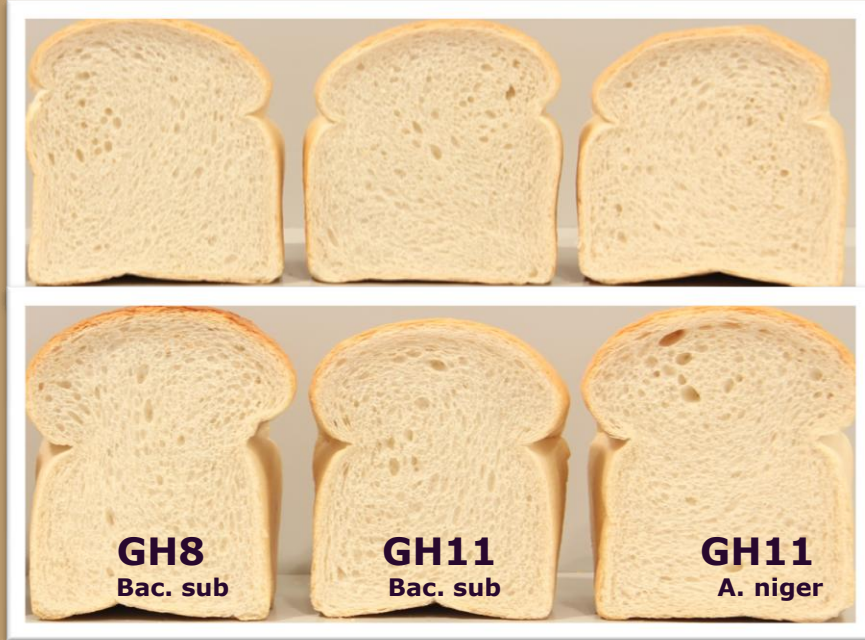
- Protein engineered in one of the loops lining the active site to modify substrate specificity and thereby reduce dough stickiness
- Naturally uninhibited
- Robust performance regardless of flour types
- High quality bread across different production parameters
- High performance in various bread types

Model of active site of new xylanase

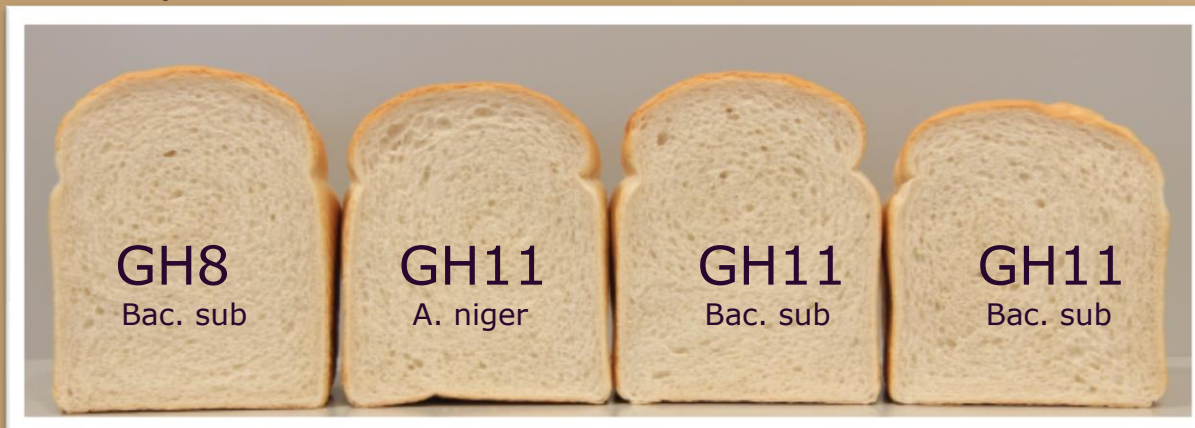


Performance in different recipes

White pan bread



Chorleywood bread



French baguette



Conclusions

New xylanase Panzea is related to GH8 family cleaving between un-substituted xylose resulting in large amount of arabinoxylan oligomers and a small amount of free xylose:

- makes dough more tolerant to different flour quality and variations in processing parameters
- combines superior volume performance and desired texture and appearance with a dry, balanced dough – all in one product

THANK YOU

ANY QUESTIONS?

Acknowledgment for generous
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Departments of Novozymes

