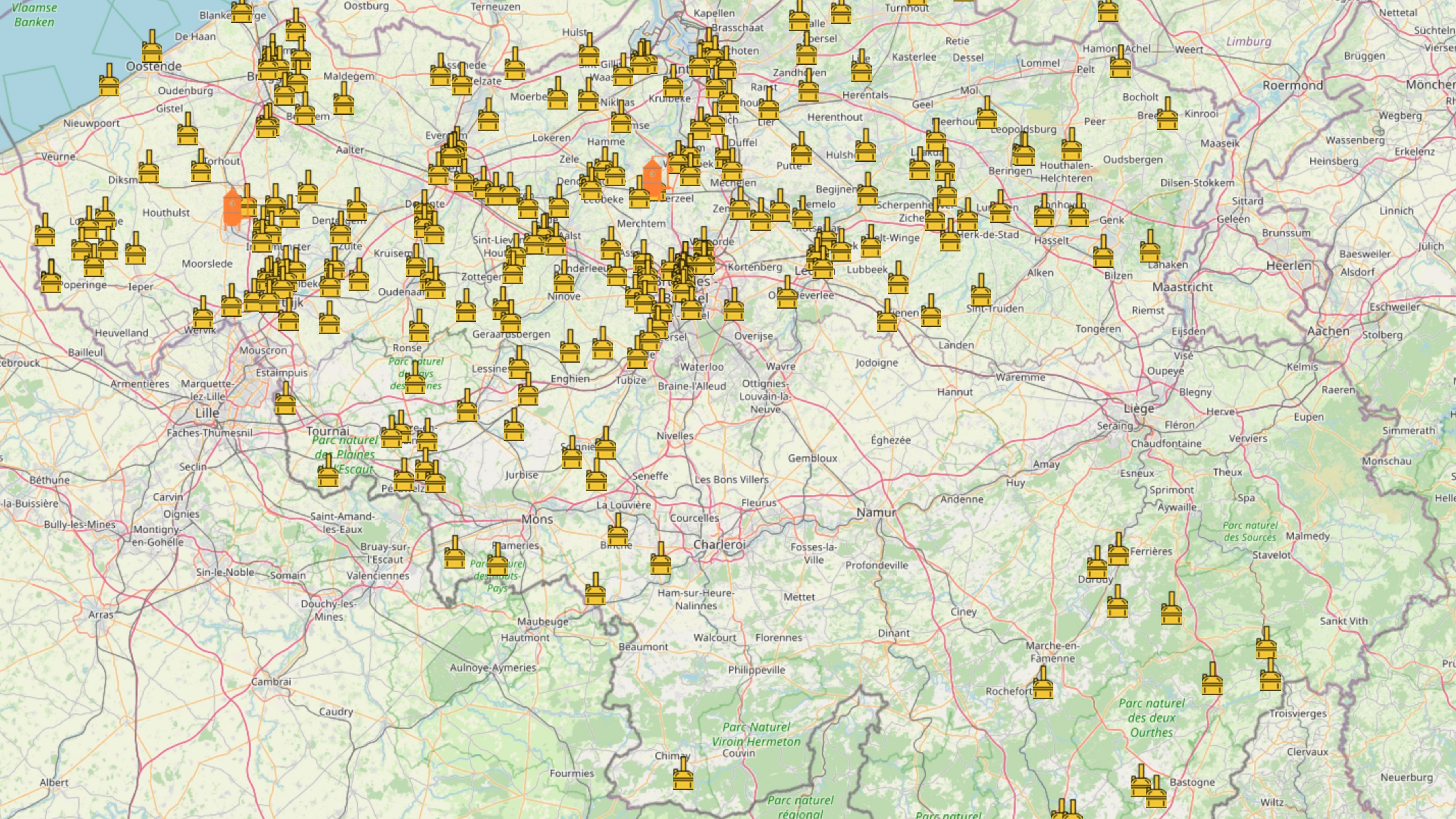


Jessika De Clippeleer, Ghent University, 16 August 2022

AlterBrew

A Practical Approach to Excellent Beers with Alternative Cereals



La carte des brasseries de Wallonie



Mais encore...

D'autres lieux touristiques et musées dédiés à la culture de la bière, comme l'Abbaye de Maredsous, la Maison Leffe à Dinant, le Musée de la bière à Sankt-Vith, le Musée de la bière au Château de l'Avouerie d'Anthies, le Musée des bières belges à Lustin... vous permettront de compléter votre programme de visites.

Plus d'informations sur le site:
visitwallonia.be/gourmandise

Des lieux accessibles pour tous !

Vous êtes une personne à besoins spécifiques et vous recherchez de l'information sur l'accessibilité des lieux qui composent cette carte? Access-i est fait pour vous !

Certains lieux ont reçu la visite d'un expert afin d'en vérifier leurs niveaux d'accessibilité. Pour en savoir plus et découvrir les infrastructures déjà certifiées et les aménagements mis en place, consultez:

www.access-i.be

12.5 25 km



La Gazette des Amis de la Bière

N°101 Printemps 2021
ISSN 1284 - 9111



● **Hommage à Pierre-André DUBOIS**



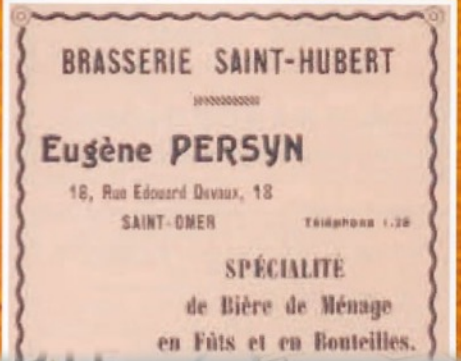
● **Le houblon**



● **De nombreuses nouvelles brasseries**

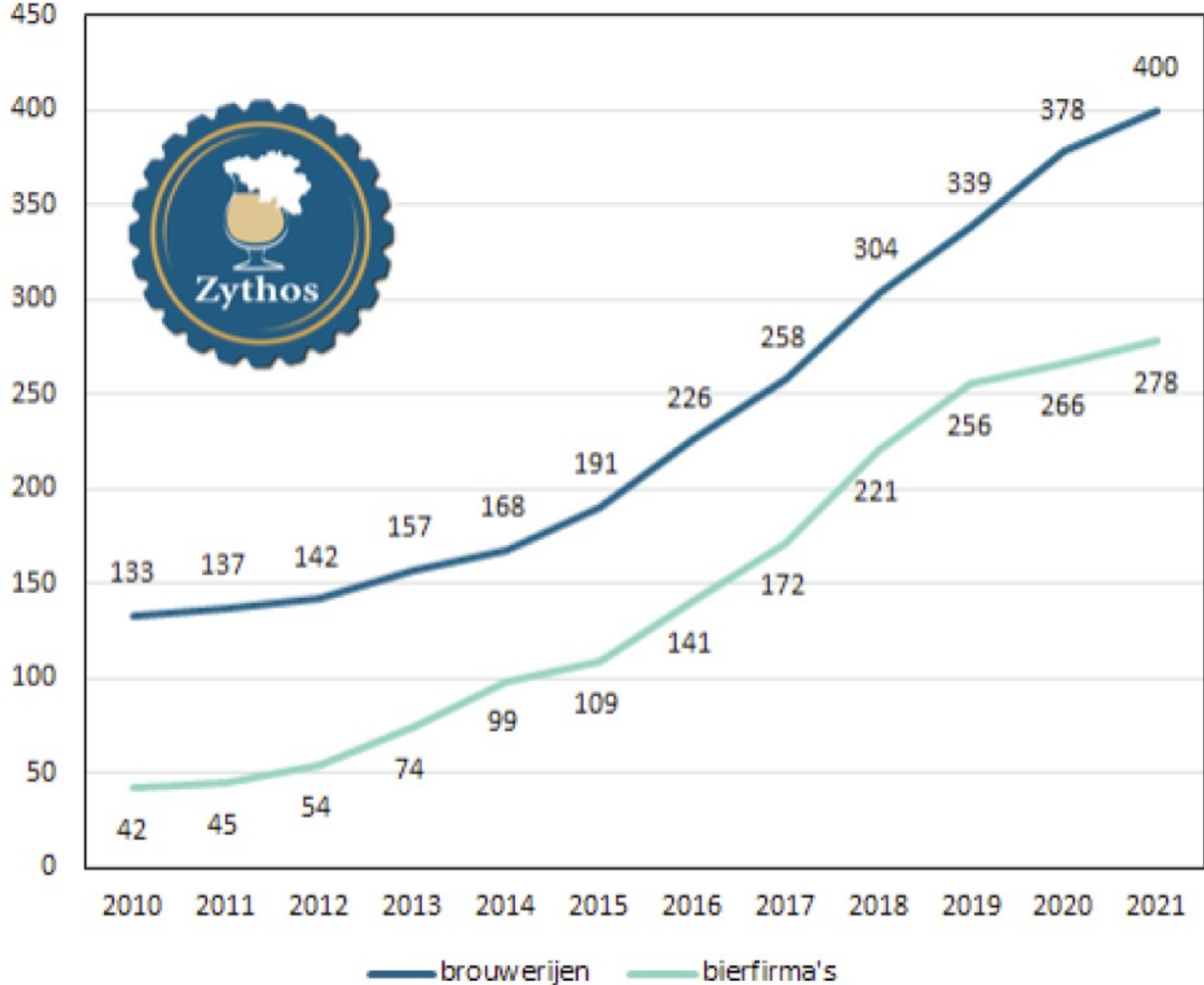


● **Zoom sur la famille Persyn**



Evolution of breweries and beer companies in Belgium

30/09/2021



VLAANDEREN

NORD-
PAS-DE-CALAIS

BXL

WALLONIA

"Les Micro-
Brasseurs
Nous inspirent!"
"Innovateurs!"











40%

addition of unmalted cereal

Ancient wheats



Einkorn



Emmer



Spelt



Khorasan

Pseudo-cereals



Amaranth



Quinoa



Buckwheat

Others



Tritordeum



Sorghum



Teff

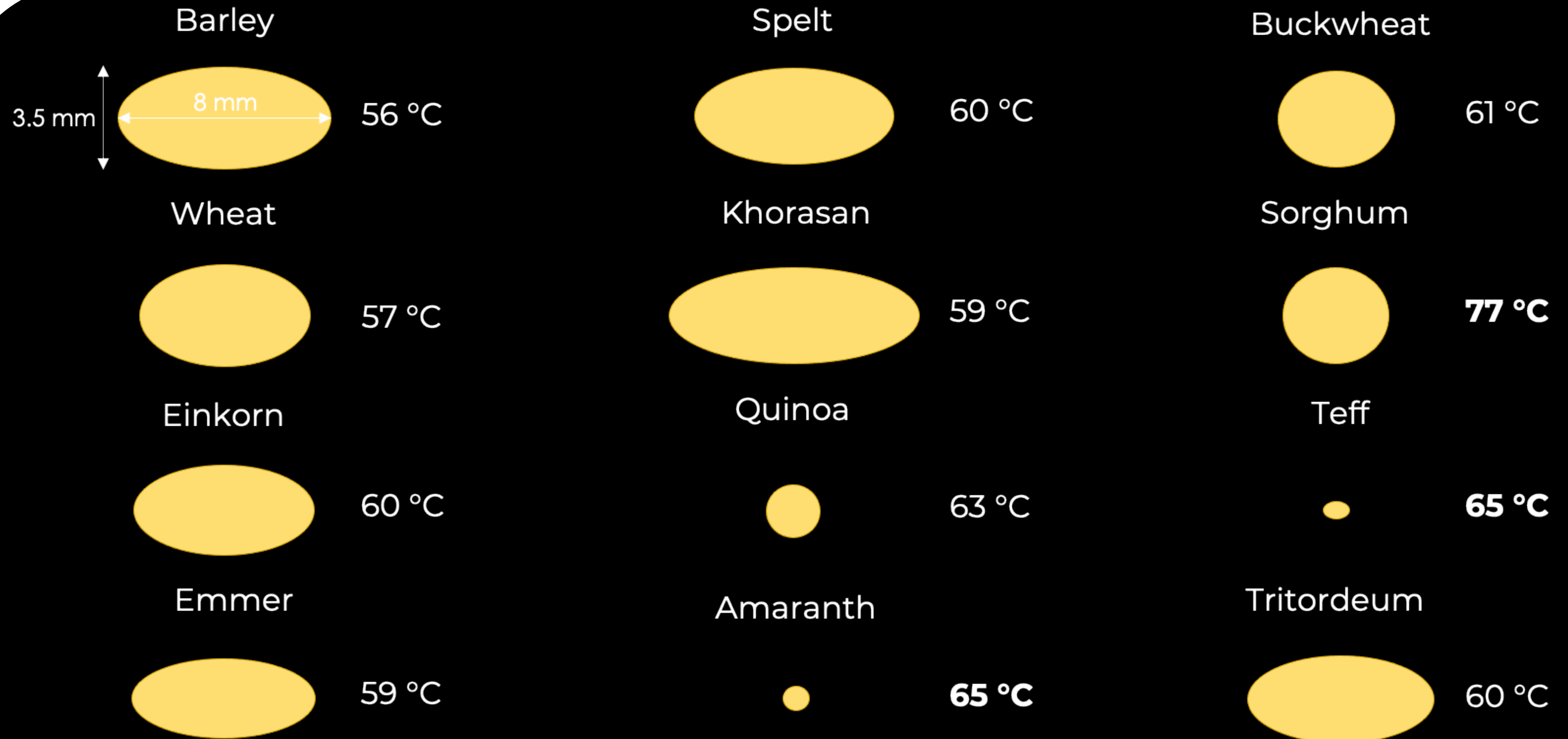


Sample set

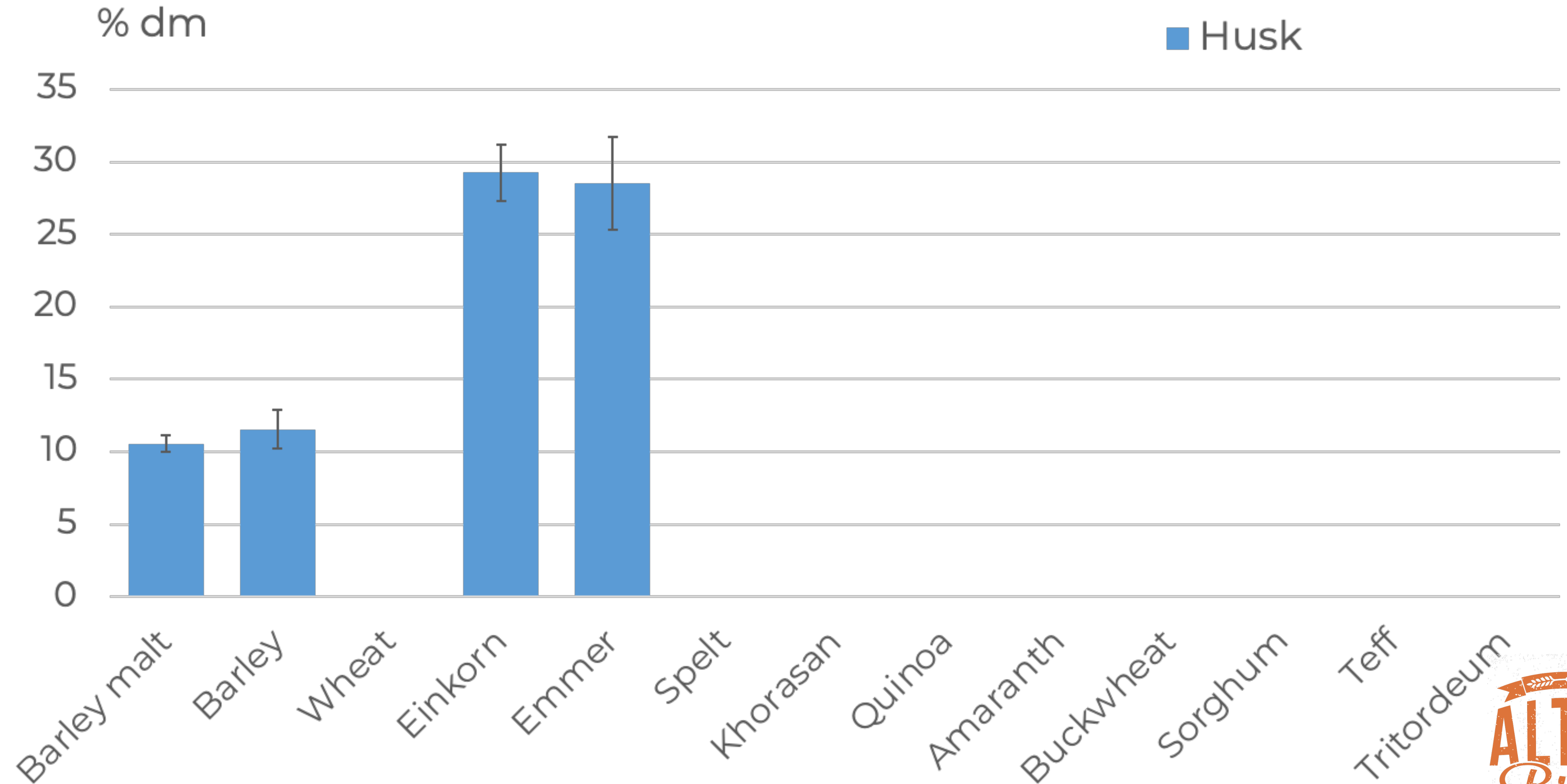
Cereal	Variety	Origin	Harvest year	Cereal	Variety	Origin	Harvest year
Barley	Etincel	France	2019	Quinoa	Vikinga	Belgium	2019
Wheat	Winter wheat	Belgium	2018	Amaranth	<i>A. caudatus</i>	India	2019
Einkorn	Ebner's einkorn	The Netherlands	2019	Buckwheat	Unknown	China	2019
Emmer	White emmer	The Netherlands	2019	Sorghum	CN7	The Netherlands	2018
Spelt	Frankenkorn	The Netherlands	2019	Teff	White teff	South Africa	2018
Khorasan	Kamut®	Canada	2019	Tritordeum	Bulel	Spain	2018



