

Stability from nature

—

Functional use of plant polyphenols in brewing

EST. 1887

MURPHY & SON

Jonas Trummer, Dr.Eng.
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Who are we?



In the heart of the UK and present all around the world

Murphy & Son Ltd.

- Since 1887 supplier and manufacturer of
 - liquor treatments and processing aids**
 - ingredients, refinements, hygiene products**
 - manual handling equipment**
- Strong technical support
- UKAS accredited laboratory, Quality Control
- Research & Development

passionate about beer and the industry!

About Us

Customer Profiles

We work with some of the biggest names in the industry

Improve - Quality of the Product or Process

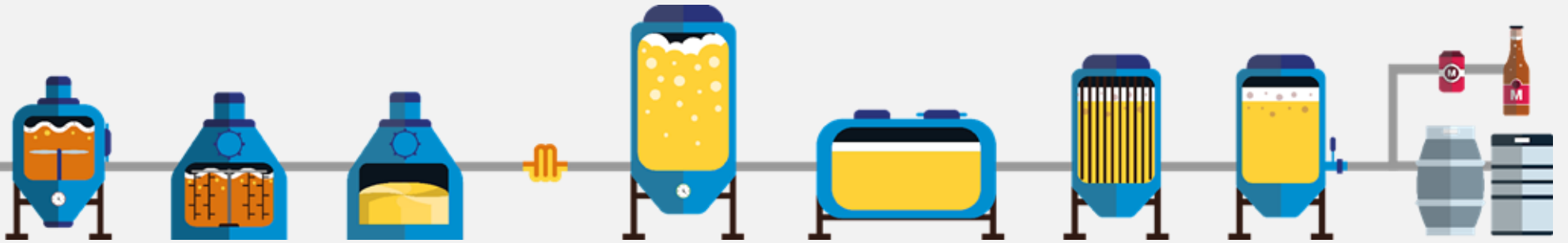
Reduce - Waste, Energy & Emissions

Save - Time and Money



Product range

PROCESS
OPTIMIZATION



Liquor treatments
& Raw materials



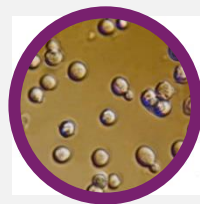
Stabilisers



Clarifiers



Foam-Enhancers



Yeast & Nutrients



Enzymes



Finings



Foam control



Laboratory
Services

Processing aids

- (i) not consumed as a food by itself;

- (ii) intentionally used in the processing of raw materials, foods or their ingredients, to fulfil a certain technological purpose during treatment or processing;

- (iii) May have a presence in final product (residue of substance or derivative), but do not present any health risk and do not have any technological effect on the final product



Product Range

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Learning Outcomes

| Brewty | Staze | MashLife |
|-----------------------------------|---|---|
| Antioxidant | Antioxidant | Antioxidant |
| Beer fining (protein) | Stabilising desirable haze (protein) | Very low fining properties |
| clear beer, shelf life extension, | NEIPAs, fruity hazy beers, Cider | Any type of beer to improve shelf life |
| Remove haze | Keep Haze | Extend shelf life, protect flavour |



Tannins

**Hydrolysable
Tannins**

Condensed Tannins
(Catechins or
proanthocyanidins)

**Gallotannins
(Gallic acid
base)**

**Ellagitannins
(Ellagic acid
base)**

Quinic acid
base (Tara
pods)

Ellagic acid
(Chestnut)

**Glucose base
(Gall nuts)**

Brewty and
Staze

**Punicalagin
(Pome-
granate)**

Mashlife

Brewty – Natural fining



Historic use of tannins....



Oak Tannins from barrels deliver preservation of beverages through inherent antioxidant function.



Tannins

Hydrolysable
Tannins

Tara Pods



Gallotannins
(Gallic acid
base)

Quinic acid
base (Tara
pods)

Glucose base
(Galls/Sumac)