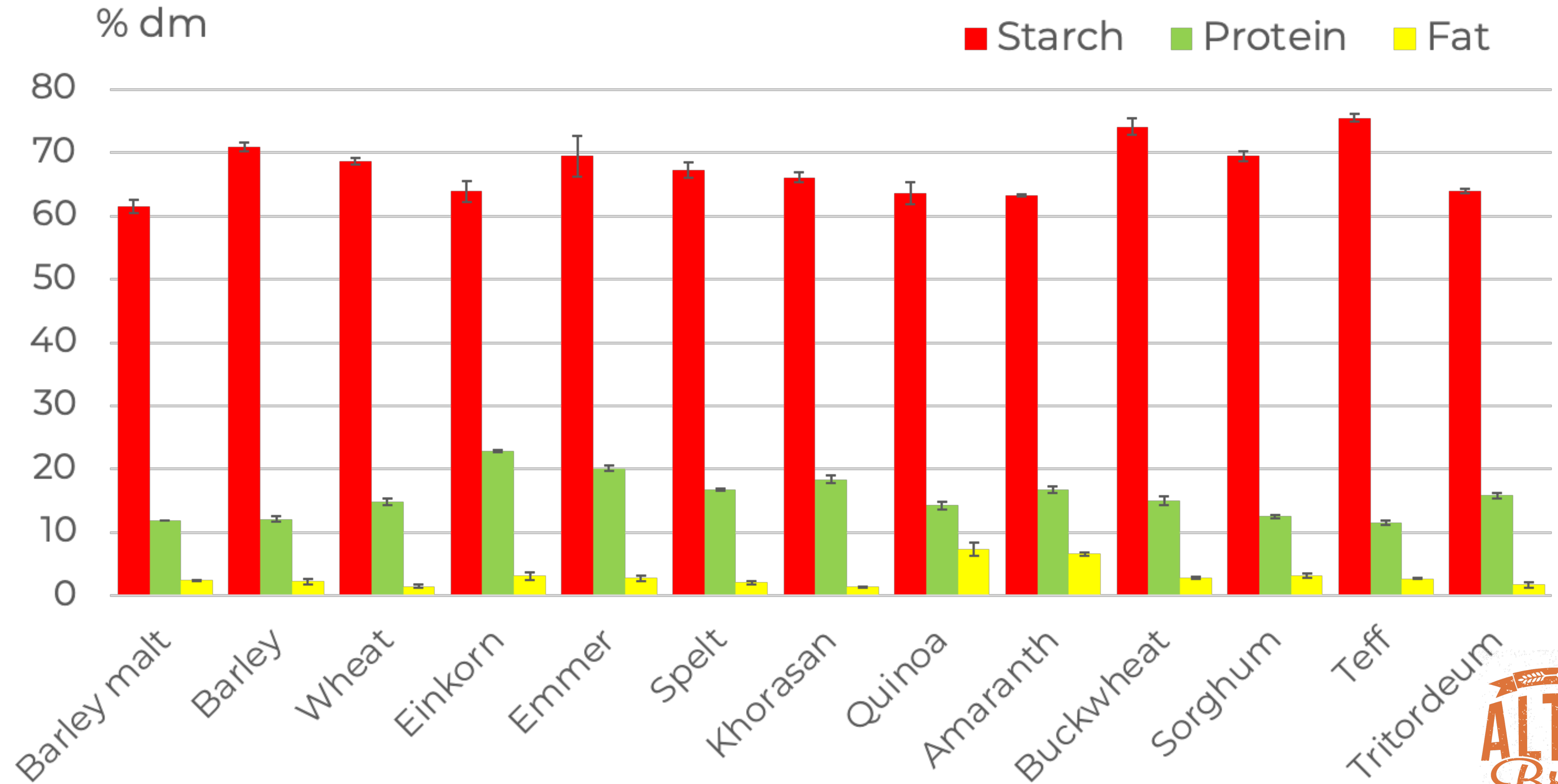
Size cereals and gelatinization T



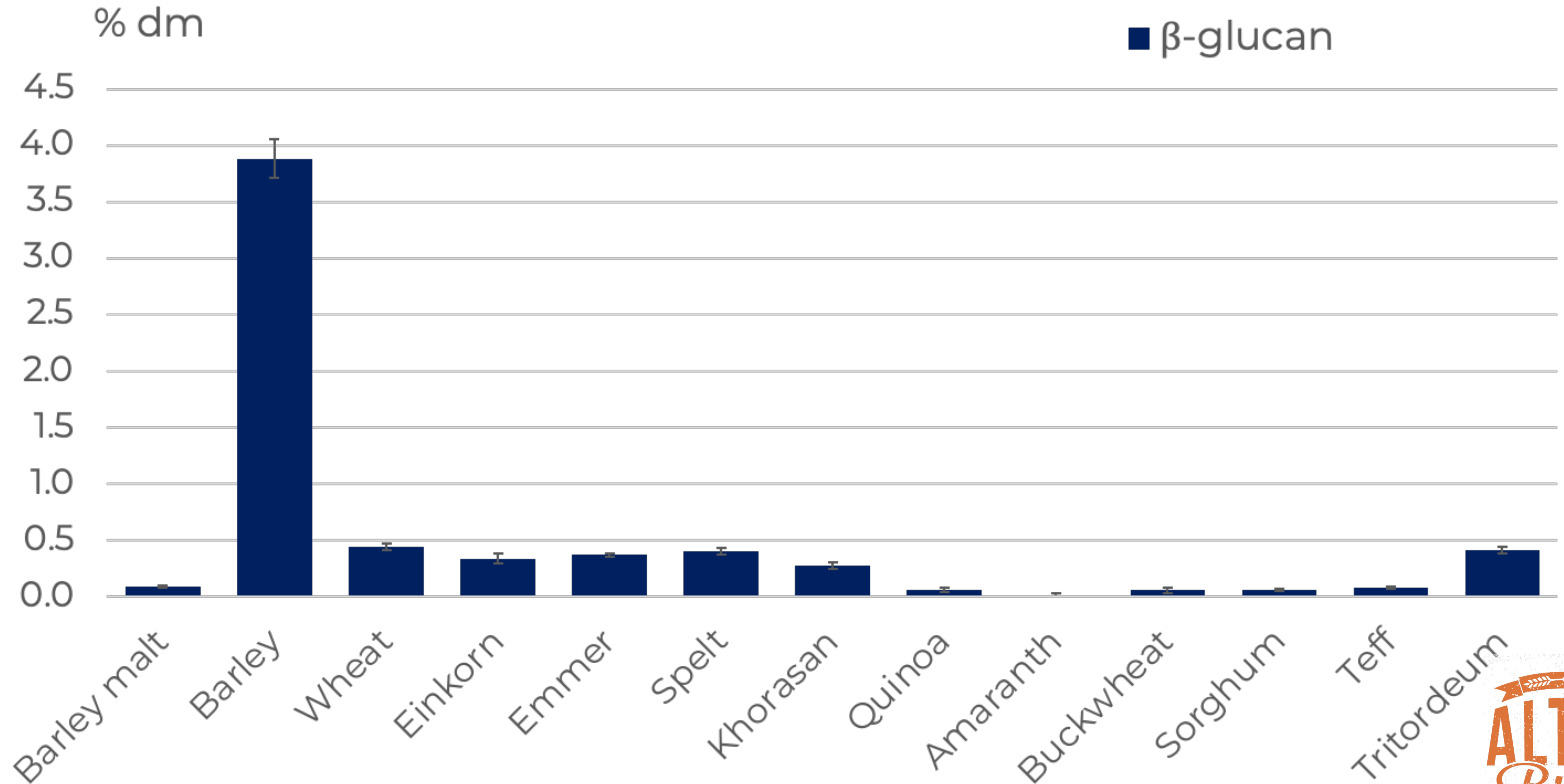
Composition unmalted cereals



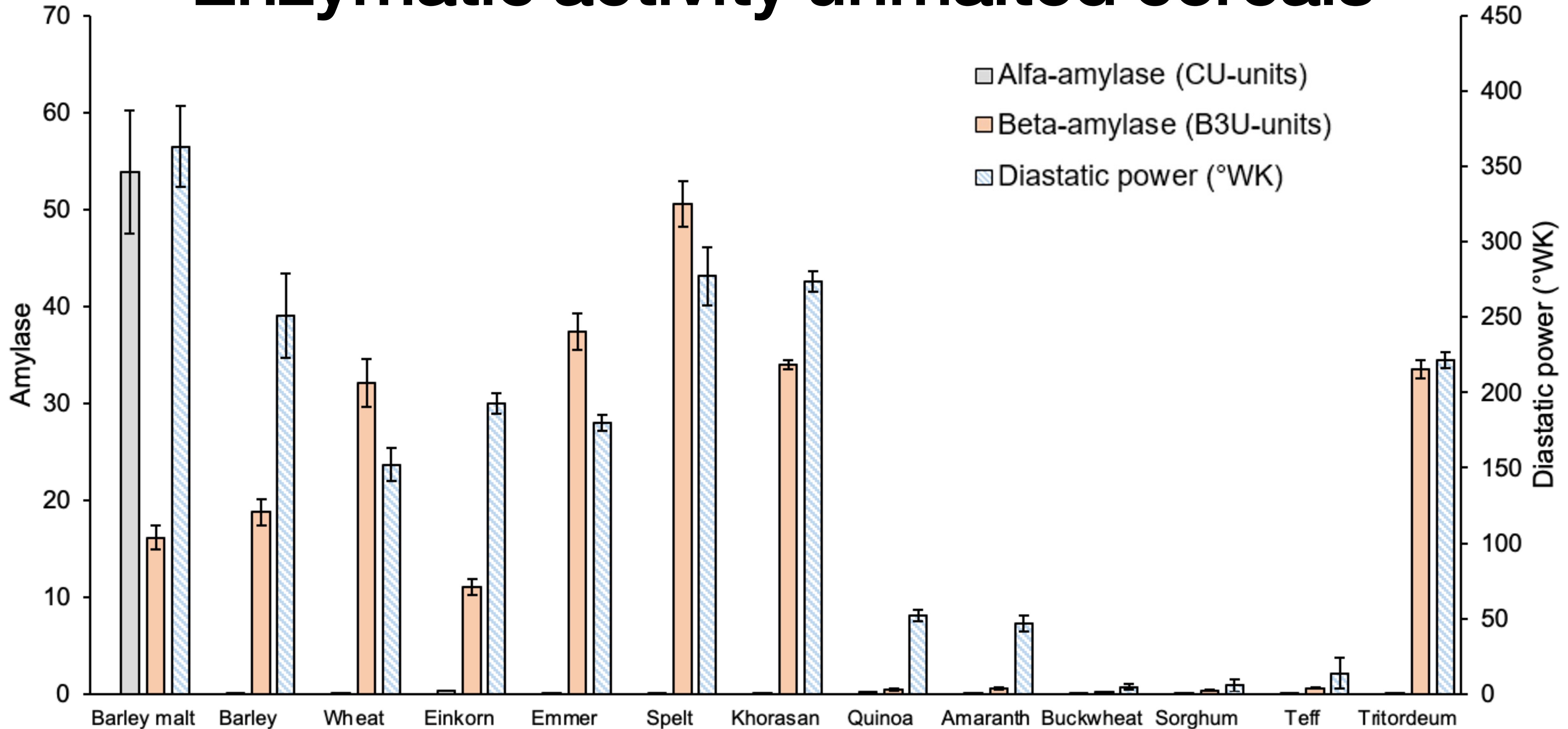
Composition unmalted cereals



Composition unmalted cereals



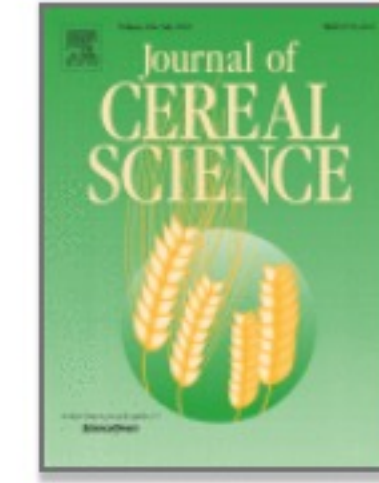
Enzymatic activity unmalted cereals





Journal of Cereal Science

Volume 106, July 2022, 103482



10 unmalted alternative cereals and pseudocereals: A comparative analysis of their characteristics relevant to the brewing process

Jeroen Baillièrè ^{a, 1}, David Laureys ^{a, 1}, Pieter Vermeir ^b, Filip Van Opstaele ^c, Gert De Rouck ^c, Luc De Cooman ^{c, 2},
Dana Vanderputten ^d, Jessika De Clippeleer ^{a, d}  

Show more 

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<https://doi.org/10.1016/j.jcs.2022.103482>

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Practical implications unmalted form

- Sorghum
 - High **viscosity** during gelatinization → lower grist/water ratio!
- Buckwheat
 - High **viscosity** after mashing
 - **Foaming over** during fermentation
- Emmer/Einkorn
 - High **water uptake** in husk during mashing (10 – 20% more than malt)
- Quinoa
 - **Saponin** rinsing prior to milling → Use of saponin free quinoa
- Quinoa, amaranth & teff
 - Not compatible with roller mills → Disc or hammer mill



Info sheets

INFO SHEETS

TETRA AlterBrew



EINKORN

TRITICUM MONOCOCCUM L. SSP. MONOCOCCUM

The great-grandmother of modern wheat

Domesticated einkorn, *Triticum monococcum* L. ssp. *monococcum*, is the oldest cultivated wheat variety. This diploid variety (2n = 14 chromosomes) originates from the Middle-East, with the oldest traces of its cultivation leading back to around 9500 years ago in South-East Turkey. Since then, the crop has spread across Europe and has played an important role in agriculture and human nutrition. For example, traces of einkorn wheat were found



Fig. 1. Spreading of einkorn

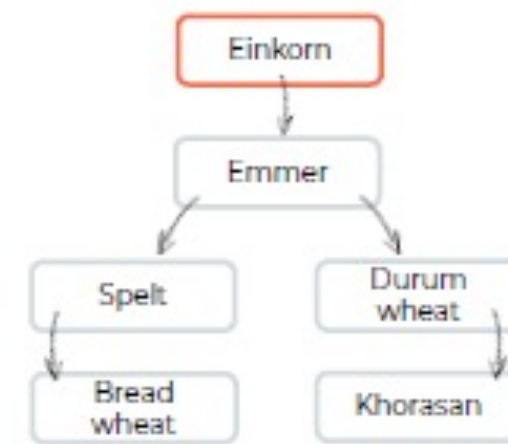


Fig. 2. Simplified evolution of Triticum species

back inside the stomach of Ötzi, the mummy who was found in the Alps, where he lived about 5000 years ago. With time, most of the einkorn got replaced by spelt and subsequently free-treshing wheat. Until today's renewed interest in the cereal, einkorn cultivation only persisted in isolated, mountainous regions in for example Turkey, Italy, Morocco and the Caucasus. Examples of einkorn varieties are Terzino and Ebner's einkorn.

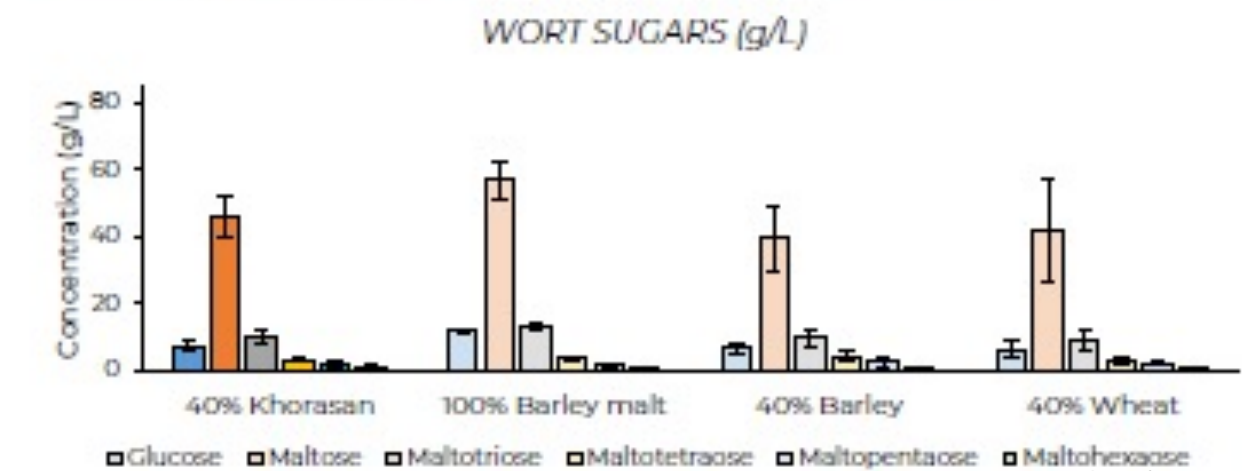
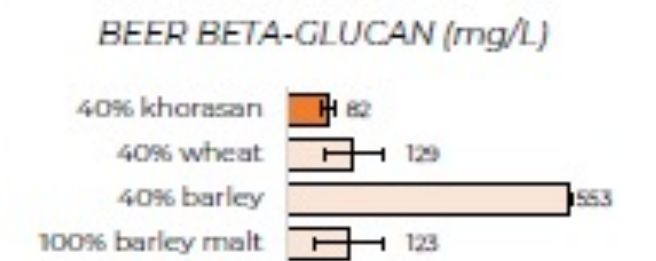
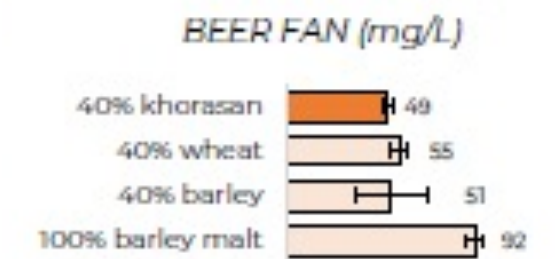
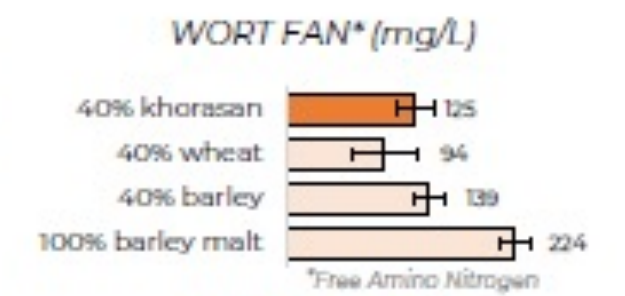
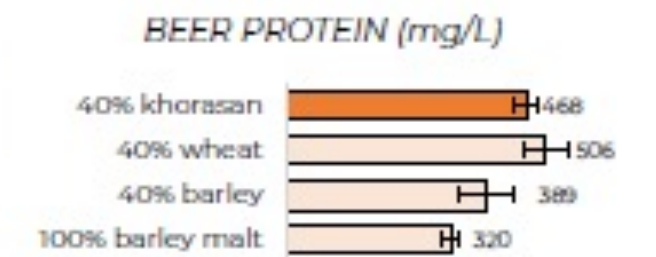


Although the FAN concentrations in the wort differ between 40% khorasan and the three reference worts, the profile of the separate amino acids is very similar between them. Also, no significant differences were found between 40% khorasan beer and the reference beers regarding the metal ions present in the final beer.

Sensory wise, the addition of 40% khorasan resulted in a beer with a nice round body and a very soft and creamy mouthfeel. This is mainly caused by the present proteins rather than any unfermentable sugars or fibres. The flavour palate provides clear, but mild nutty flavours with subtle floral tones and hints of blueberry in the background.

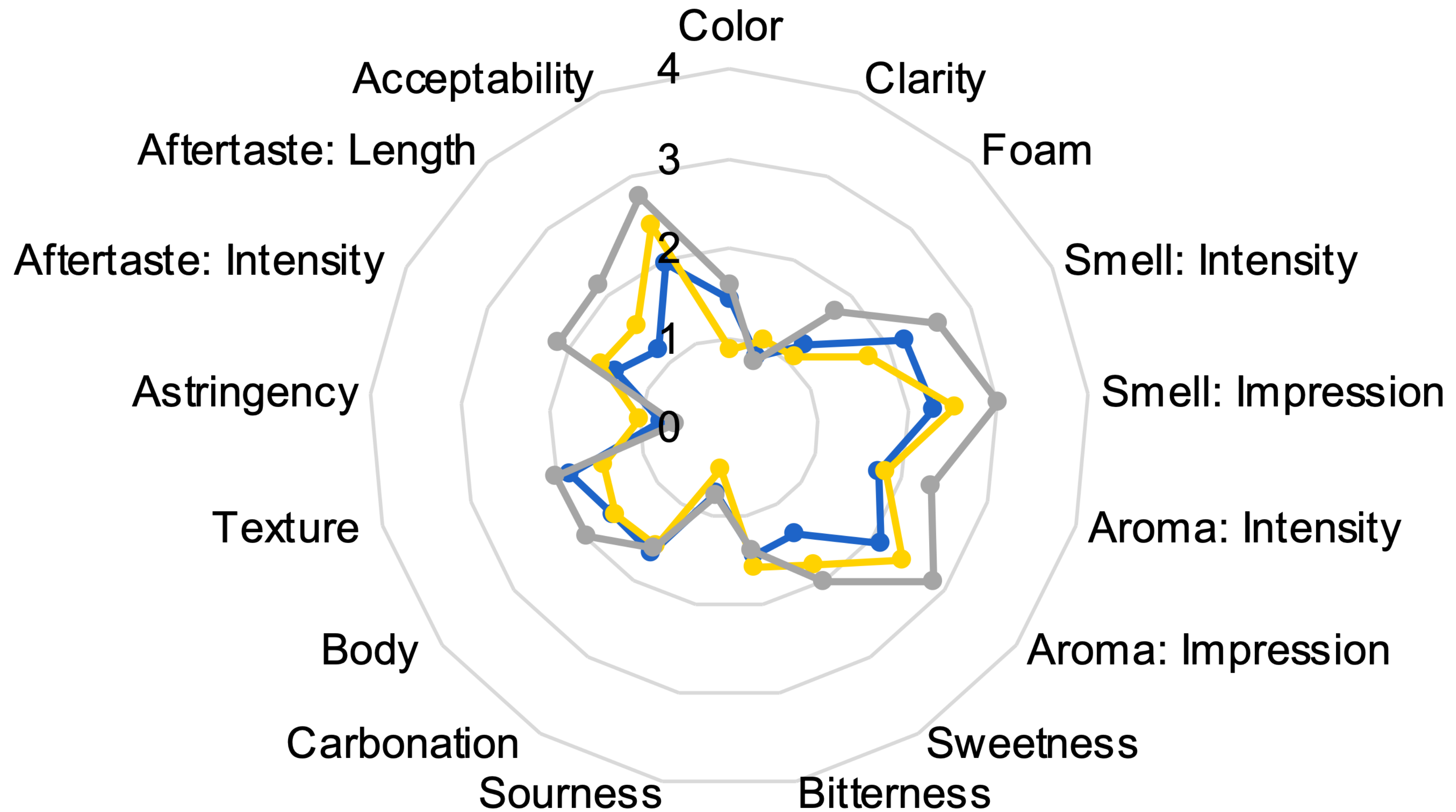


Fig. 8. 40% khorasan beer



Preference for beers with 40% addition





—●— 40% eenkoorn —●— 40% khorasan —●— 40% teff



Pilot scale brewing trials



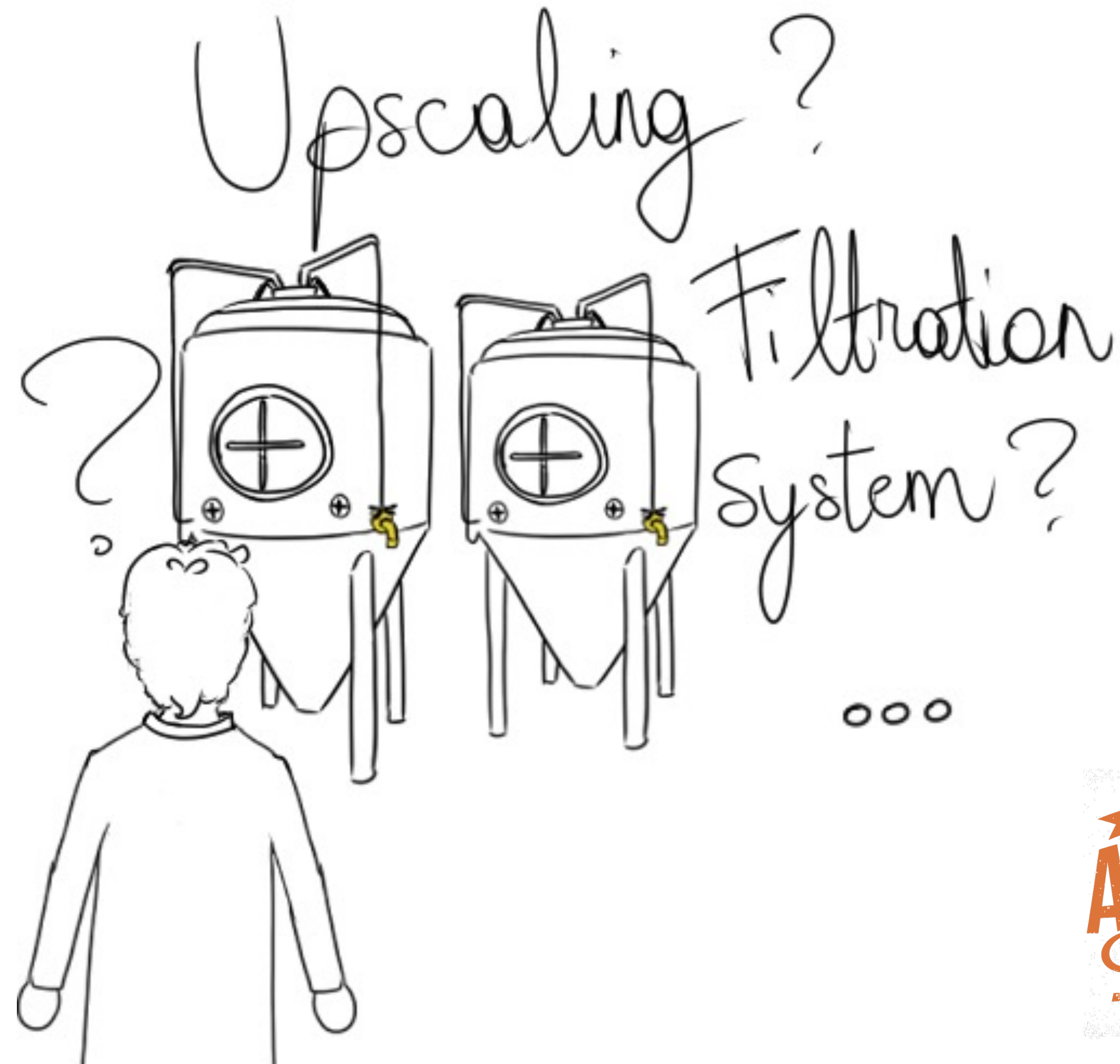
Einkorn



Khorasan



Teff



Pilot scale wort filtration

Lauter tun
60 L



Thin bed filter
500 L



Pilot scale brewing trials

40% alternative cereal + 60% barley malt

60 L

30 min @ 80°C (*Teff*)

+ *Mats L Classic® (DSM)*

20 min @ 52°C (*all excl. 100% barley malt*)

25 min @ 63°C

15 min @ 72°C

1 min @ 78°C



60 min boiling

15 IBU Magnum pellets type 90

12 °P density

500 L

7 days fermentation, 14 days maturation

Fermentis SafAle S-04

Filtration, saturation & filling

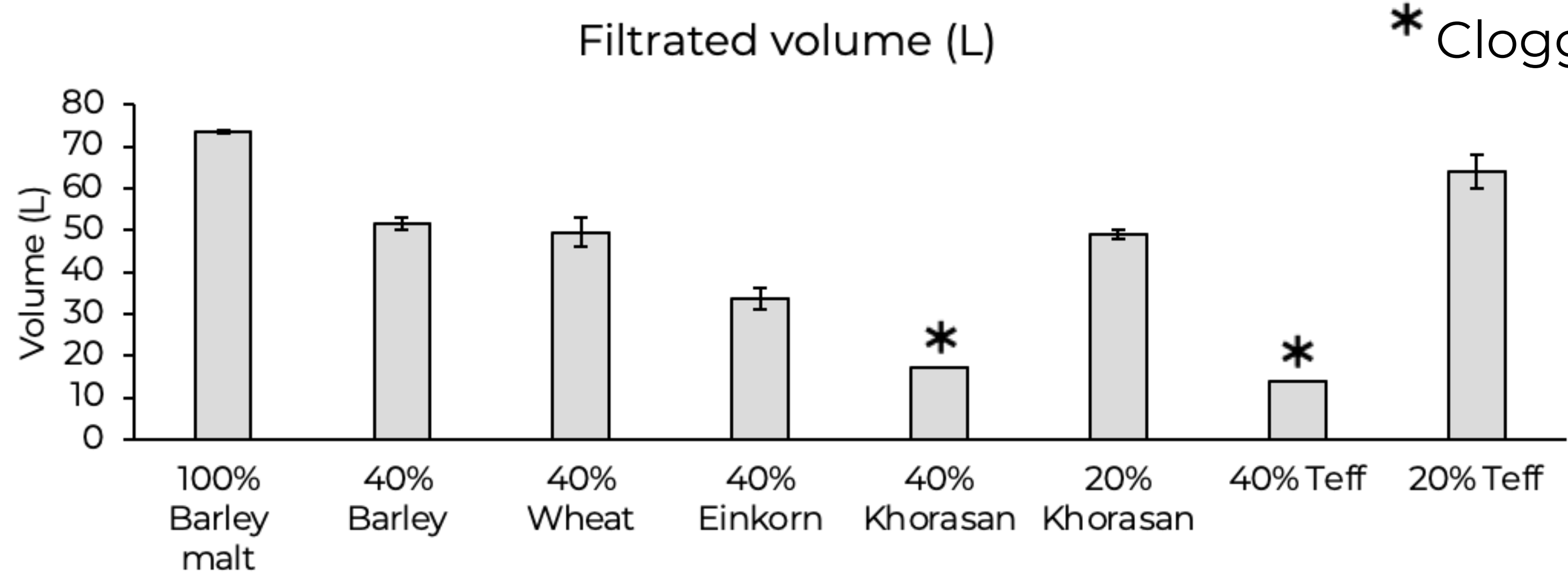
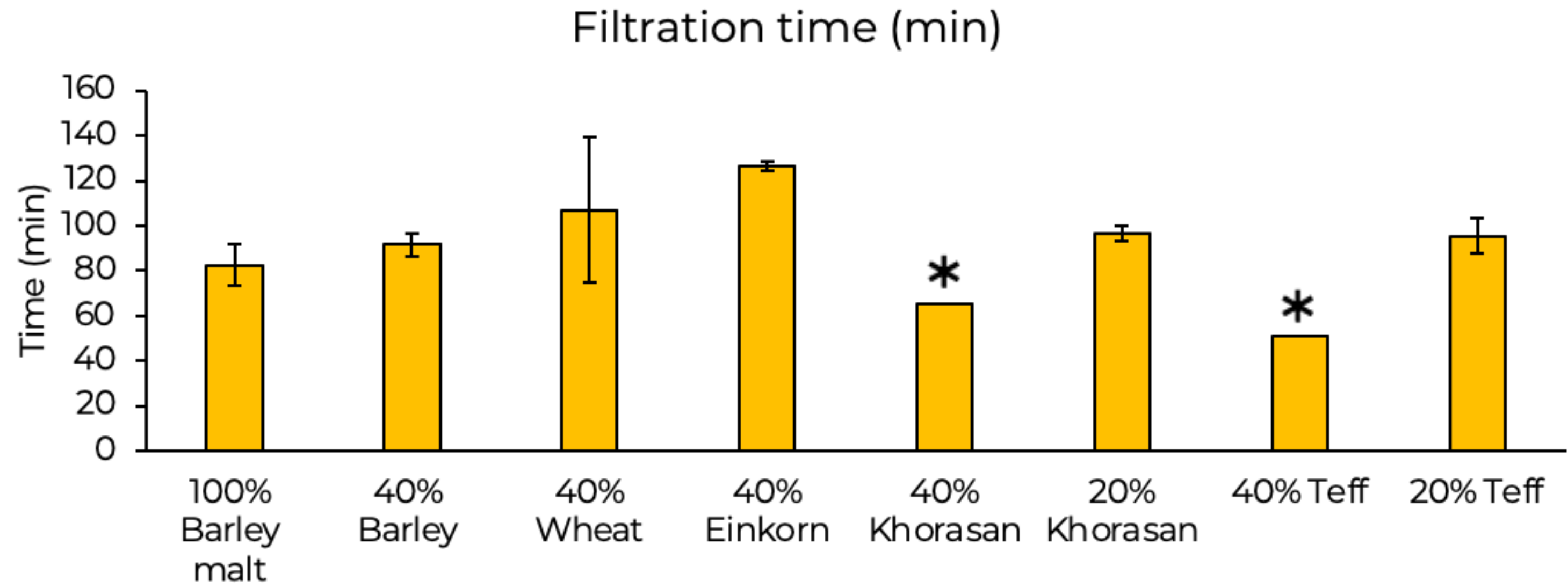
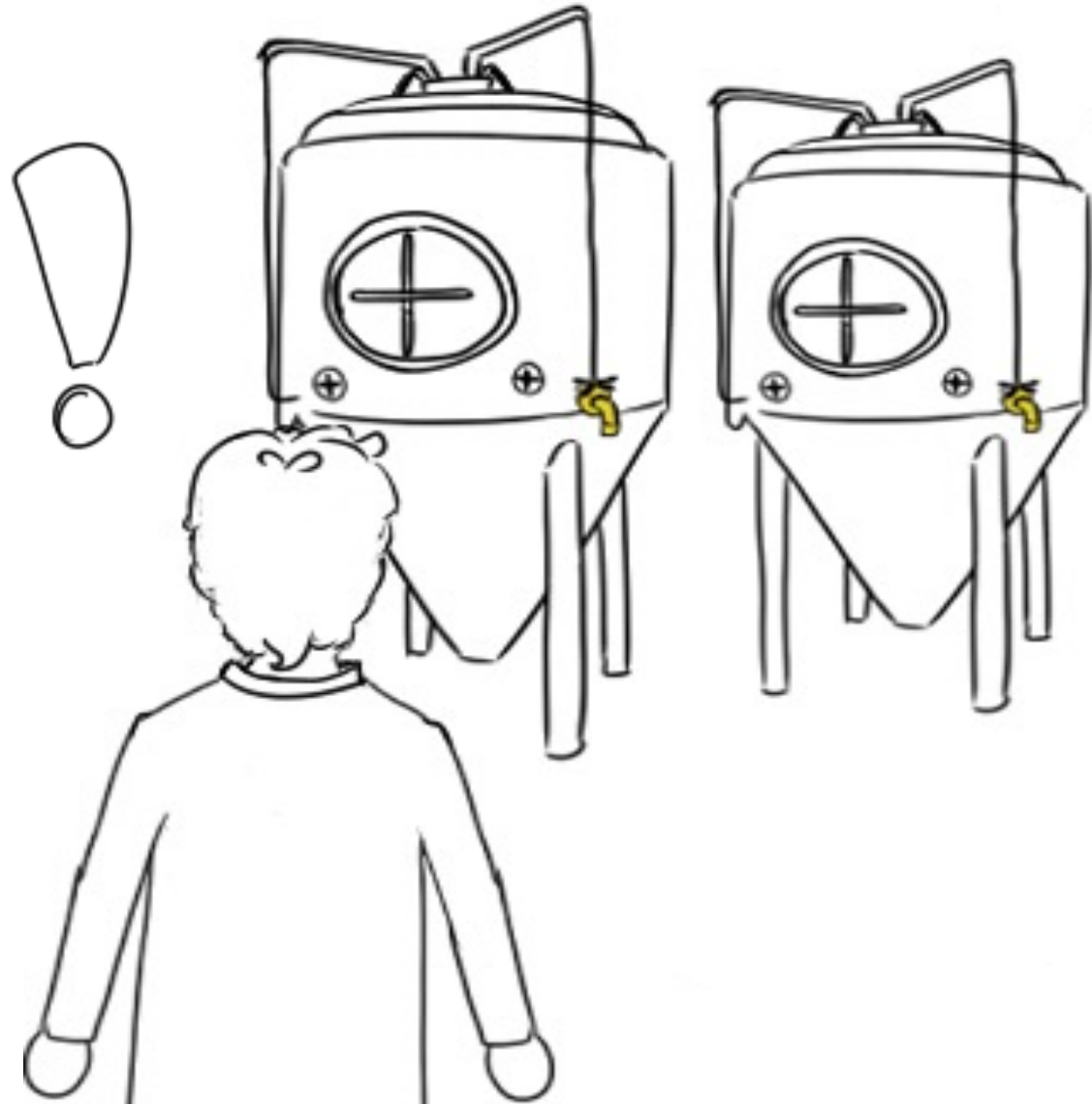
Plate filter becopad 350 sheets

5.6 ppm CO₂

6-head rotating counter-pressure filler with double pre-evacuation and foaming before capping



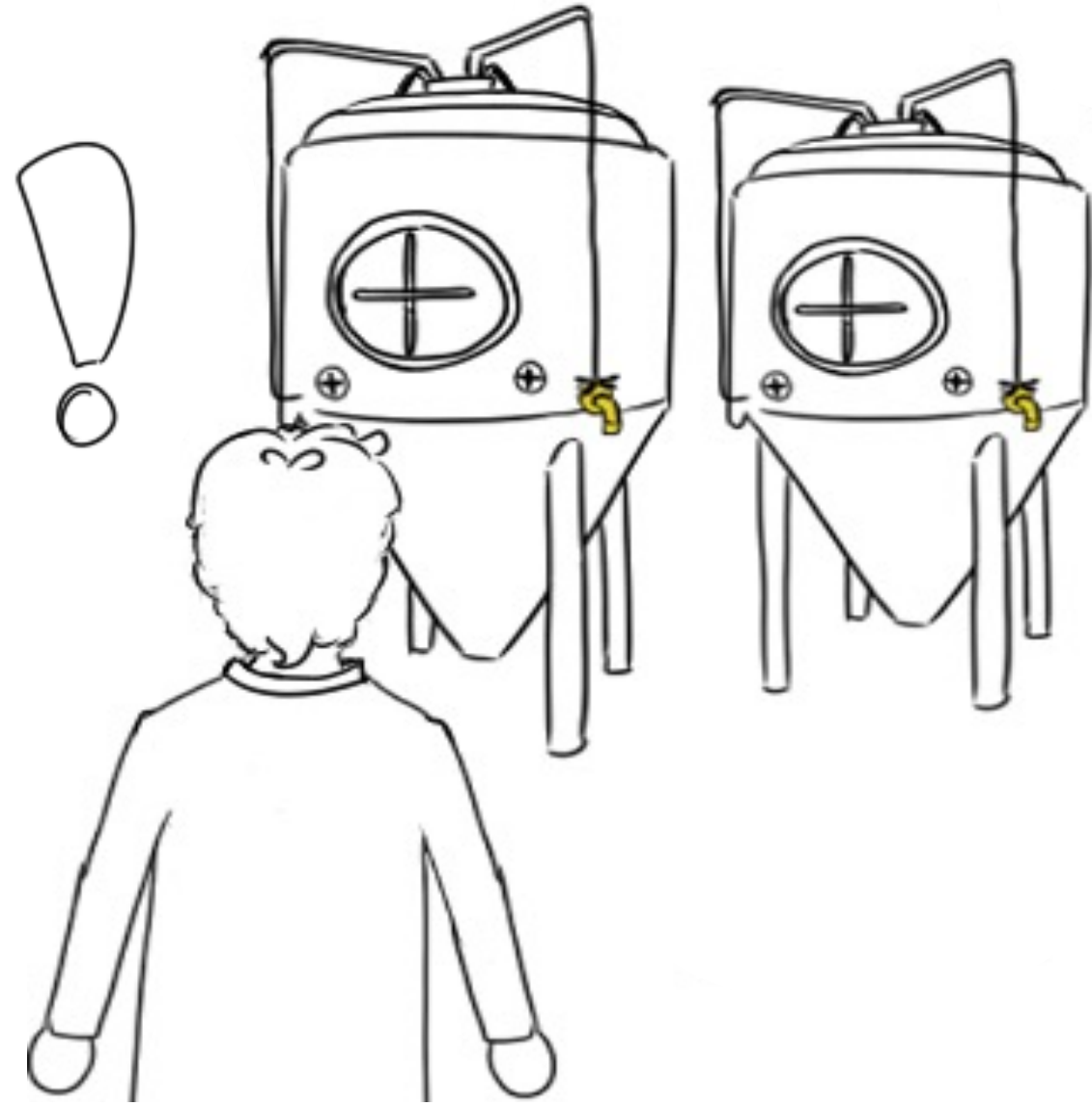
Pilot scale wort filtration - Lauter tun



* Clogged filter



Pilot scale wort filtration - Lauter tun



Watch out for:

- Milling & husk (einkorn)
- Milling & protein content (khorasan)
- Kernel size & stirring (teff)



Einkorn



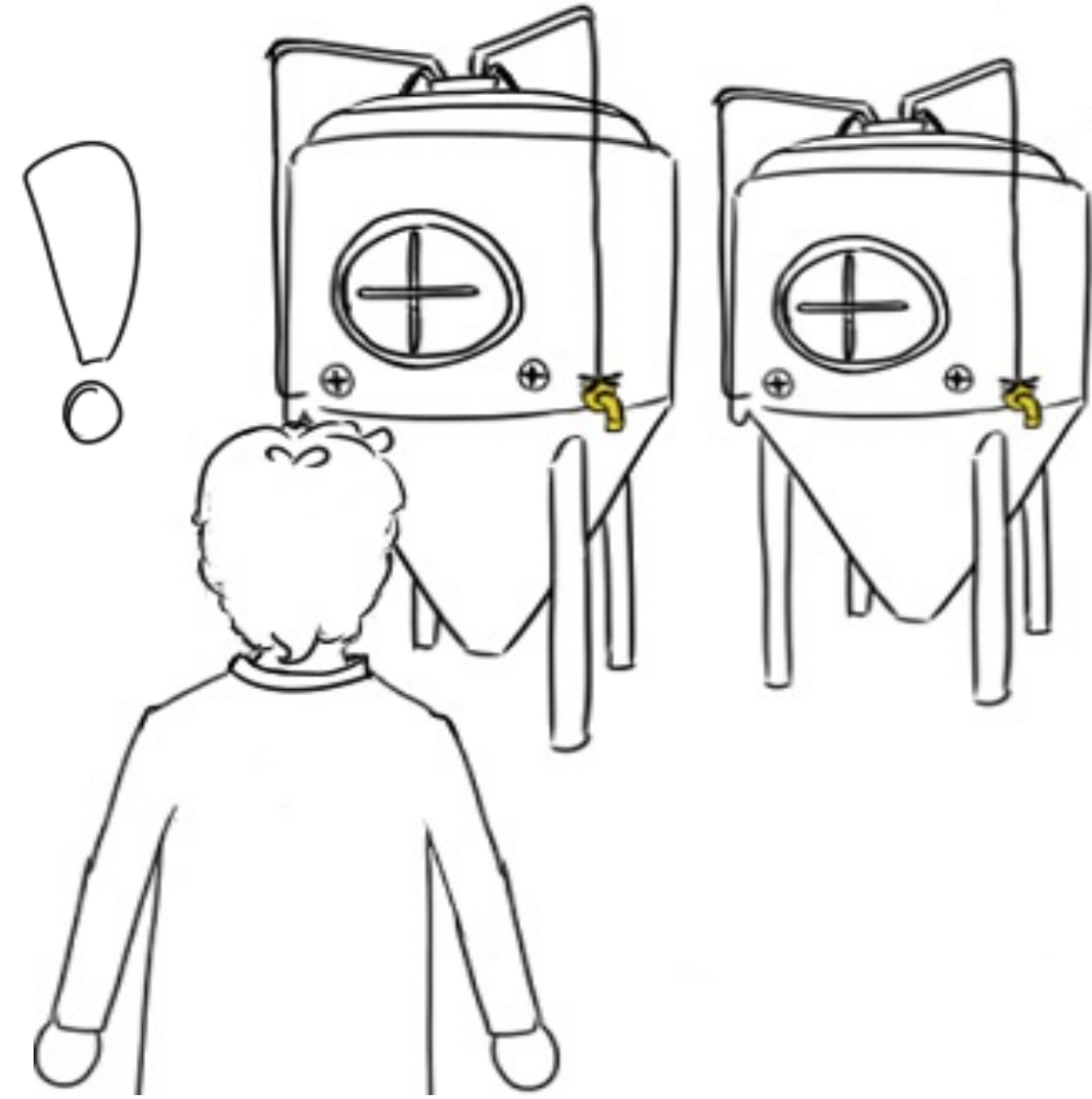
Khorasan



Teff



Pilot scale wort filtration - Thin bed filter



Possible for all cereals using 40%

Watch out for:

- Mash thickness (einkorn)
- Kernel size & stirring (teff)



Einkorn



Khorasan



Teff

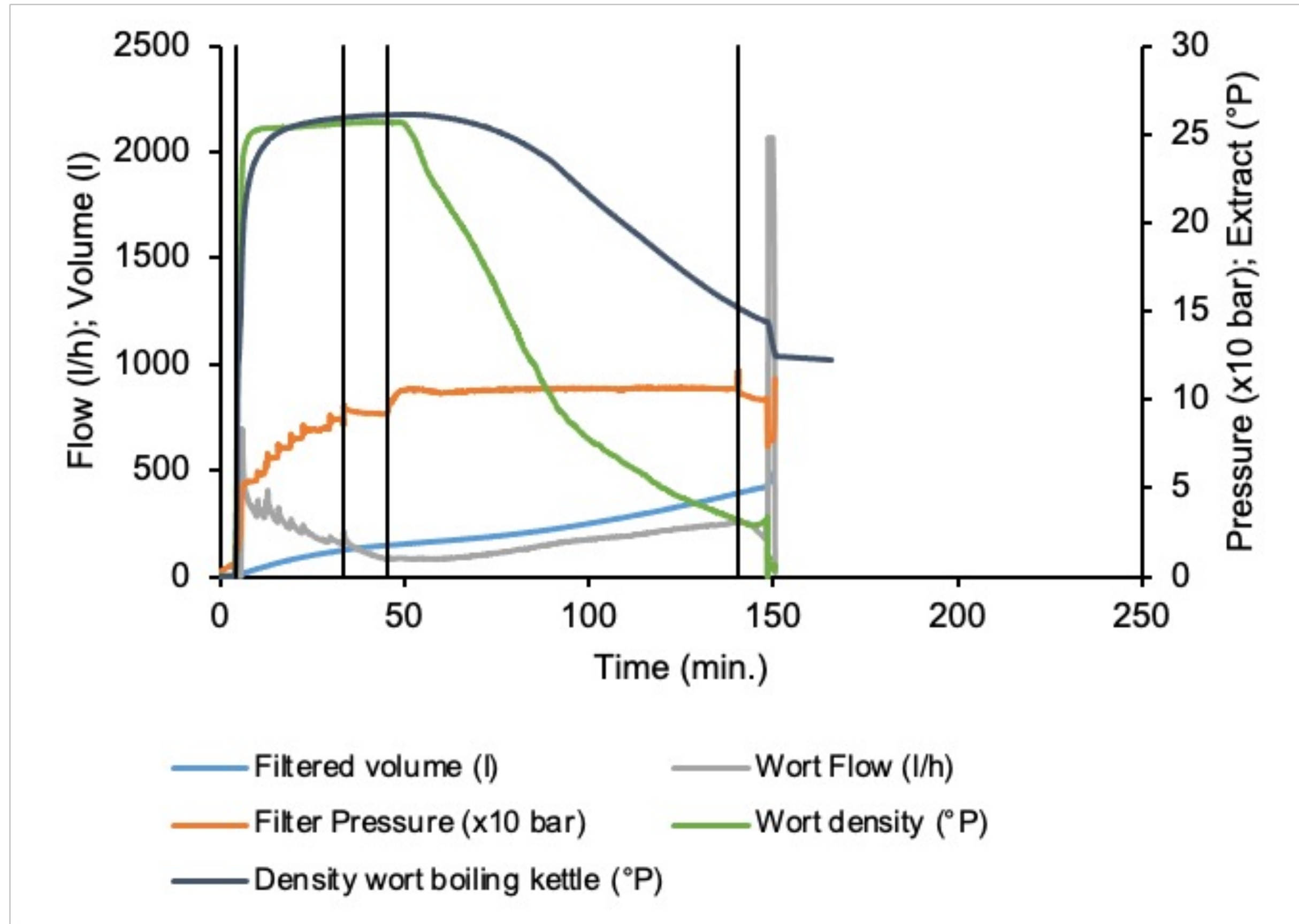


Pilot scale wort filtration - Thin bed filter

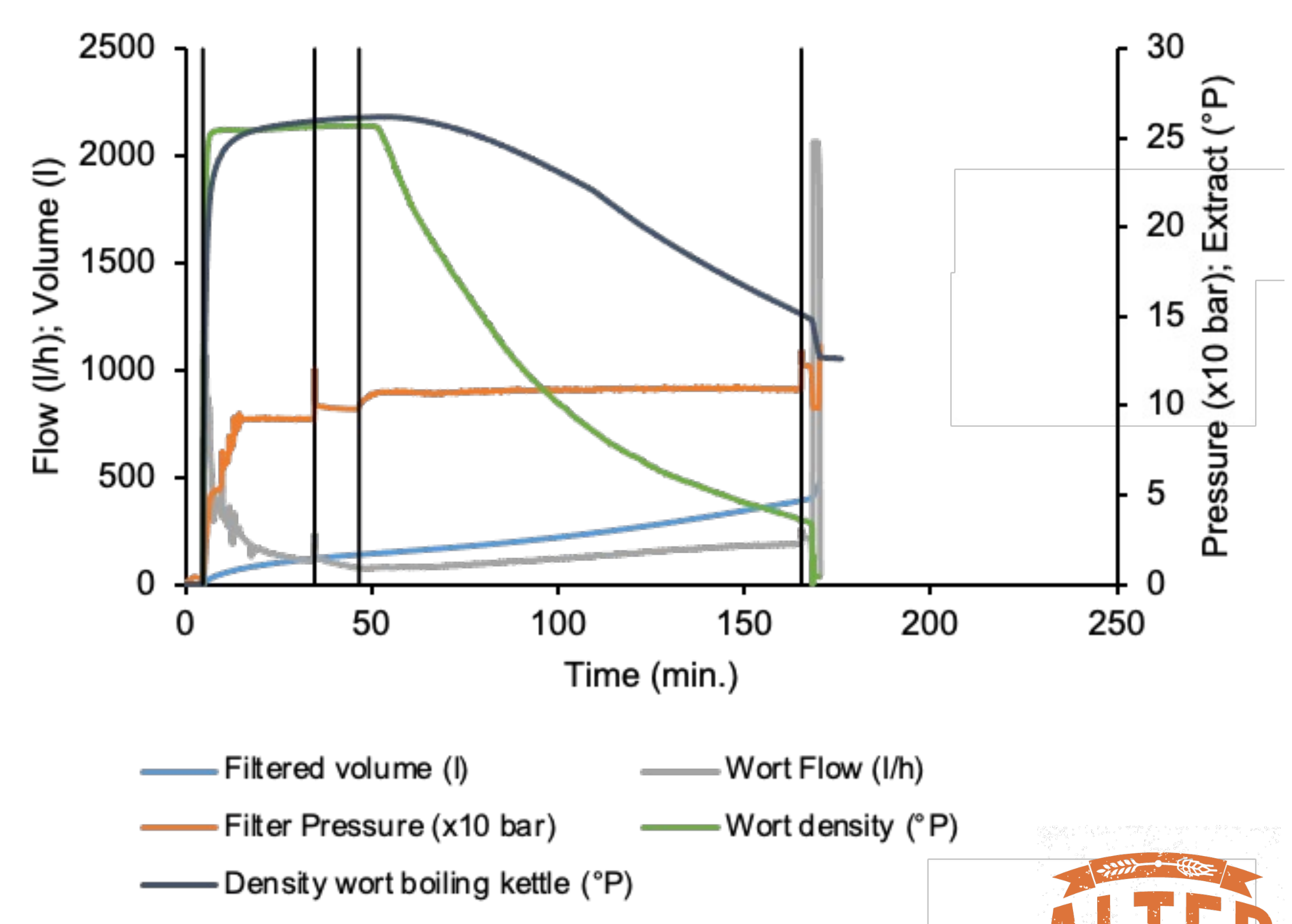
100% barley malt

Batch 1

Batch 2



Brewhouse efficiency: 79.2%



Brewhouse efficiency: 76.9%

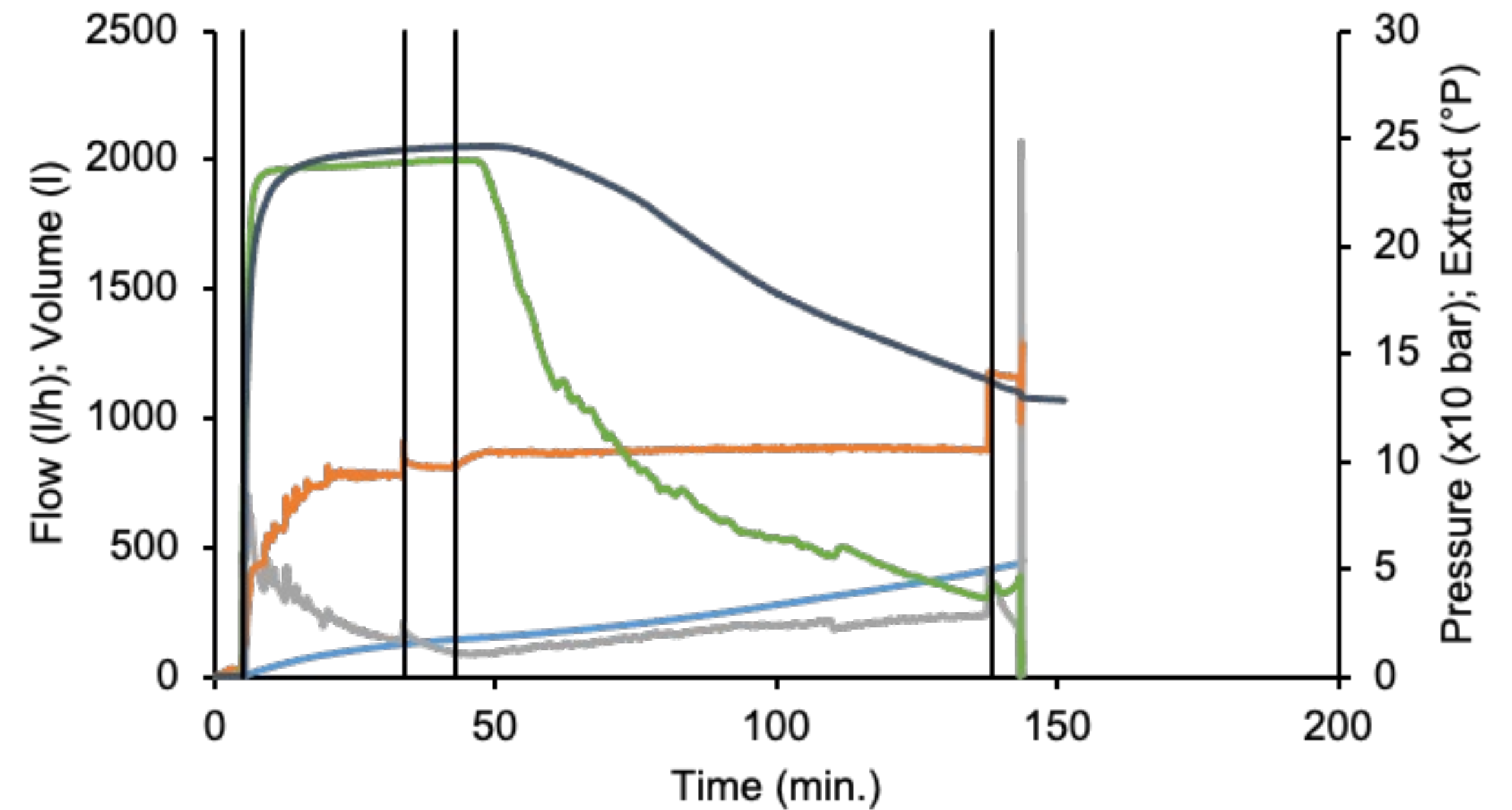
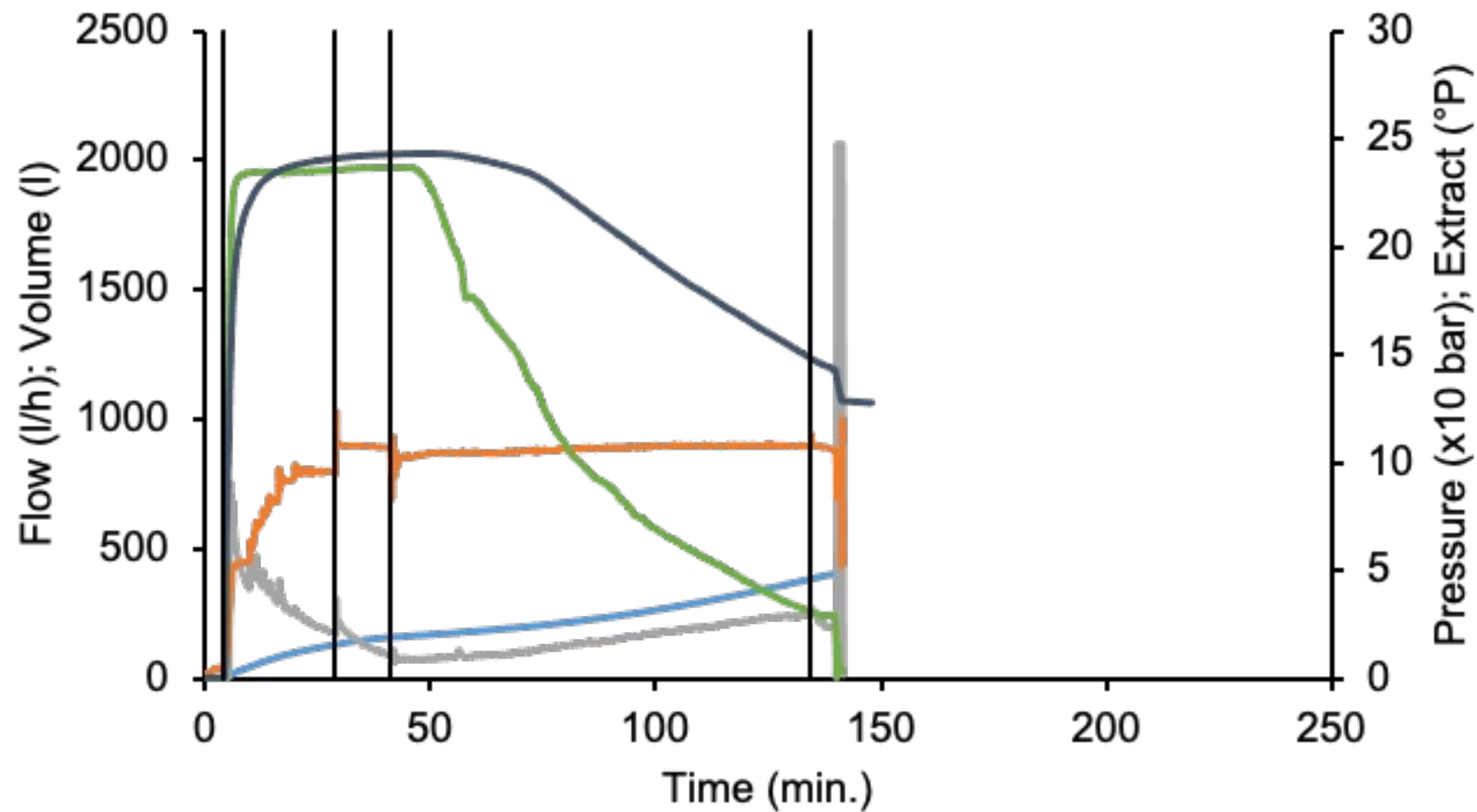


Pilot scale wort filtration - Thin bed filter

40% khorasan

Batch 1

Batch 2



Filtered volume (l) Wort Flow (l/h)
 Filter Pressure (x10 bar) Wort density (°P)
 Density wort boiling kettle (°P)

Filtered volume (l) Wort Flow (l/h)
 Filter Pressure (x10 bar) Wort density (°P)
 Density wort boiling kettle (°P)

Brewhouse efficiency: 75.5%

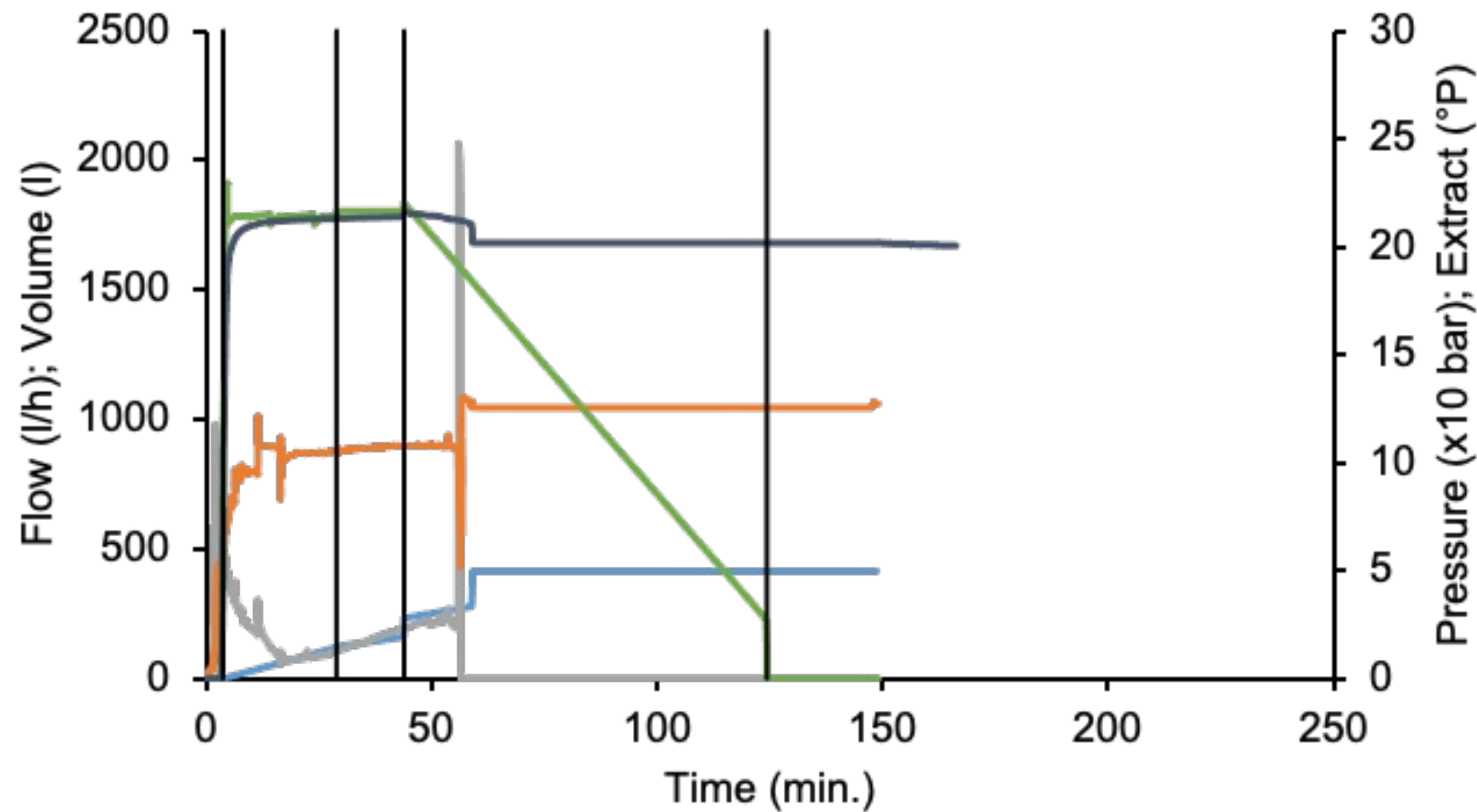
Brewhouse efficiency: 74.2%



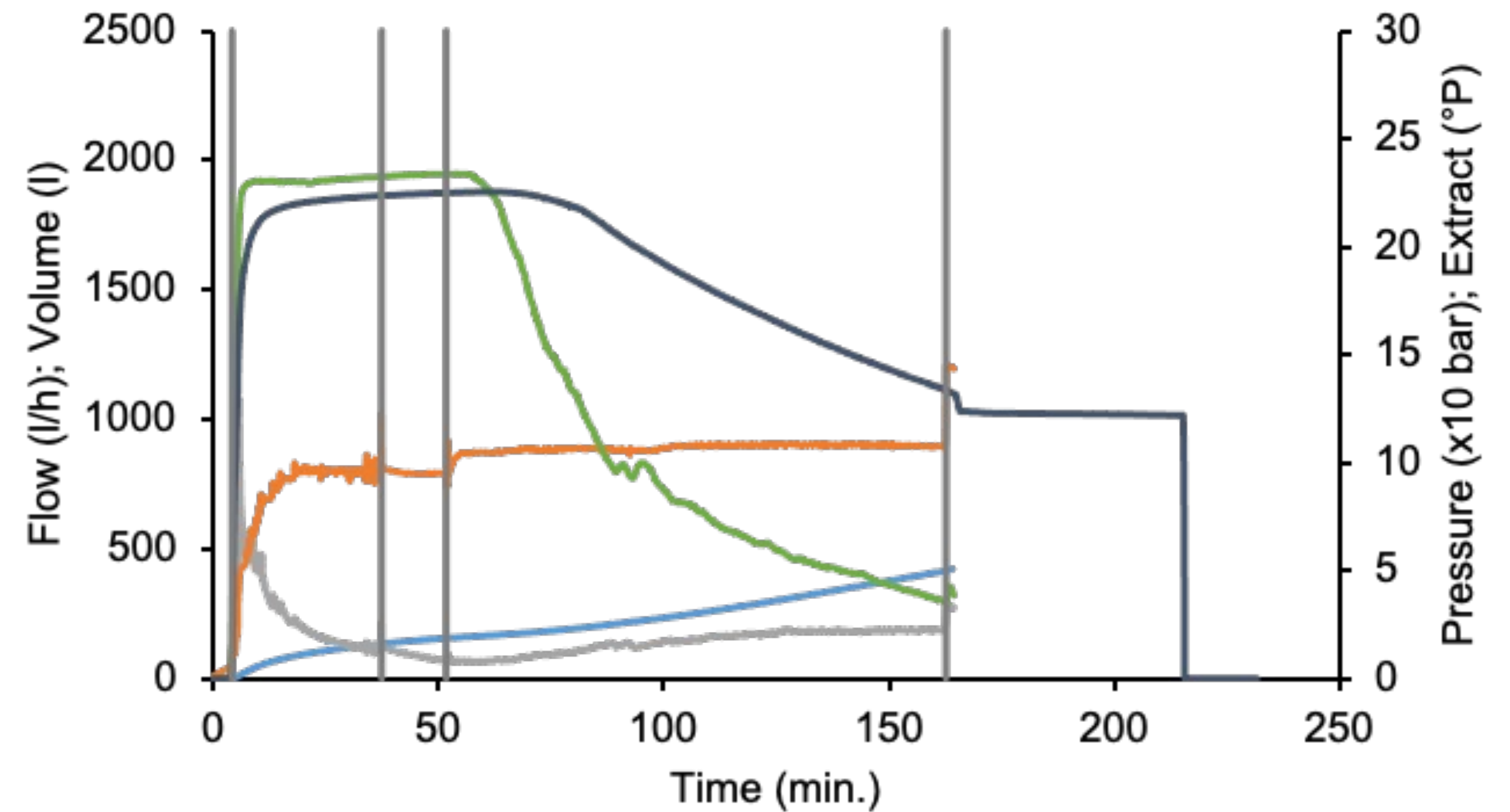
Pilot scale wort filtration - Thin bed filter