Aleppo
Gallnuts



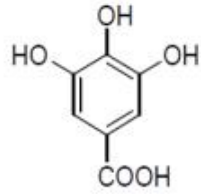
Chinese
Gallnuts



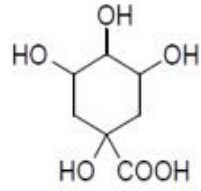
Sumac Leaves



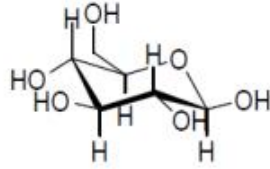
Building Blocks



Gallic acid

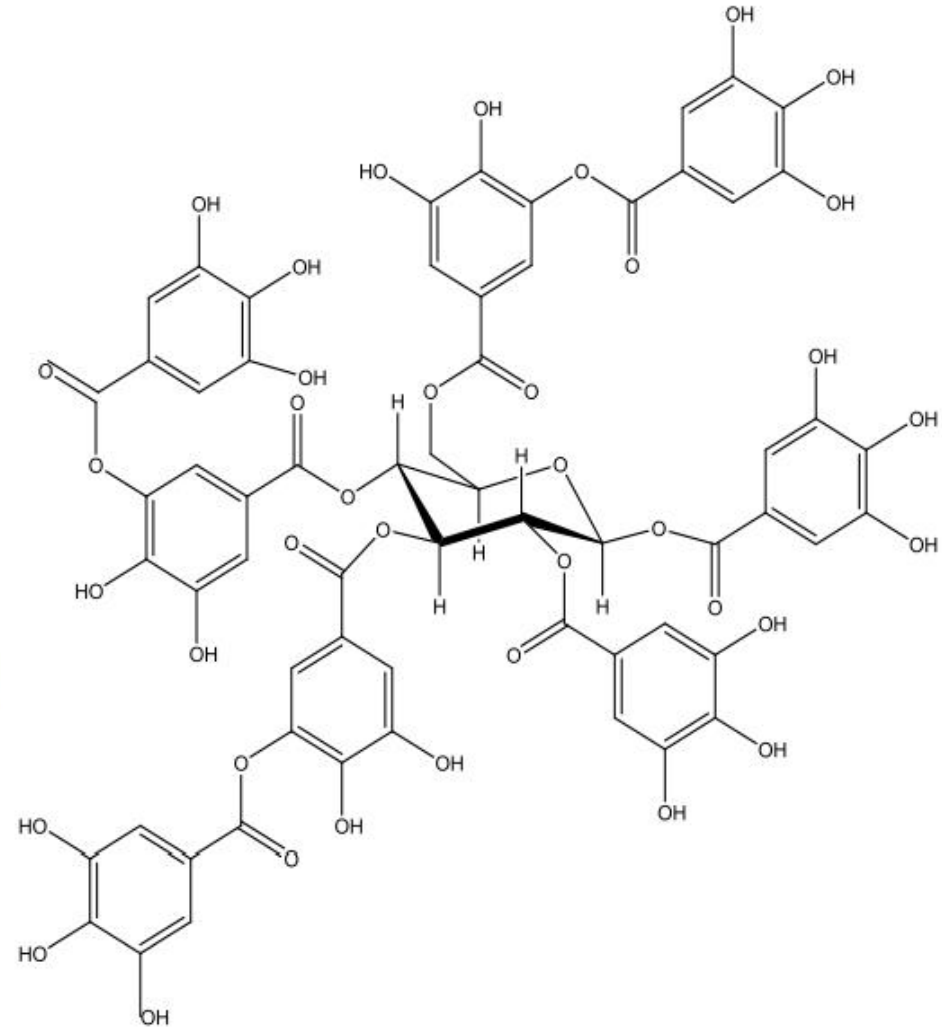


Quinic acid



Glucose

Gallotannin



Properties of Gallotannins – for brewing

Protein binding through the formation of a complex

- Removal of non-desired proteins (colloidal haze)
 - Haze sensitive, Proline, Globulin, Albumin,...
- Or – Haze stabilisation (Weizen, Wit, Summer Ales)

Metal complexation

- Binding of free metal ions (e.g. Fe)
- Inhibition Fenton oxidation reaction
- Enzyme inhibition

Antioxidant

- Preservative
- Colour stabilisation
- Flavour stability

**Colloidal
Stability**

**Organoleptic
Stability**

Colloidal Stability of Beer

Colloidal instability in beer is caused by the interaction of proteins and polyphenols

Three principal changes can be observed:

- Chill haze: precipitation of protein-polyphenol complexes
- Possible increase in off-character aftertaste
- Increase in colour (oxidation)

Controlling colloidal stability can be done by:

- Reducing proteins
- Reducing polyphenols
- Simultaneously reducing proteins and polyphenols



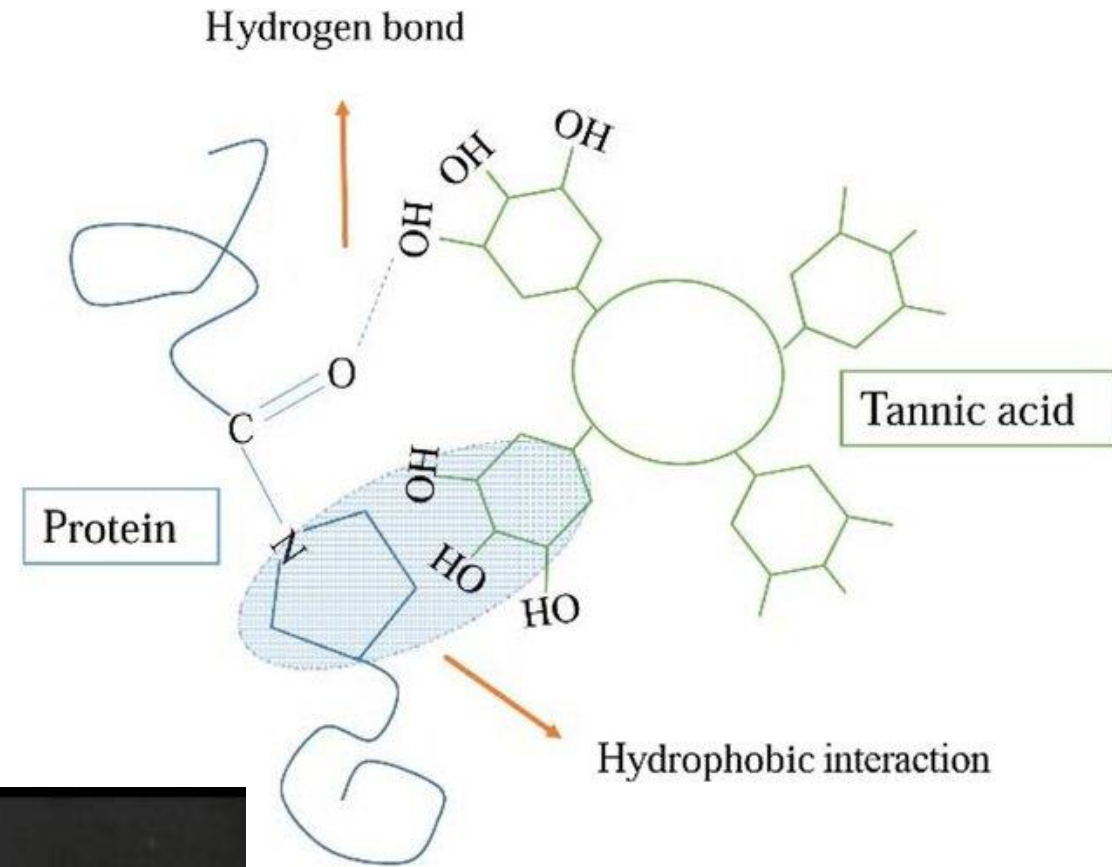
Colloidal stability

Protein binding through the formation of a complex

Very fast reactions

- hydrogen bonds
- interactions of phenolic groups of gallotannins with amino acid side of proteins