40% teff

Batch 1



Batch 2



Brewhouse efficiency: 72.9%

Brewhouse efficiency: 76.9%

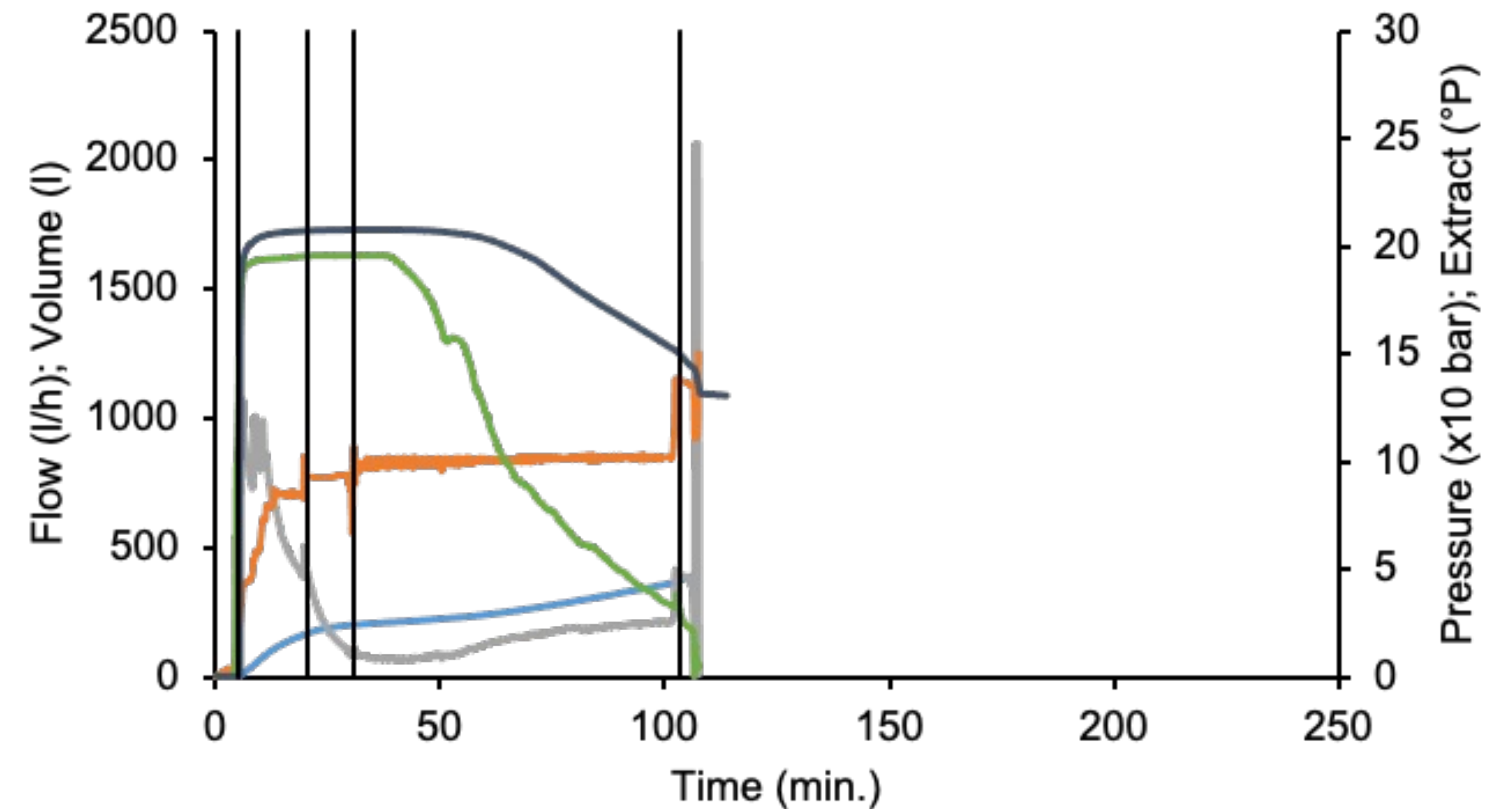
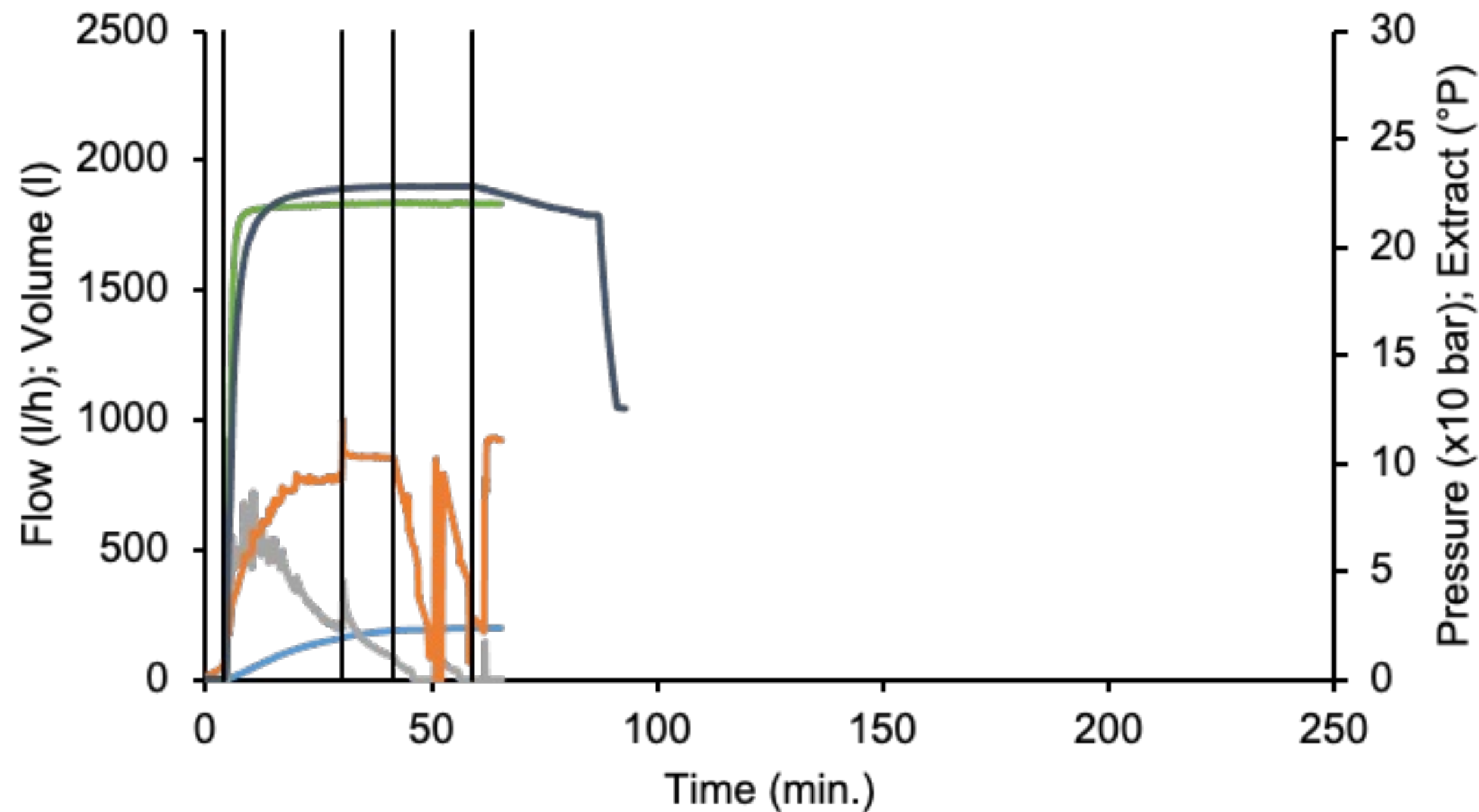


Pilot scale wort filtration - Thin bed filter

40% einkorn

Batch 1

Batch 2



Filtered volume (l) Wort Flow (l/h)
 Filter Pressure (x10 bar) Wort density (°P)
 Density wort boiling kettle (°P)

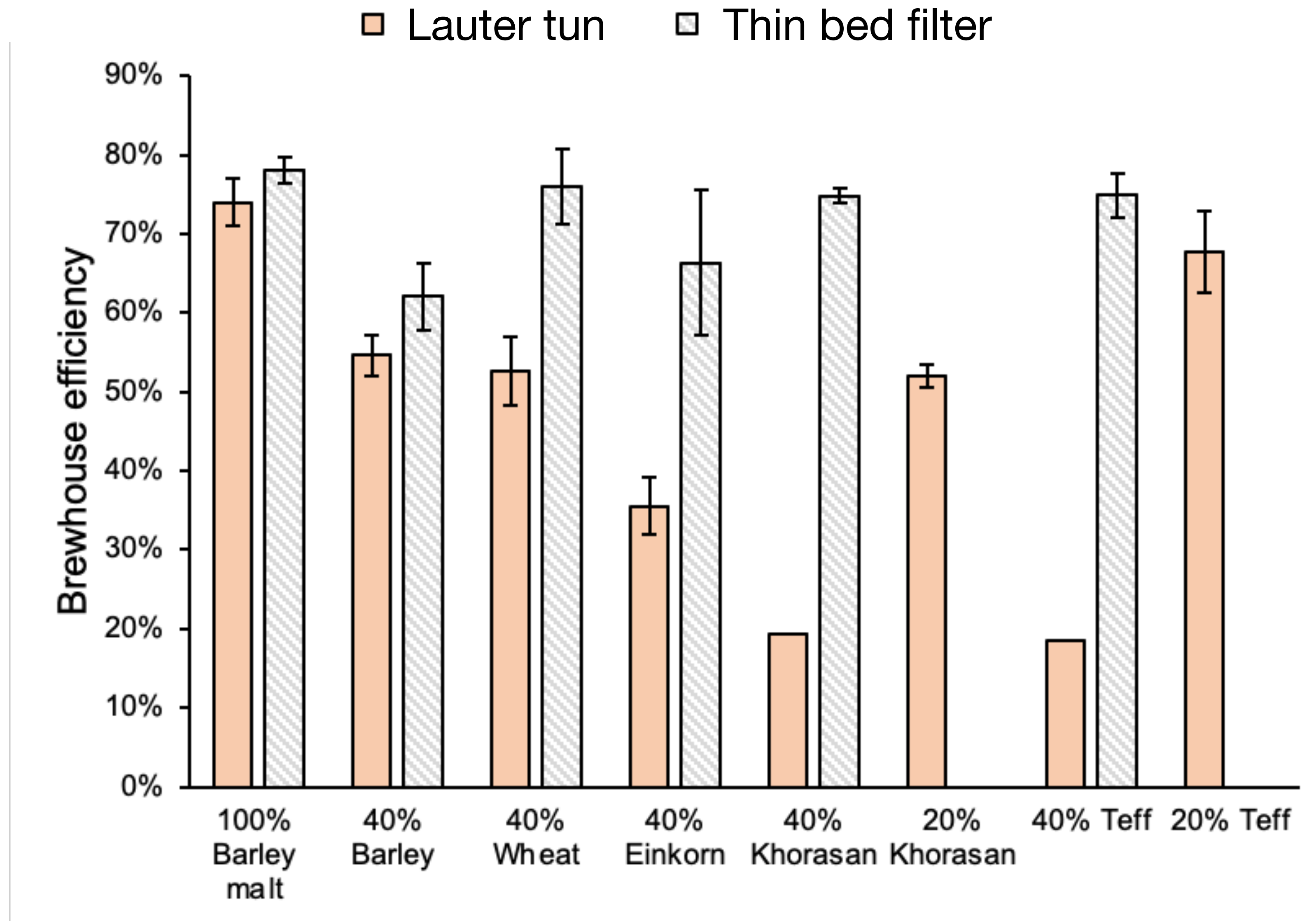
Filtered volume (l) Wort Flow (l/h)
 Filter Pressure (x10 bar) Wort density (°P)
 Density wort boiling kettle (°P)

Brewhouse efficiency: 59.8%

Brewhouse efficiency: 72.8%

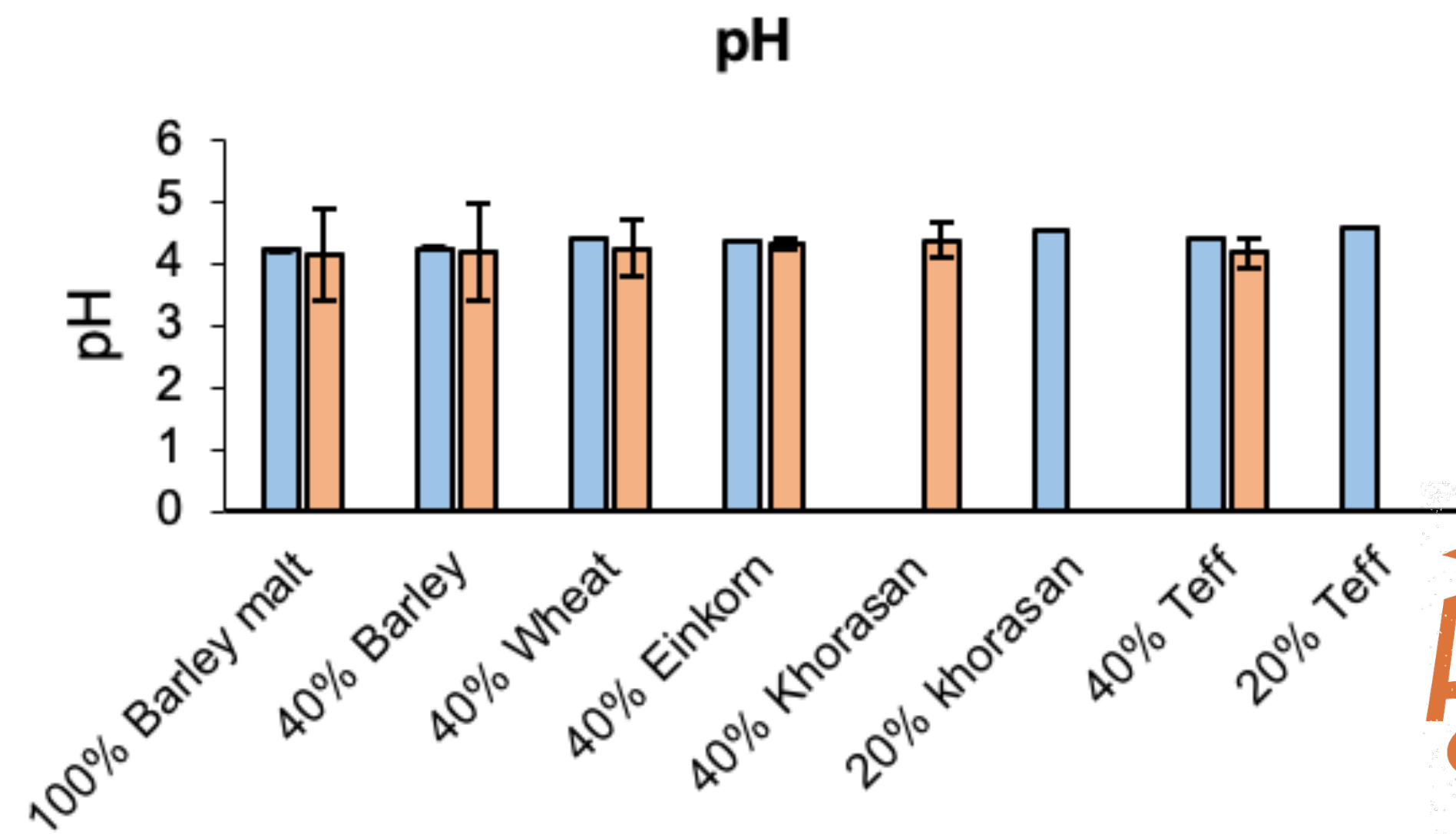
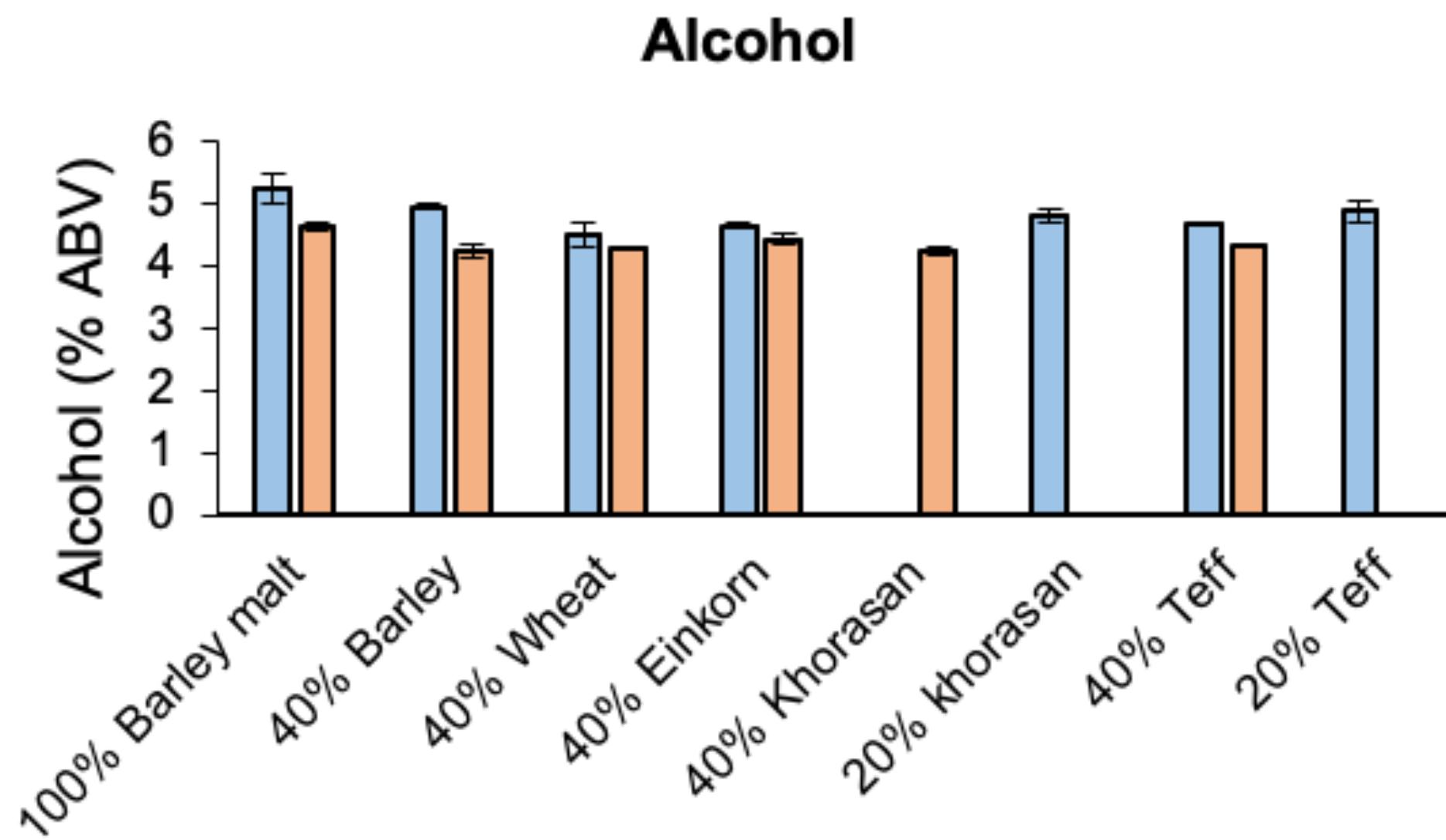
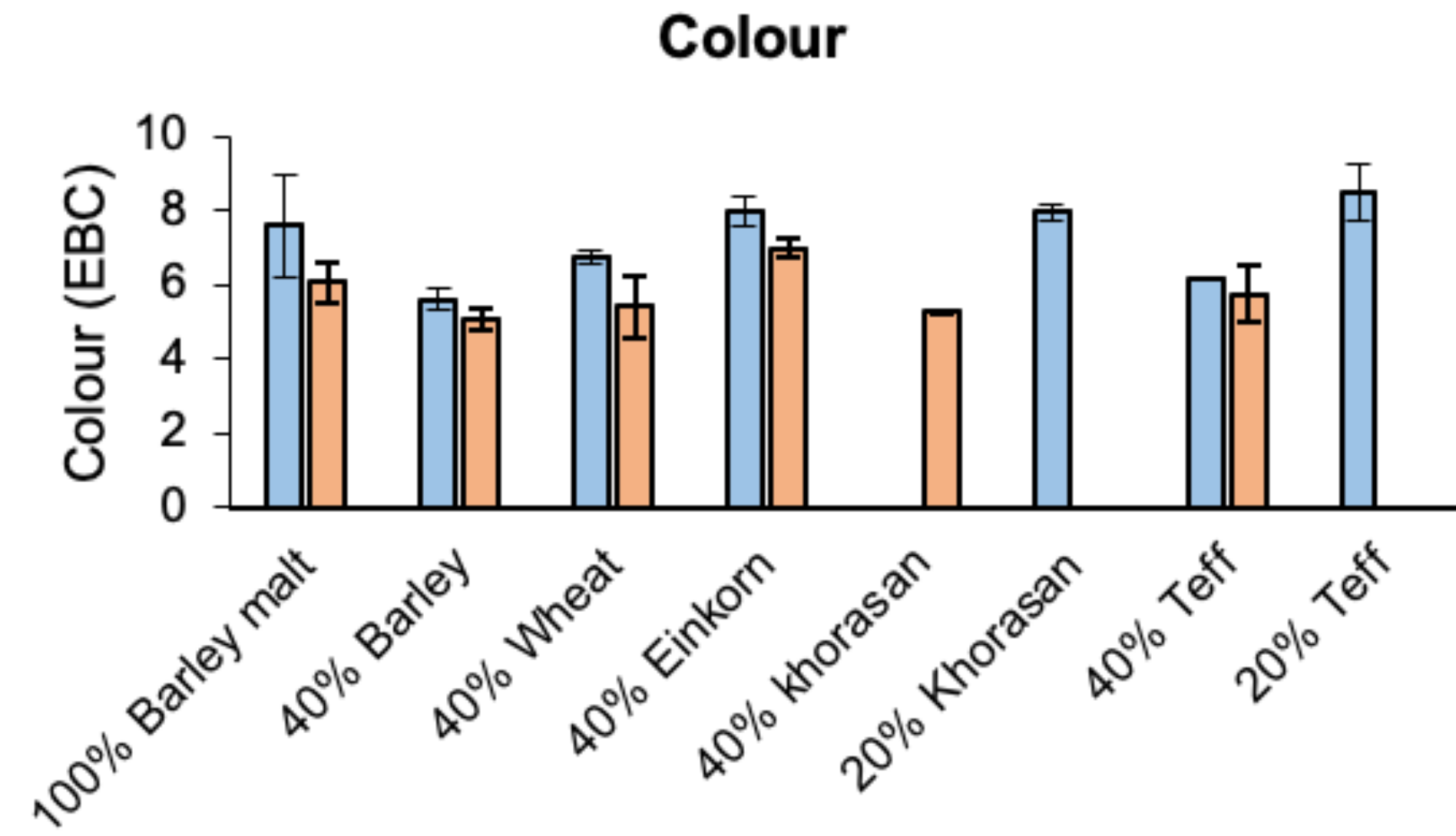
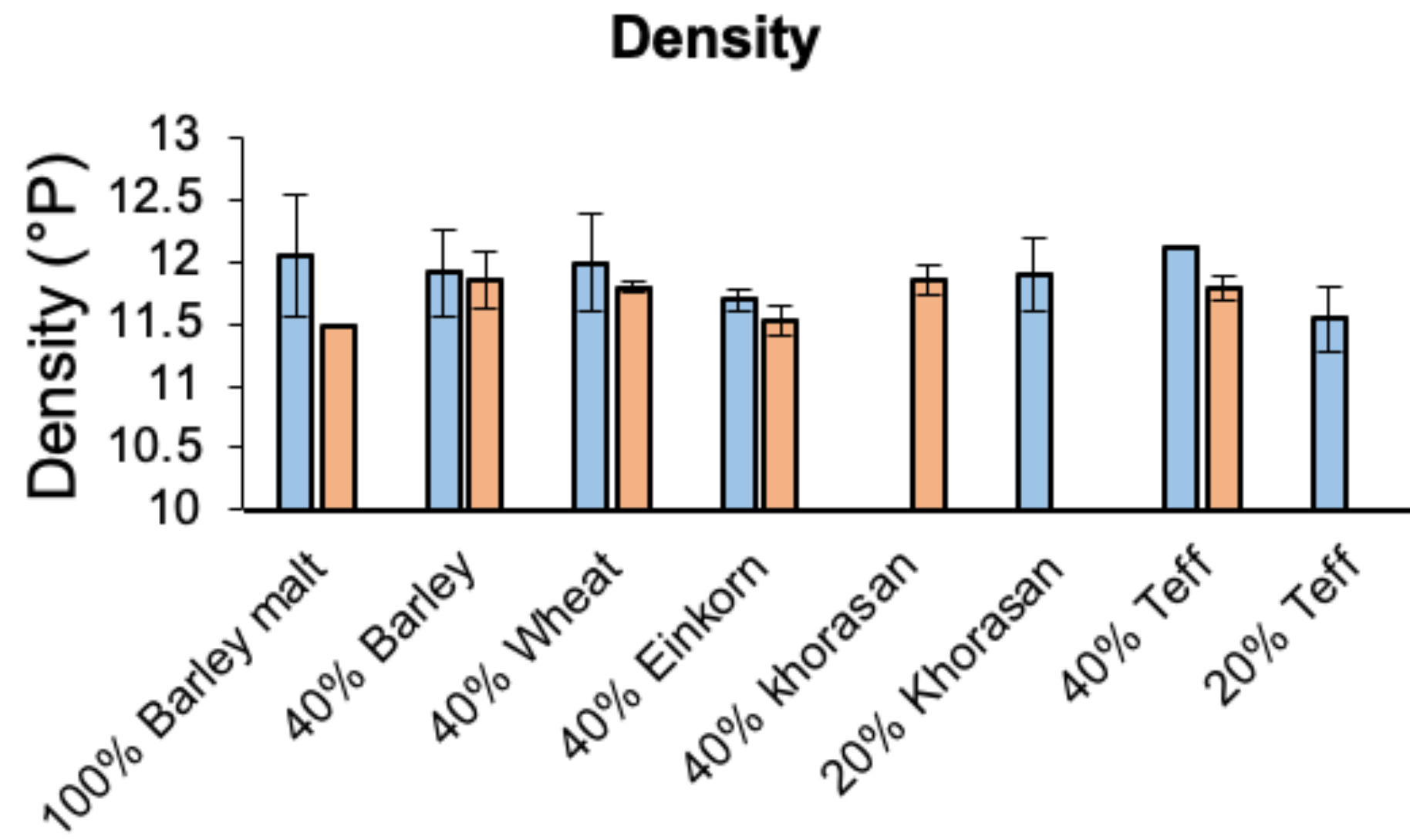


Pilot scale brewhouse efficiency



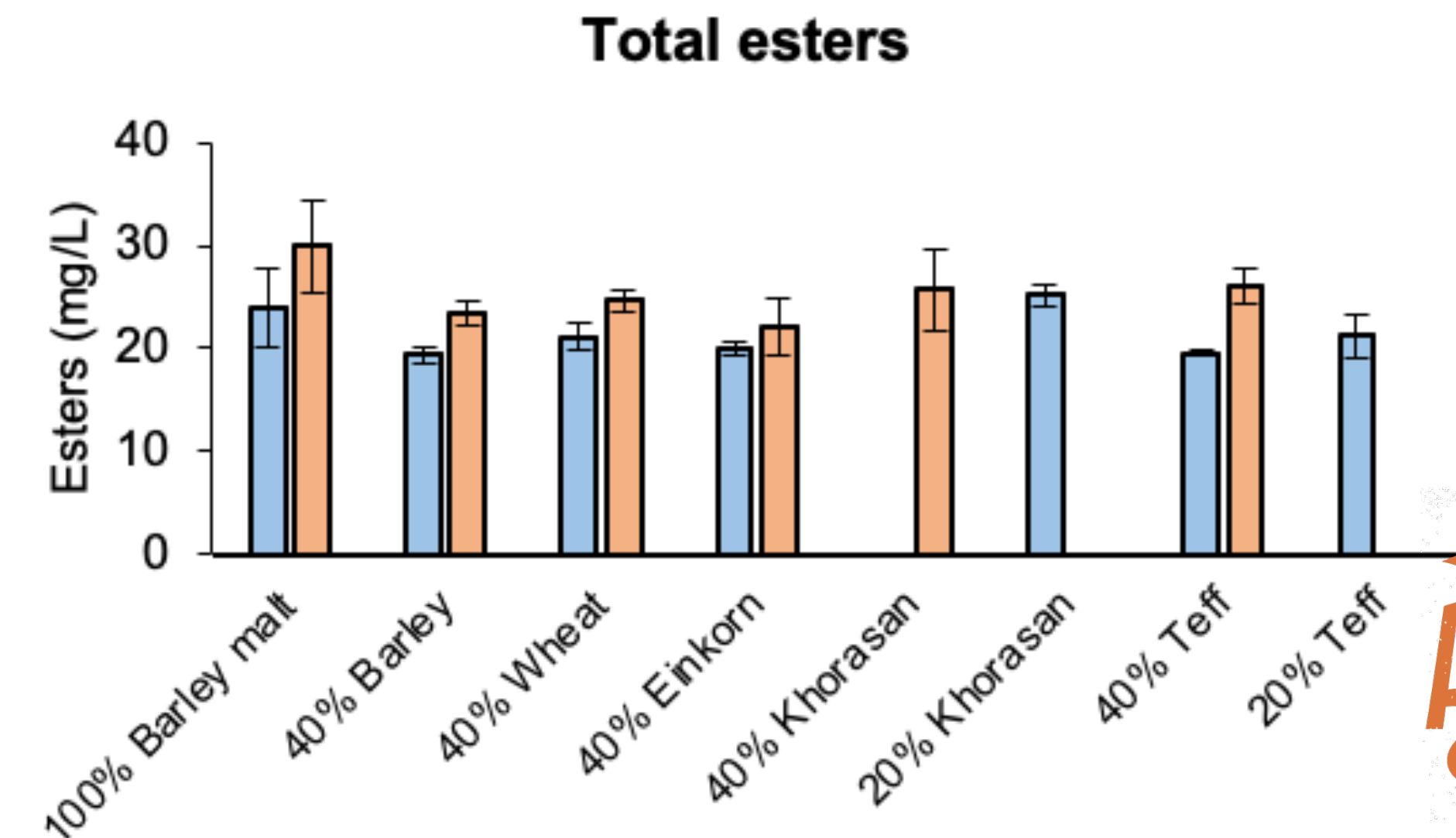
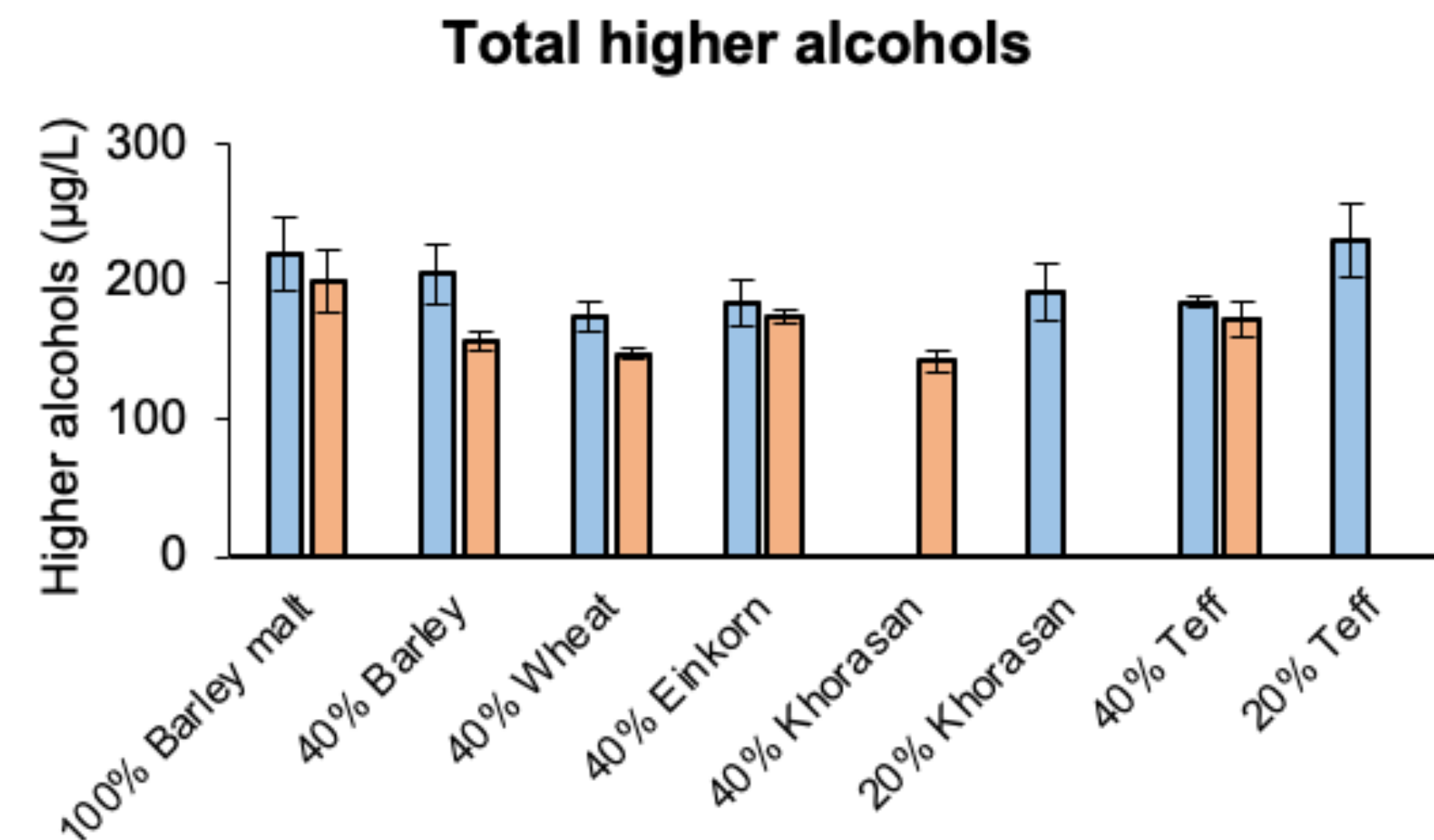
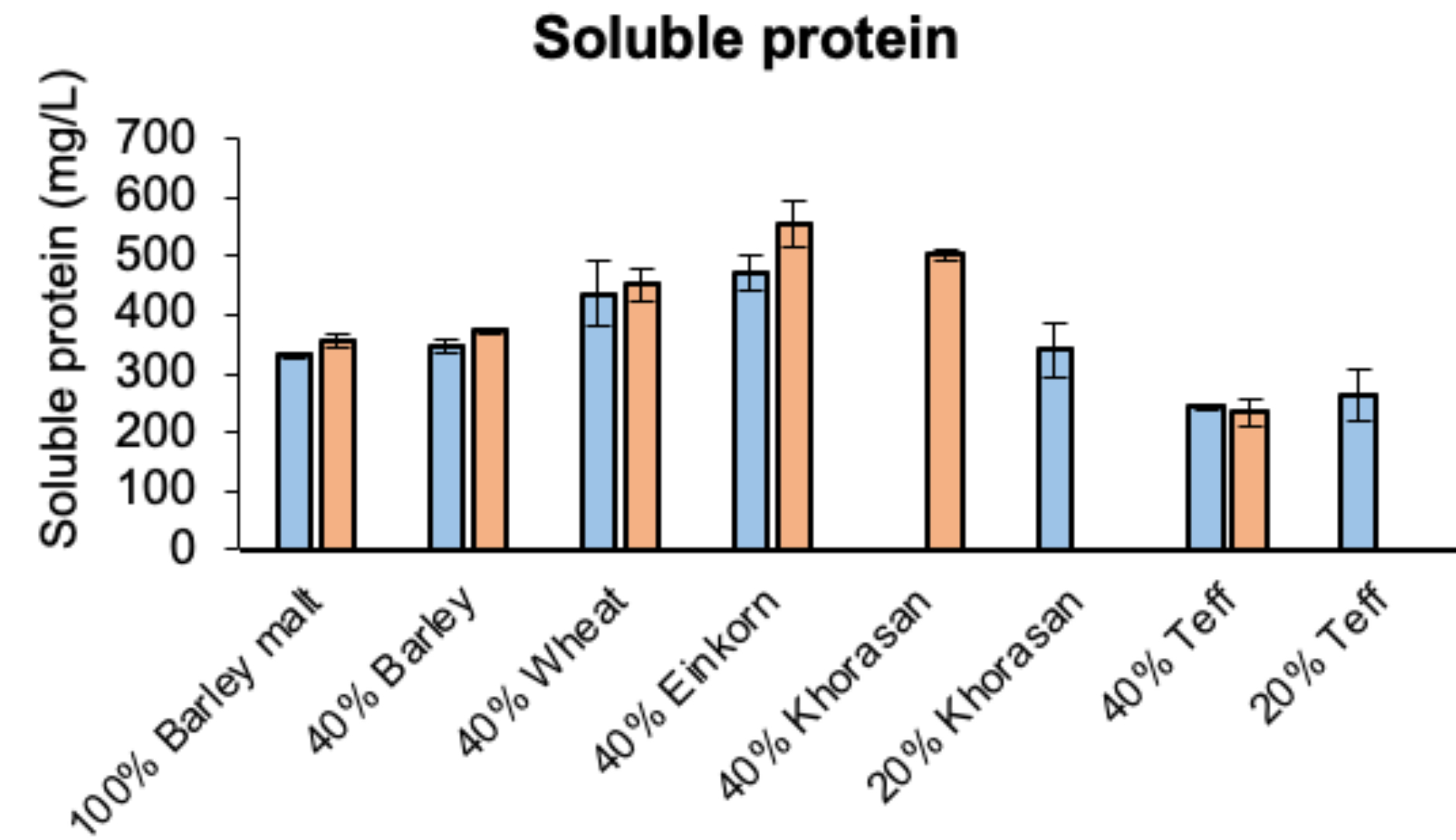
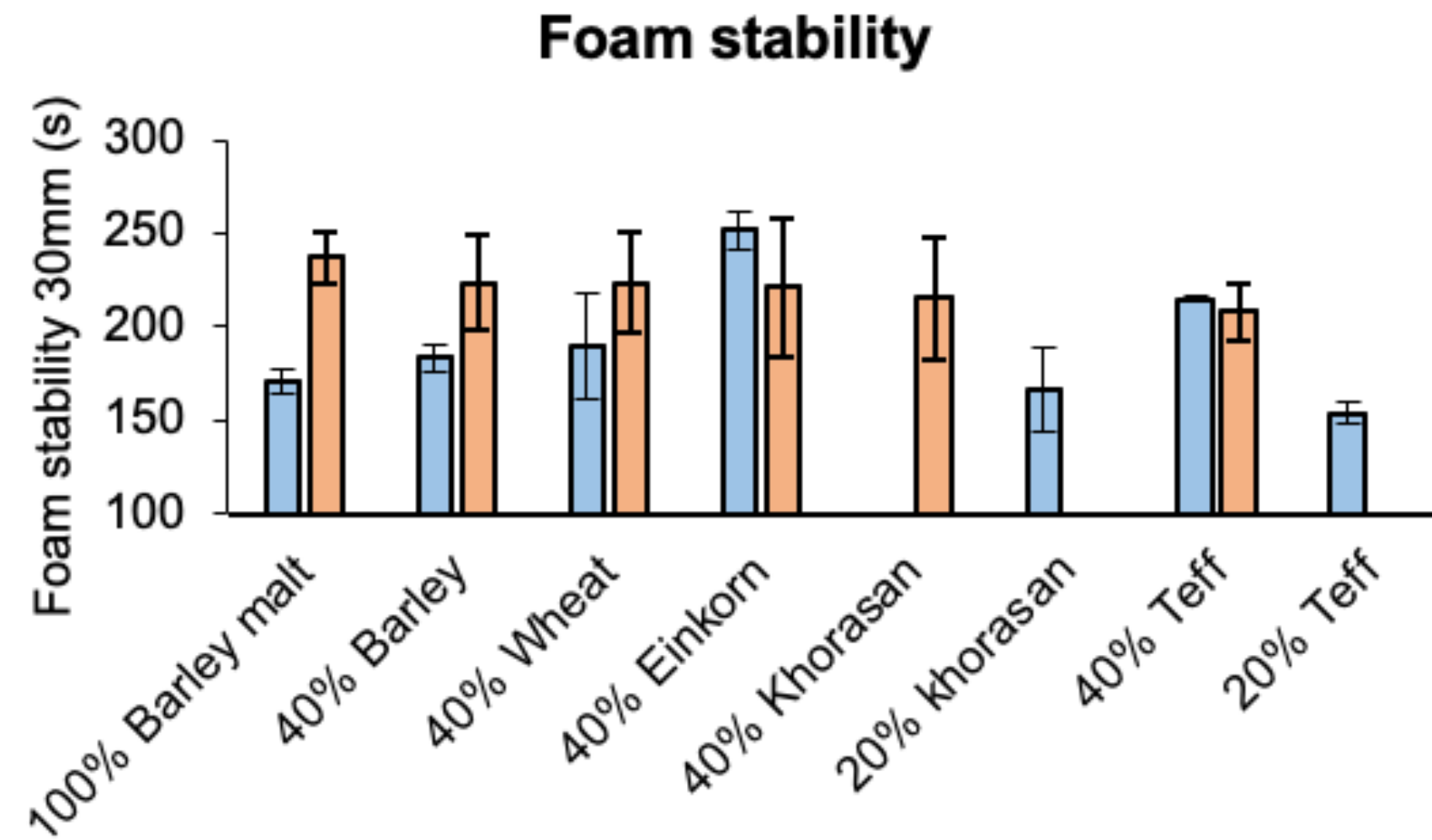
Pilot scale beers - Analytical