Reacts immediately with the sensitive proteins in the beer



Colloidal stability

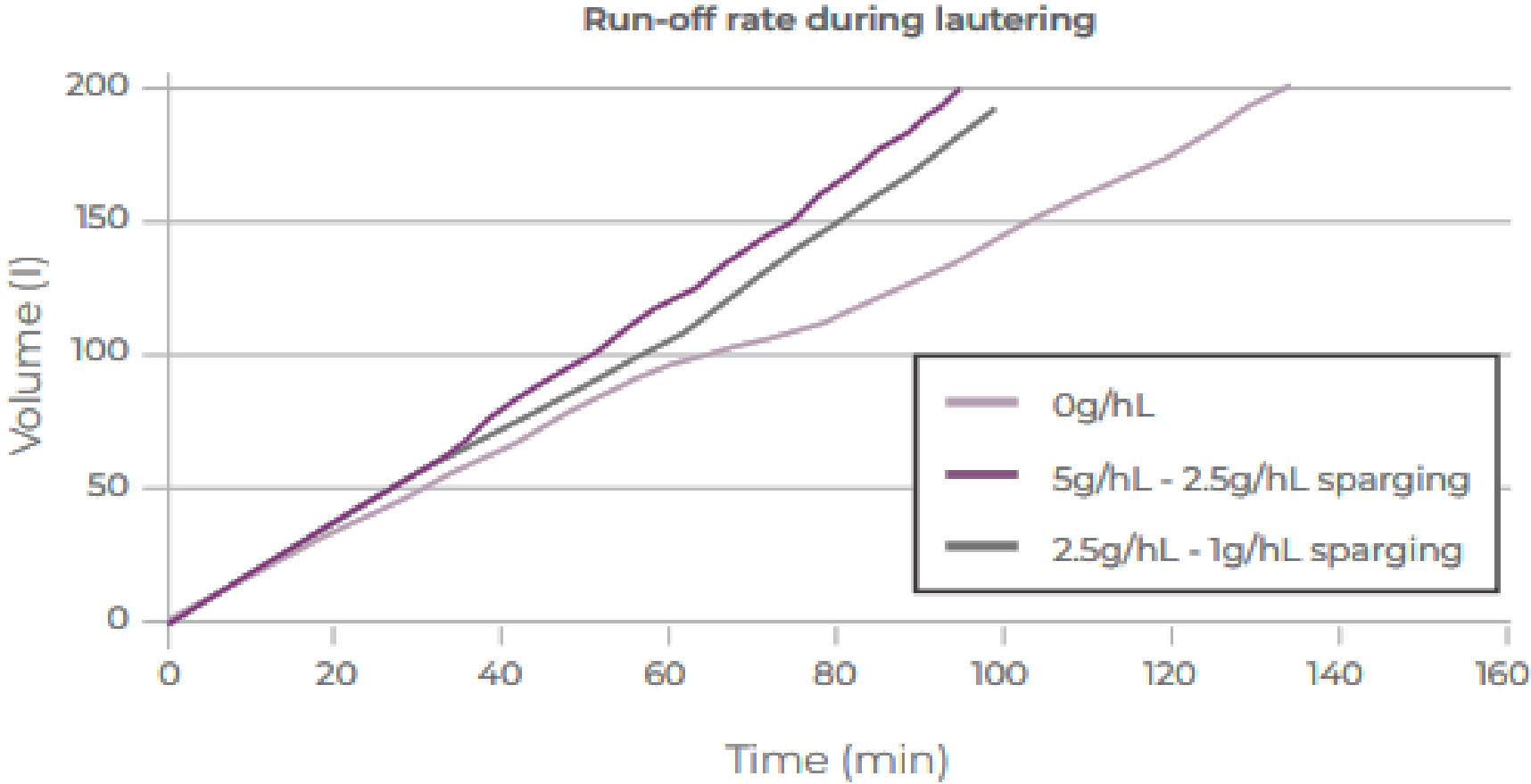
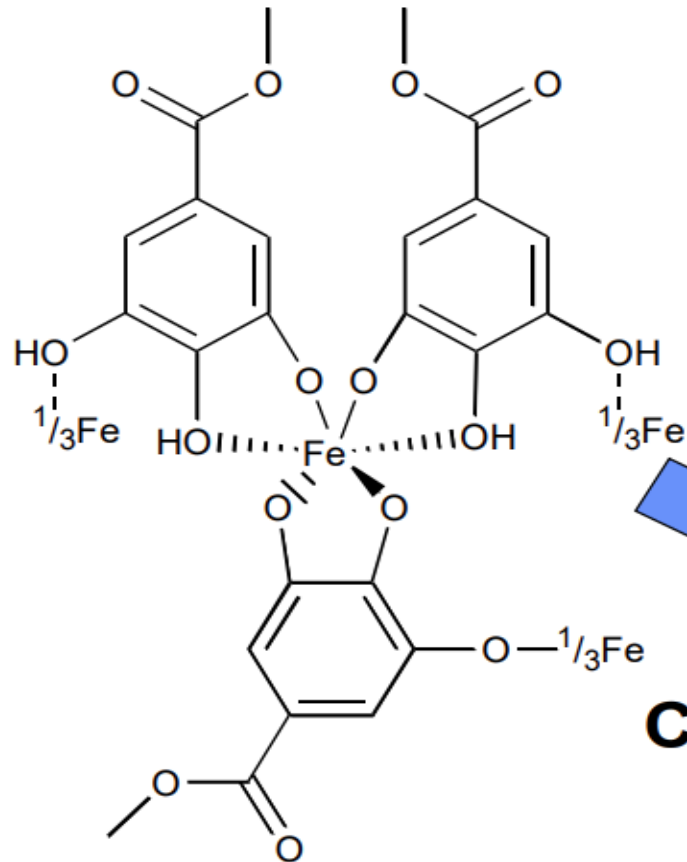