- Lauter tun
- Thin bed filter

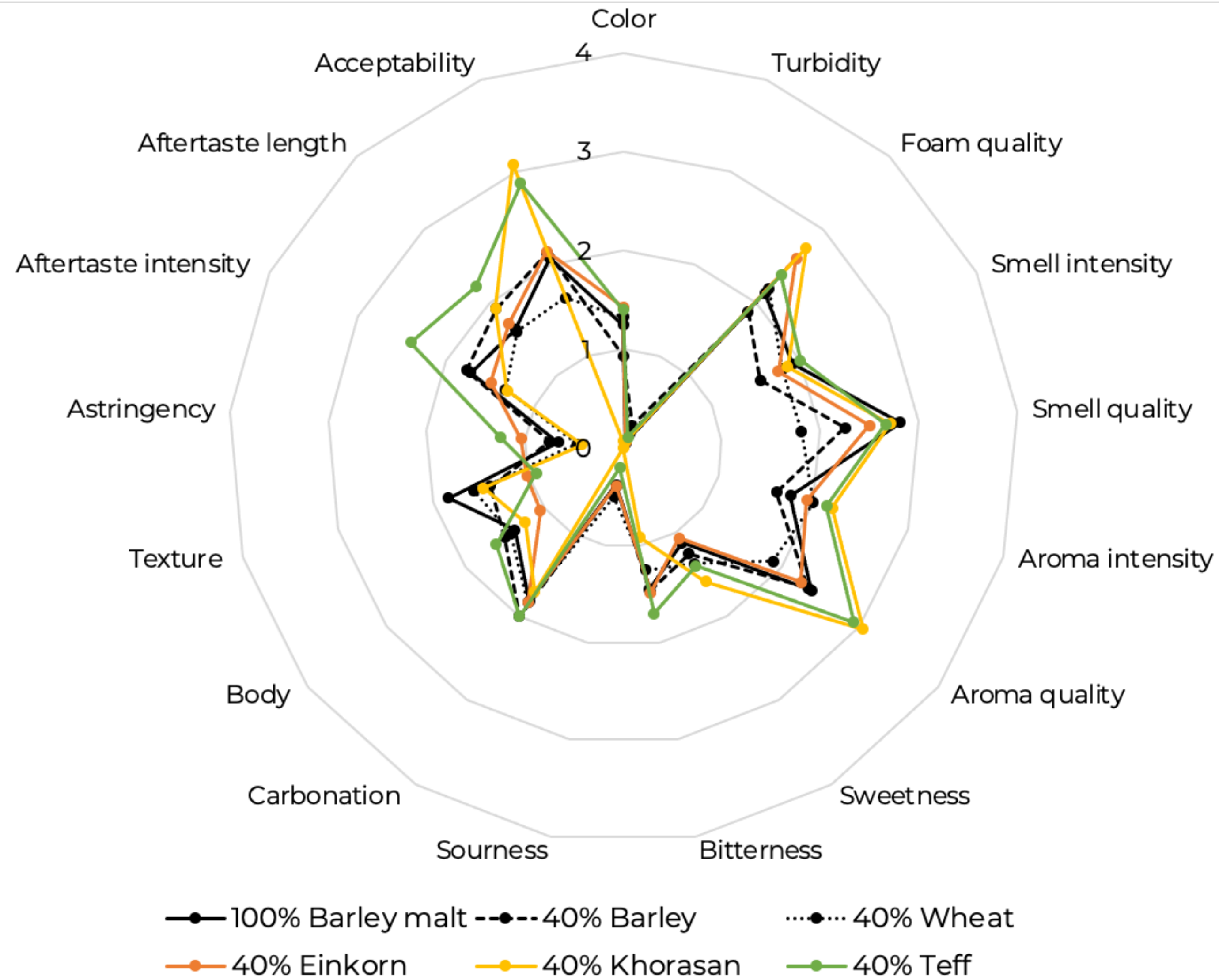


Pilot scale beers - Analytical

- Lauter tun
- Thin bed filter



Pilot scale beers - Sensory



Pilot scale beers upon storage



Einkorn

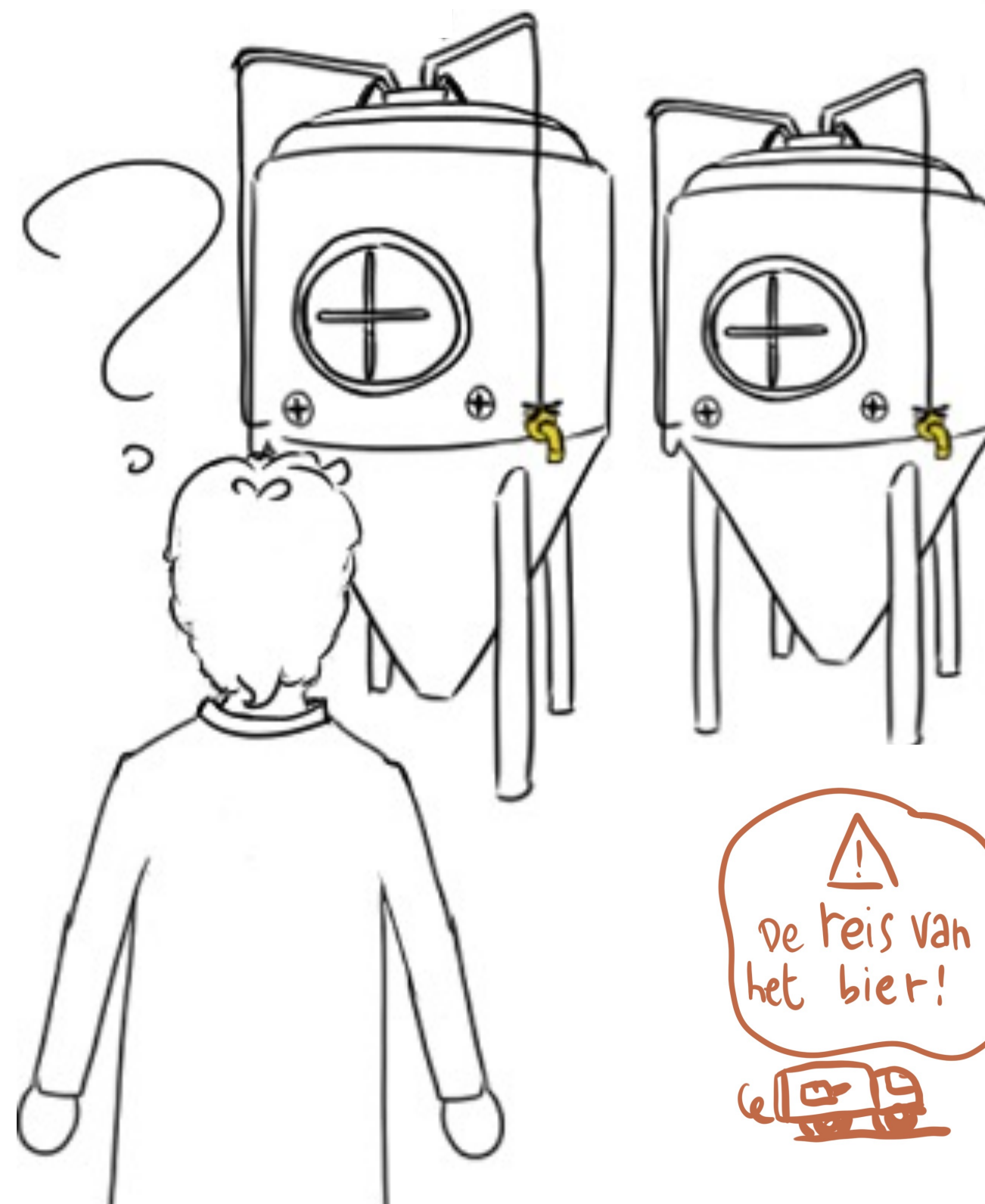


Khorasan



Teff

Beer ageing?



...EN Kwaliteit!
stabiliteit!