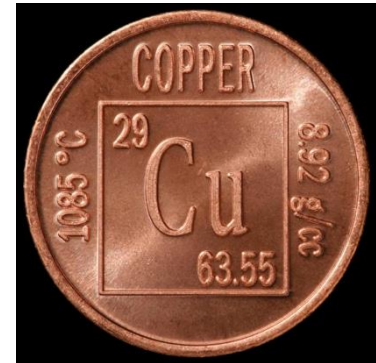
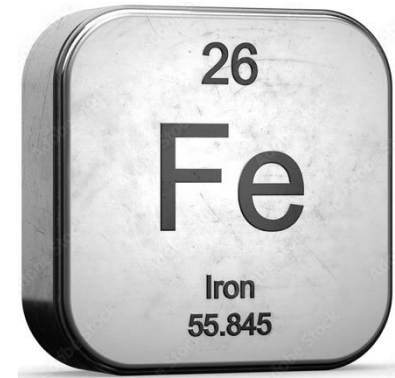
Fig. 1: Improved run-off rate during lautering when using Brewty

Gallotannin–Metal Complex Formation



Tannic acids are a well-known chelating agent

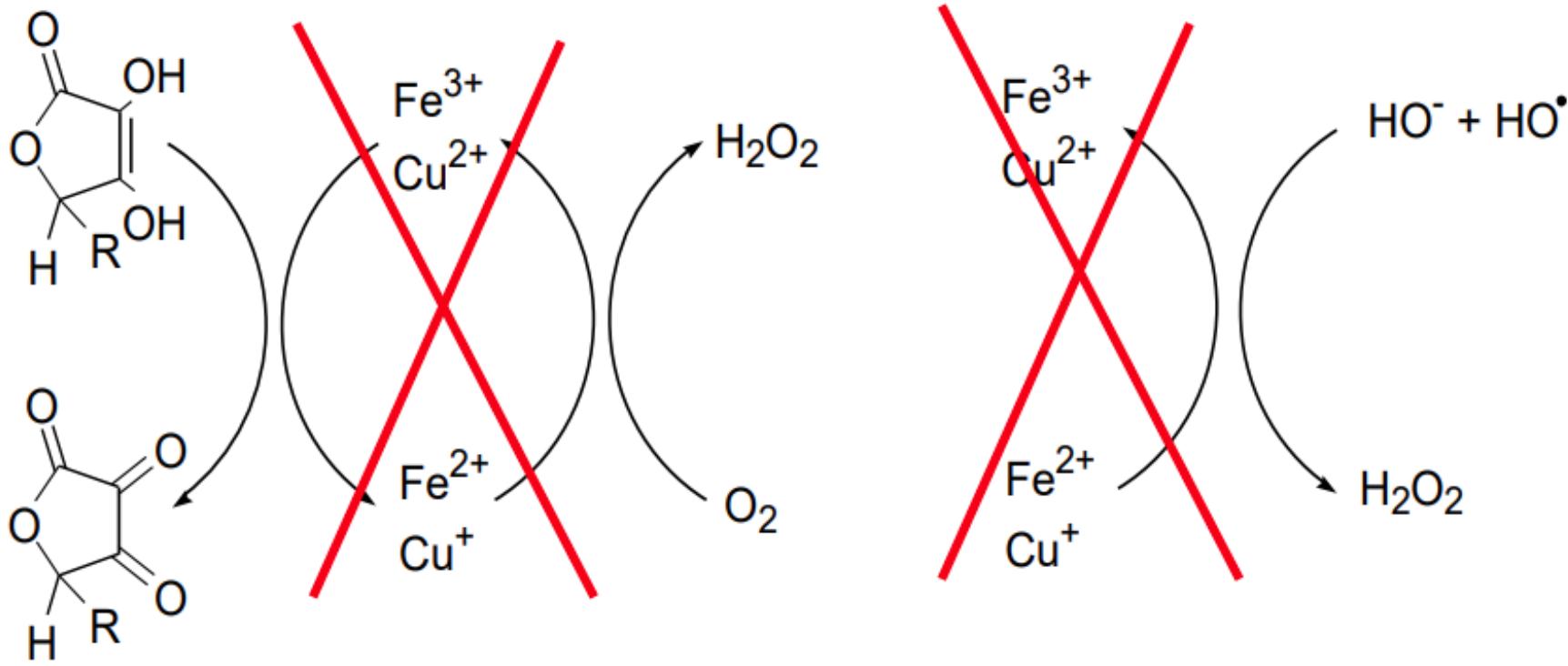
Chelation/Inactivation



Metal Complex Formation

- Chelation is a type of chemical bonding where metal ions are bound in the 3d shape of another molecule(s).
- This 'inactivates' the ion and can pull it out of solution.





Through complexation of metals, Tannic acid prevents Fenton's and Haber-Weiss reactions, reducing the risk of off-character flavor development during the shelf life of the finished product.

Staze –
Create and keep
your haze!