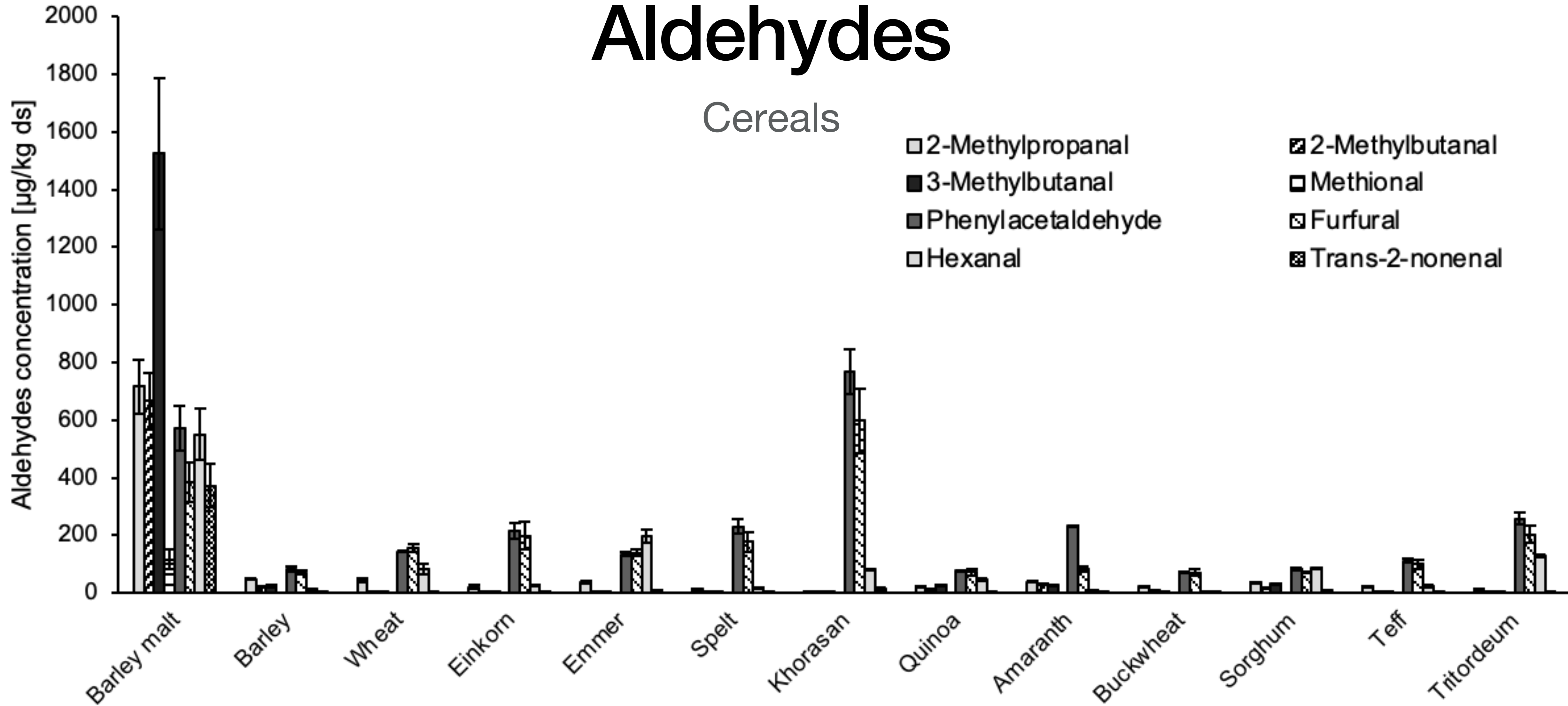
de consument komt terug

↓ Air dans la bouteille



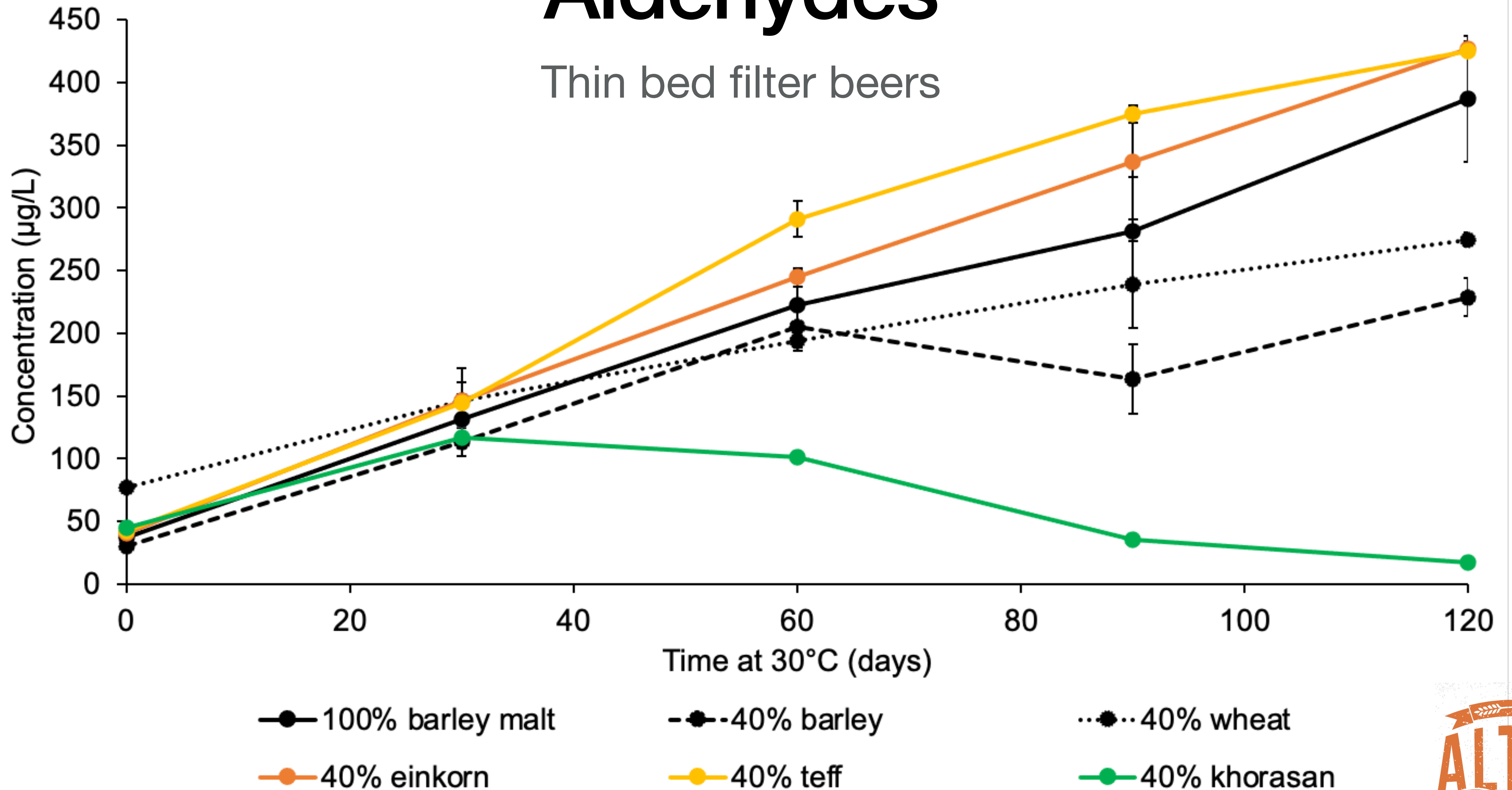
Aldehydes

Cereals



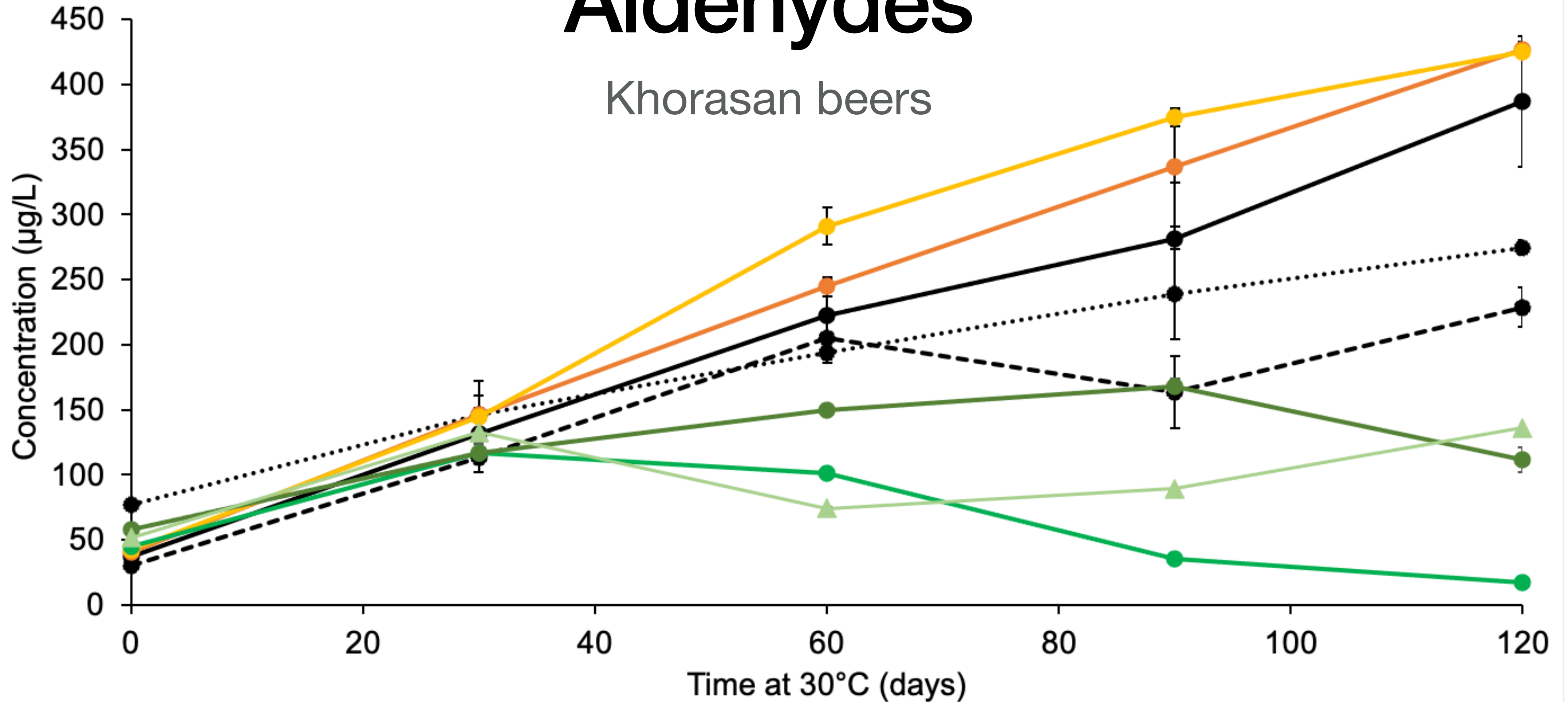
Aldehydes

Thin bed filter beers



Aldehydes

Khorasan beers



—●— 100% barley malt

—●— 40% einkorn

—●— 40% khorasan duplo

-●- 40% barley

—●— 40% teff

—▲— 40% khorasan lauter tun

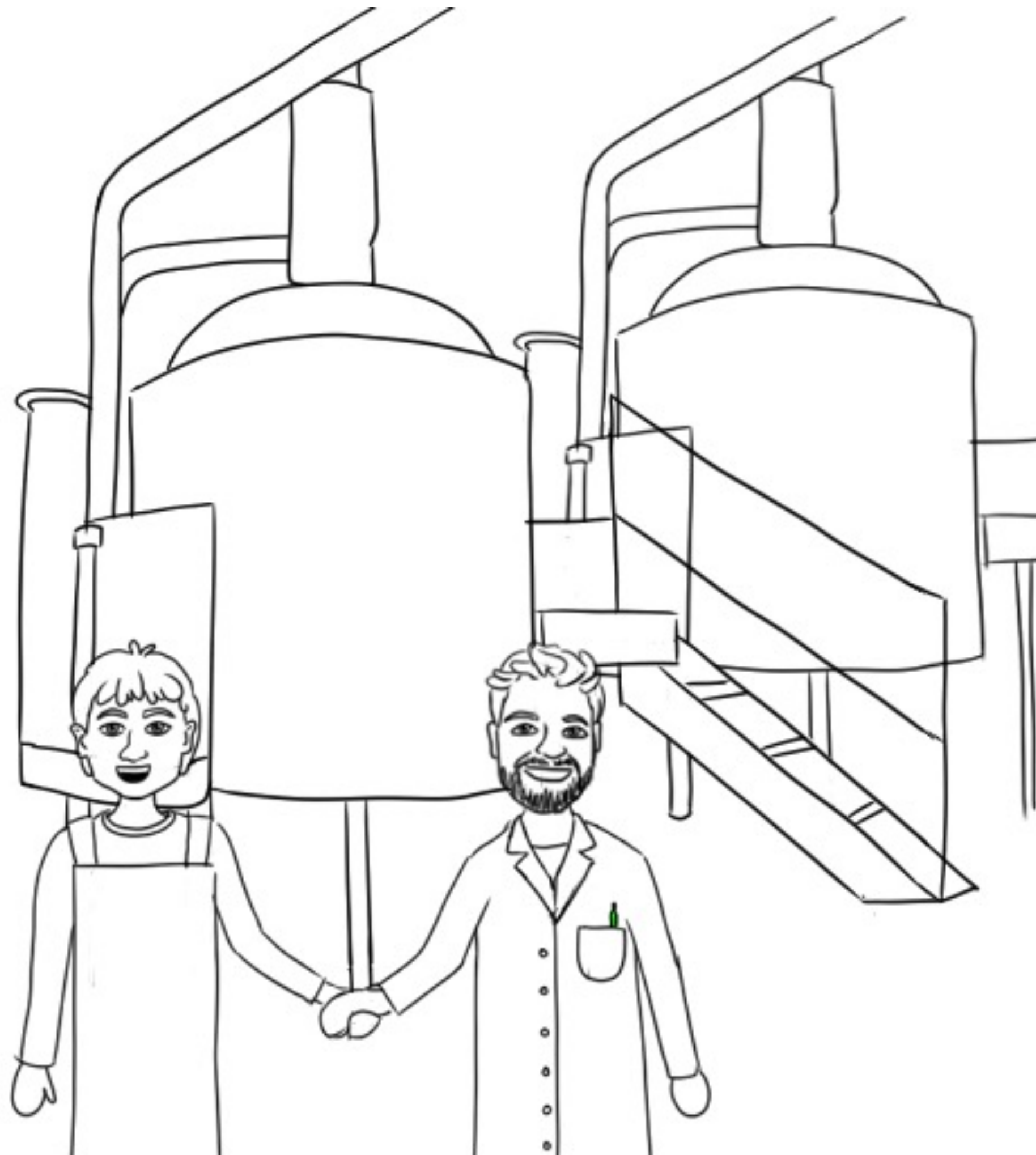
...●... 40% wheat

—●— 40% khorasan



Industrial case study

**DOOK
BREWING
CO**



Industrial case study

Equipment:

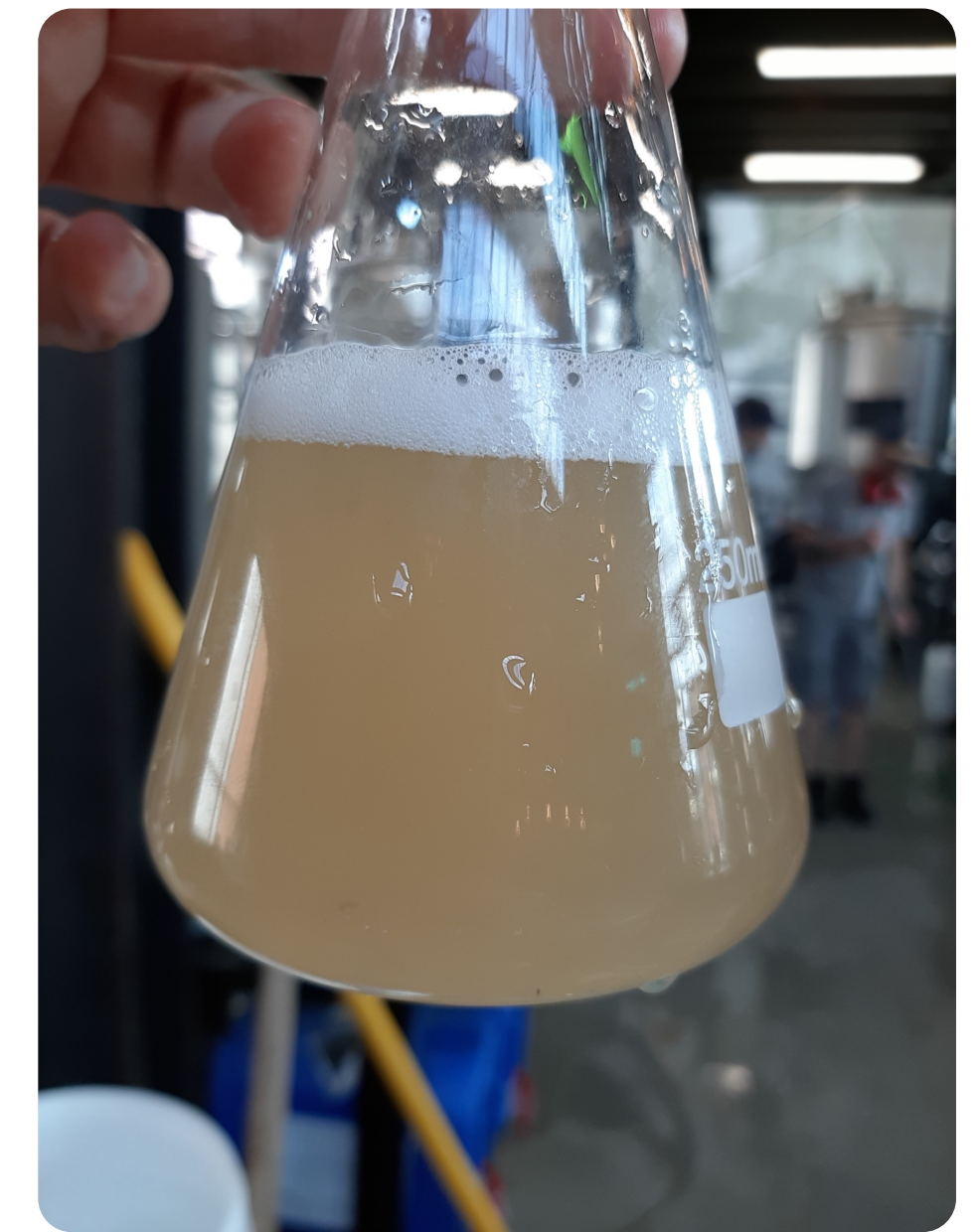
- 21 hL
- Lauter tun

Ingredients:

- 33% khorasan (Kamut®)
- 2% rice hulls
- Hallertau Merkur & Saaz
- Fermentis SafAle S-04 (19°C)

More lactic acid was needed

No filtration issues, no protein rest!



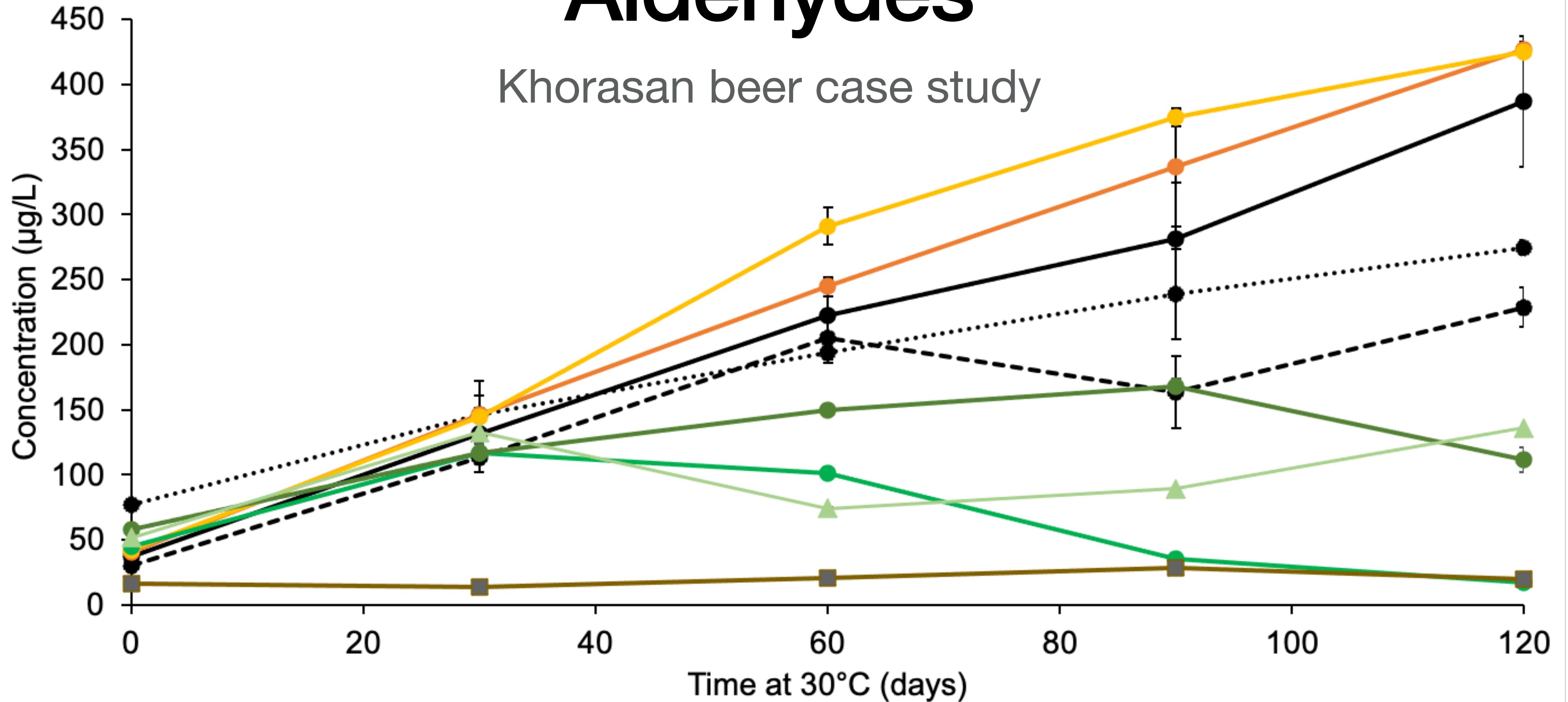
KAMUT®
BRAND KHORASAN WHEAT

DOCK
BREWING
CO

ALTER
Brew

Aldehydes

Khorasan beer case study



- 100% barley malt
- 40% einkorn
- 40% khorasan duplo
- 40% barley
- 40% teff
- 40% khorasan
- 40% wheat
- 40% khorasan lauter tun
- Camel Tooth (33% khorasan)





Meets consumer trends and brewers' requirements

CONSUMER
GEANALYSEERD



SMAAK een Geschiedenis



Gezondheid?

- bio?

- Regionaal?

- emotie

↓↓
Trends?

BRUWER
GEANALYSEERD



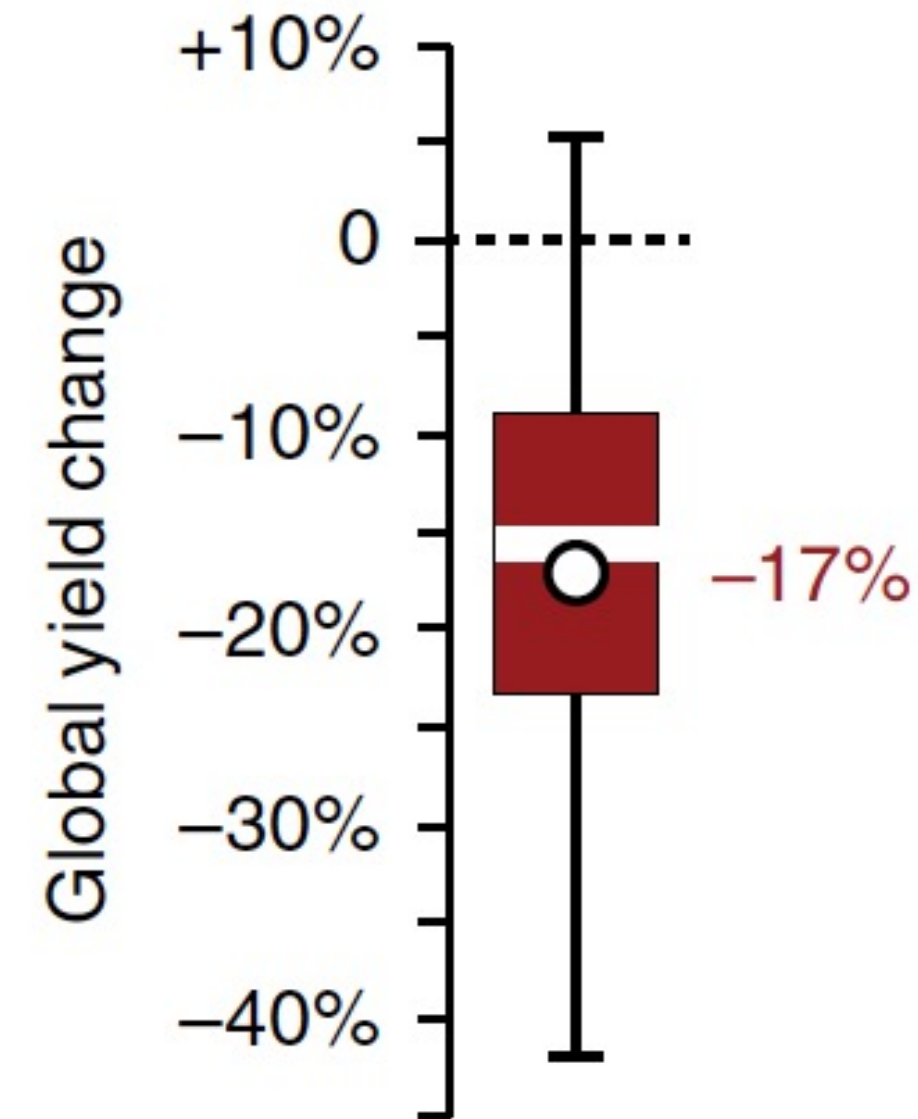
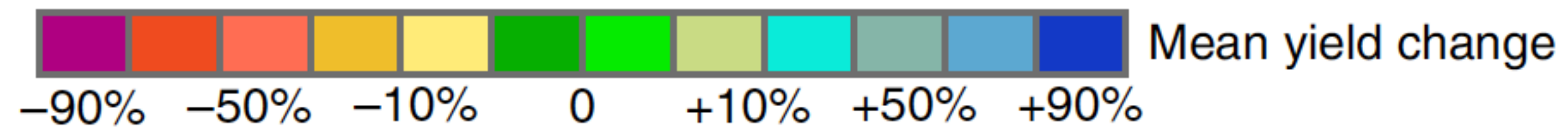
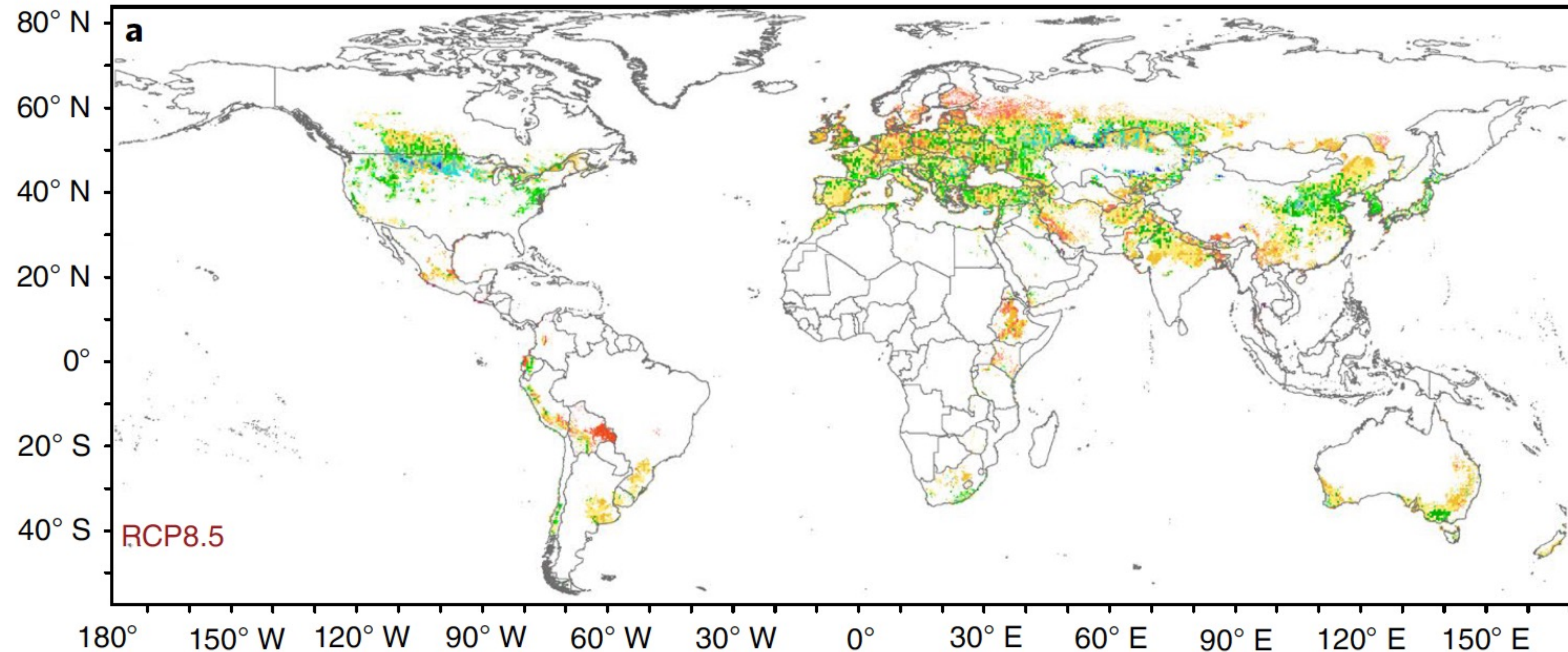
andere Granen?
Waabong

Status?

- Niche?

- Nieuwe
Producten?

Average barley yield forecast during extreme years









Jessika.DeClippeleer@UGent.be



BAILLIÈRE Jeroen¹, LAUREYS David¹, HUYS Joren², DE SUTTER Wouter³, SCHLICH Johanna³, VANOPSTAELE Filip³,
DE ROUCK Gert³, DE COOMAN Luc³, VANDERPUTTEN Dana², DE CLIPPELEER Jessika^{1,2}

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² IBF - Innovation centre for Brewing & Fermentation, AgroFoodNature, HOGENT University of Applied Sciences and Arts, Valentin Vaerwyckweg 1, 9000 Ghent, Belgium

³ EFBT - Laboratory of Enzyme, Fermentation, and Brewing Technology, KU Leuven Technology Campus Ghent, Gebroeders De Smetstraat 1, 9000 Ghent, Belgium

Illustrations: Vincent Rif & Loes De Witte



Pilot scale wort filtration - Thin bed filter

	100% Barley malt	40% Barley	40% Wheat	40% Khorasan	40% Teff	40% Einkorn *
Extract (°P)	25.7	24.3	23.7	23.8	23.2	20.9
Flow rate total (L/h)	156	139	137	180	166	204
Flow rate filtration (L/h)	245	154	234	288	266	518
Flow rate precompression (L/h)	107	77	91	127	127	170
Flow rate wash step (L/h)	141	142	111	158	165	142
Flow rate final compression (L/h)	213	115	158	289	280	376

* Brews with 40% einkorn are brewed with larger quantity of brewing water, so that these parameters cannot be compared with the other brews