Creating Stable haze – STAZE

- WHY
 - Hazy beers getting clear over a short or longer time after packaging in bottle or keg
- For which type of beers
 - Hazy IPA
 - NEIPA
 - All kinds of wheat beer
 - Kellerbeer/Zwickelbeer
 - Beer with fruit (juice/puree) addition



Creating Stable haze – STAZE

- HOW
 - A mixture of high-quality tannic acids with different particle sizes
 - It reacts with haze forming proteins in the green or finished beer
 - Flocs formed are not so big and will be kept in solution
 - Particles without binding partner drop out to the bottom of the tank





Filtered, stabilised Lager



After Staze



24 h later

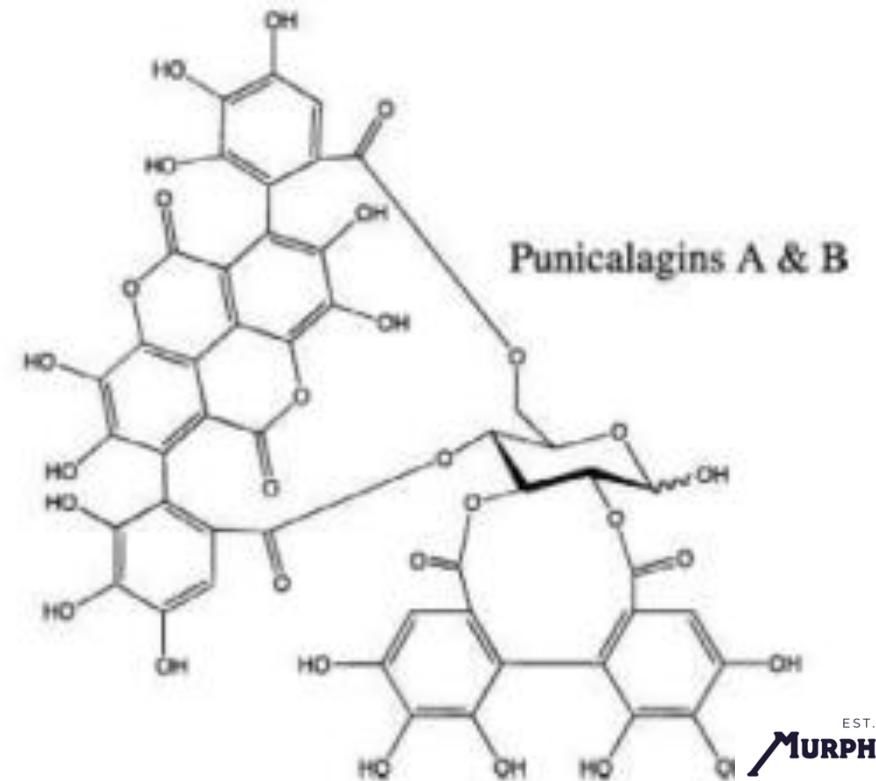
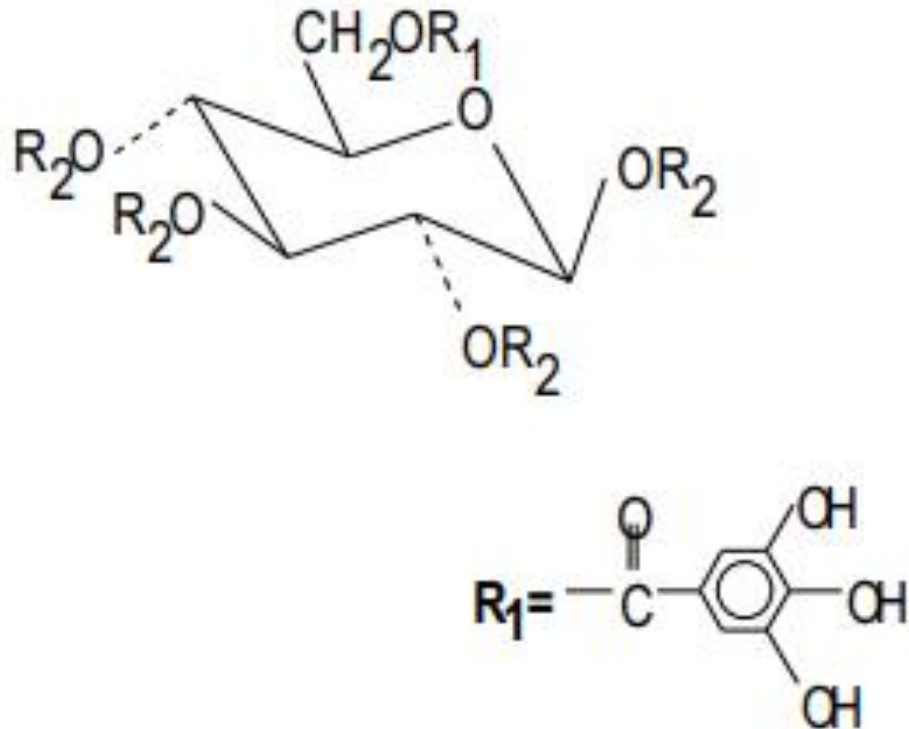
Still keeping established brewing techniques for hazy beers!

MASHLIFE – THE ANTIOXIDANT

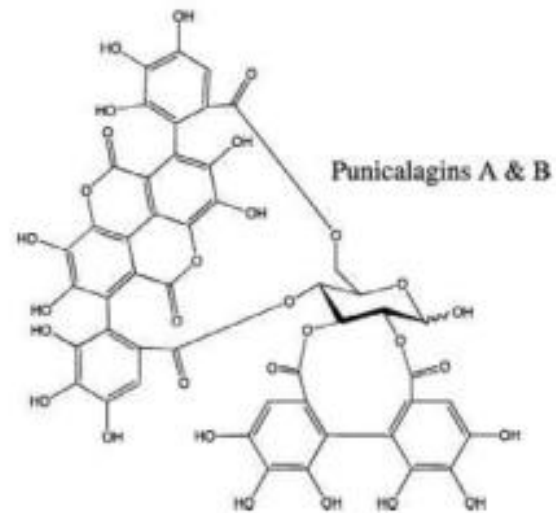
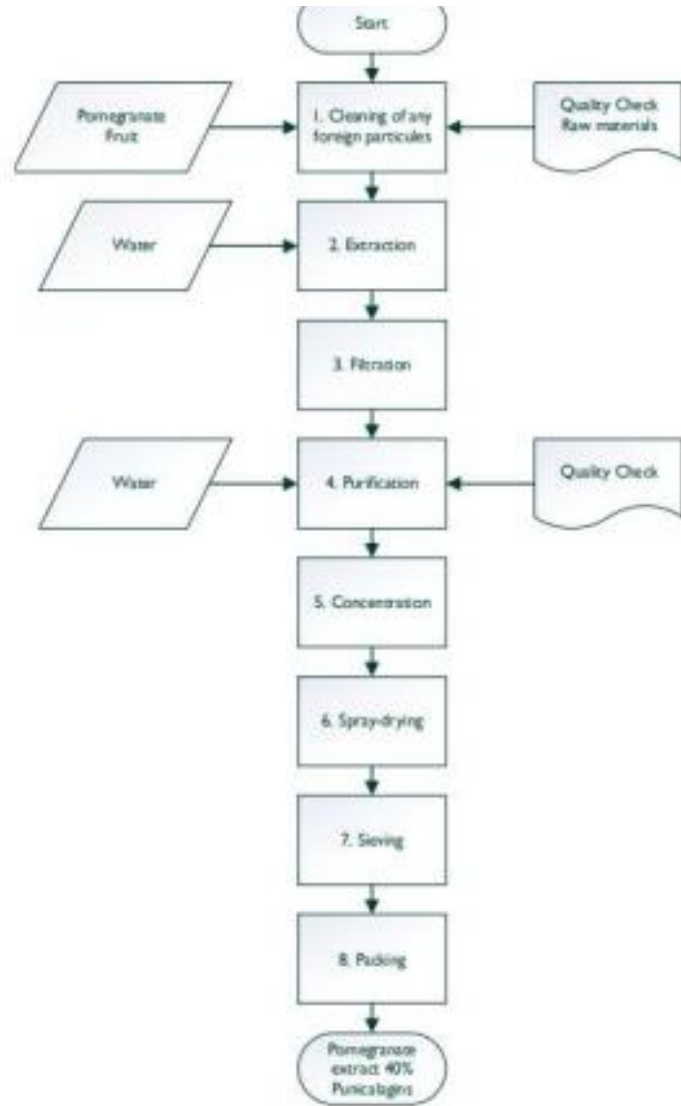


Mashlife – highly purified Punicalagin

- Polyphenols = complex 3 dimensional structures



Natural, botanical extract



Sample Matrix – TU Berlin tests

Control:

- Control trials without addition

Trials 1:

- 3 g/hL dry to mash grist case

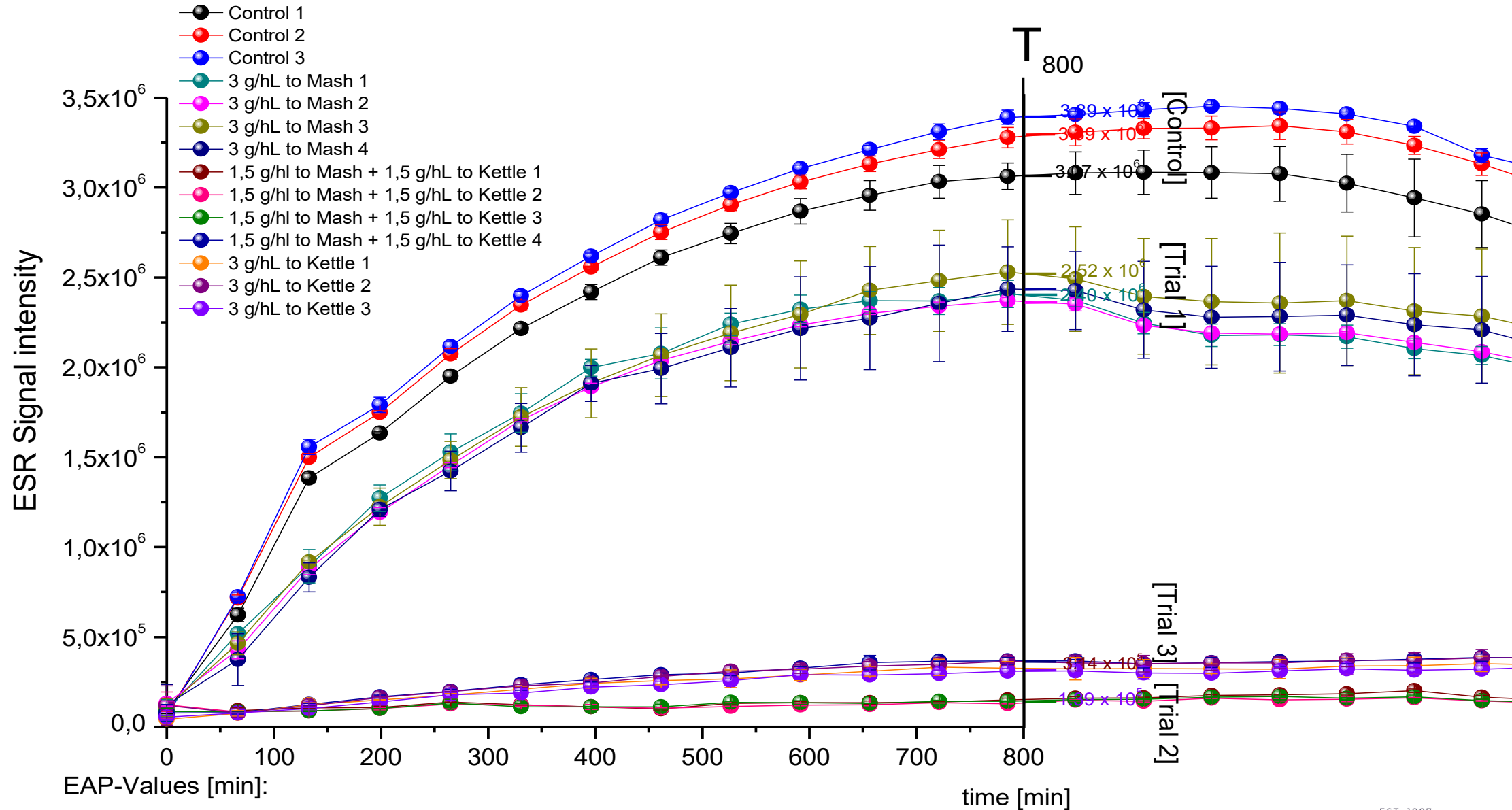
Trials 2:

- 3 g/hL to kettle before first hop addition as a 5% solution

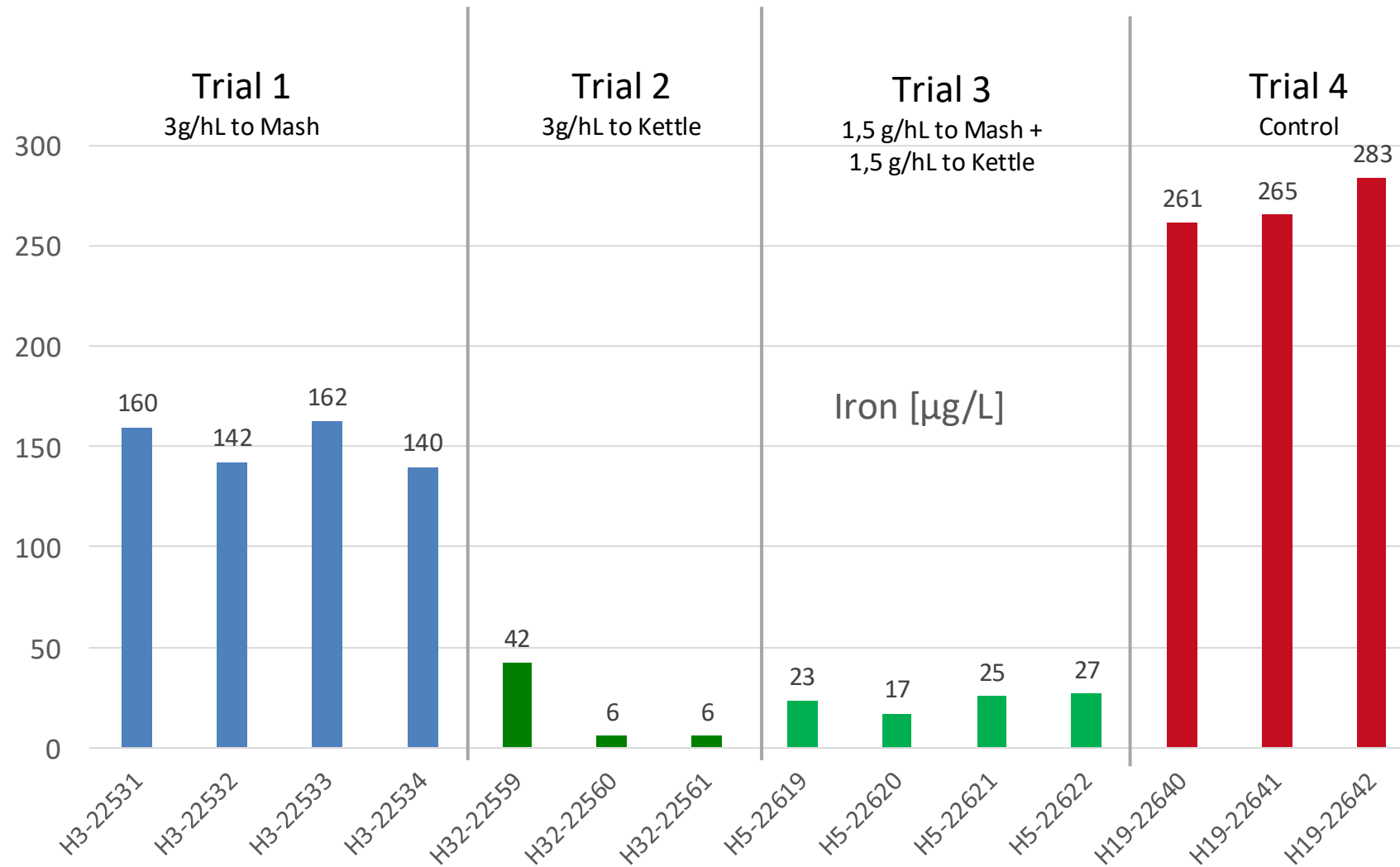
Trials 3:

- 1,5 g/hL dry to mash grist case
- 1,5 g/hL to kettle before first hop addition as a 5% solution

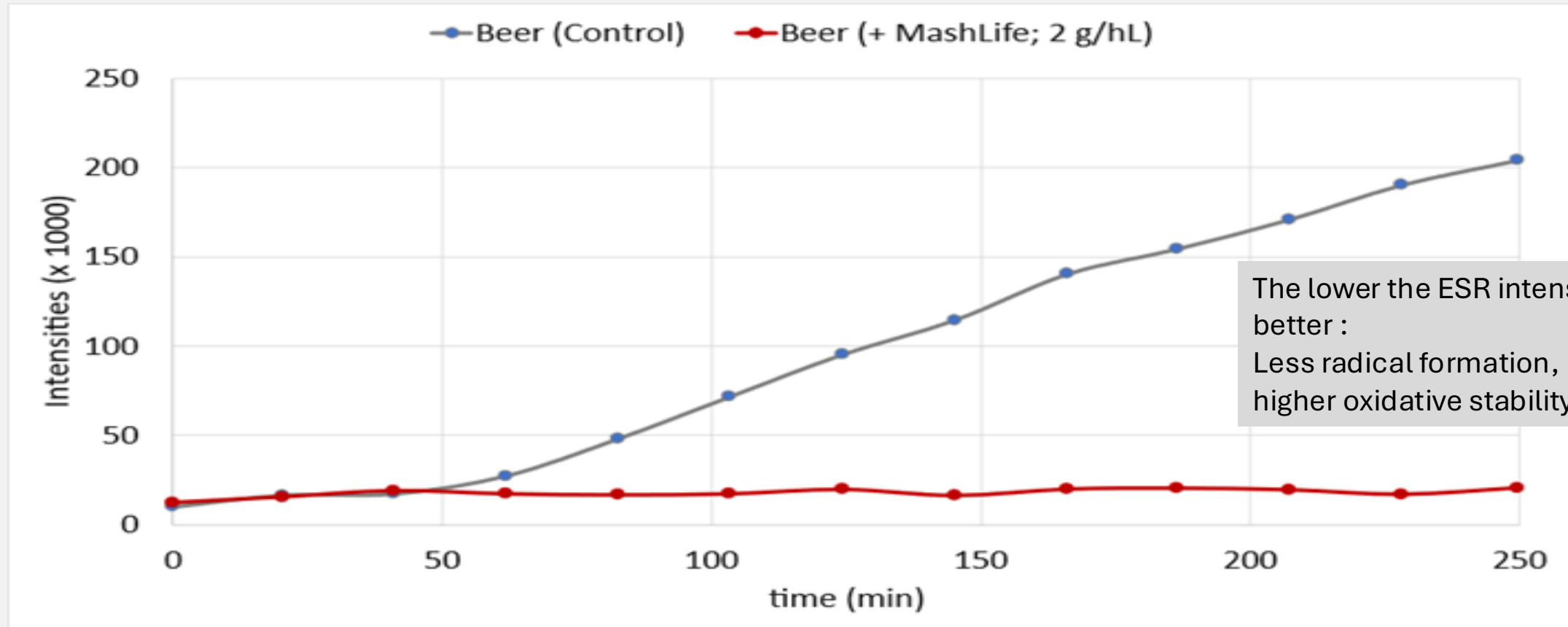
Wort analyses - ESR



Wort analyses – Iron content



How Effective?



Evaluation of oxidative stability evaluated using Electron Spin Resonance (ESR) analysis of forced aged beers with (**2g/hl**) and without the addition of the pomegranate extract product (MashLife).

and fyi... Ascorbic acid (Vitamin C) is actually prooxidative

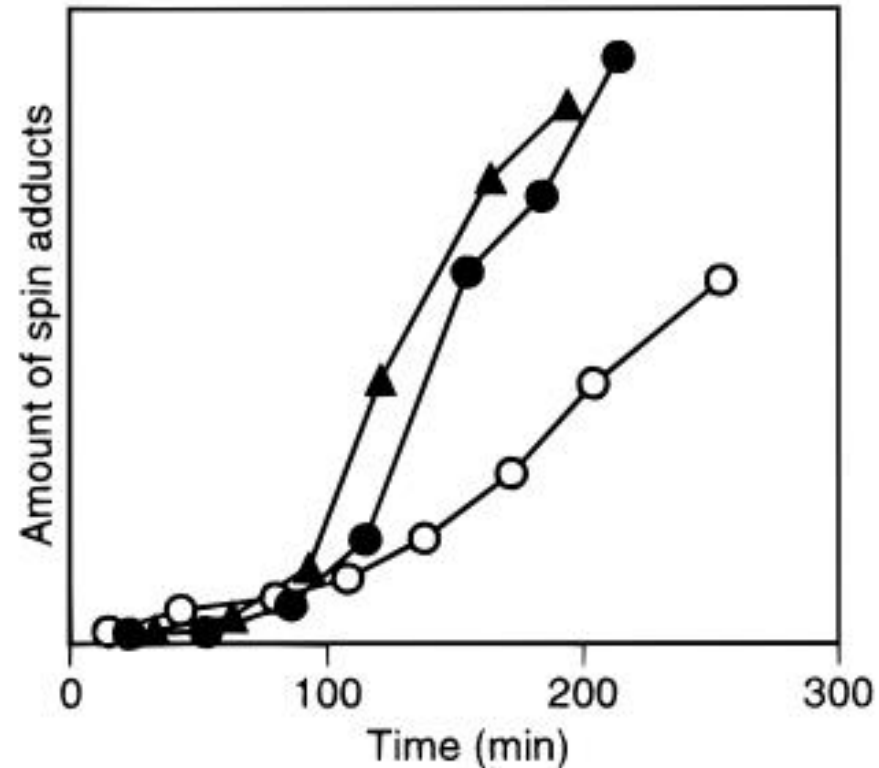


Figure 7. Prooxidative effect of ascorbate in lager beer. The intensity of ESR signals from PBN spin adducts in beer D spiked with 0.2 mM ascorbate (●), 0.5 mM ascorbate (▲), and control (○). PBN (30 mM) was added, and the beer was heated to 55 °C.

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