

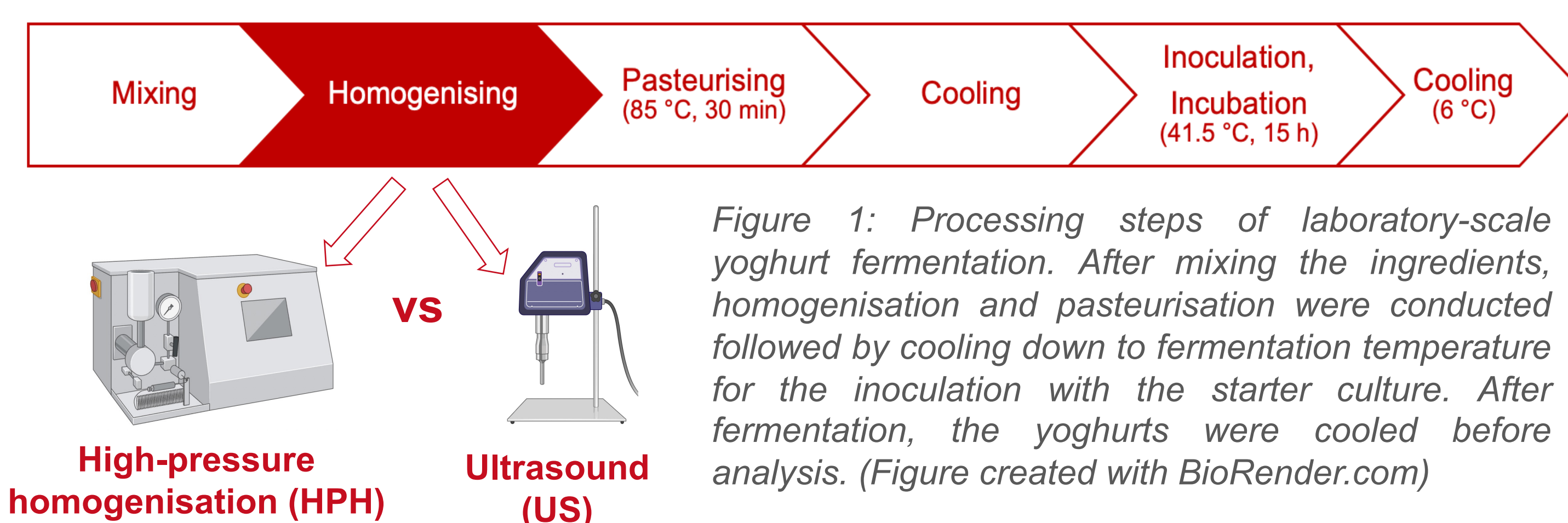
Effect of techno-functional modification of fibre-enriched pea protein-based yoghurt alternatives on aroma profile and texture characteristics

Introduction

- The intake of **plant proteins and dietary fibres** is recommended for a **healthy diet** [1].
- Their incorporation into conventional foods may be **challenging** due to **techno-functional** and **sensorial limitations**:
 - characteristic of pea protein: **off-flavours** → "beany", "grassy" [2]
 - characteristic of plant fibres: high water-binding capacities → might **change texture** and **sensory properties** of foods [3]
- **Yoghurt is a protein-rich food with high consumer acceptance** [4].
- **Fermentation decreases** plant protein-related **off-flavours** [5, 6].
- This study aimed at developing a plant **protein-based yoghurt alternative**, consisting of **4.65 % pea protein isolate**, **3 % plant fibres**, **3 % rice syrup**, and **2.5 % rapeseed oil**, fermented by lactic acid bacteria.

Methods

- **Ultrasound treatment (US)** was used as alternative to conventional high-pressure homogenisation (HPH) in yoghurt production process:



- **Off-flavour reducing potential of US and fibres** were determined by **aroma analyses (HS-GC/MS)**.
- **Texture characteristics and quality parameters** were determined by rheology (amplitude sweep), syneresis, scanning electron microscopy (SEM), pH, and colourimetry.

Results

Effects of US on aroma profile

- **US significantly**
 - **reduced** concentrations of **legume-related off-flavour** compounds (hexanal, 2-pentylfuran, 2-methylpropanal) (Fig.2)
 - **increased** concentrations of **yoghurt-related aroma** compounds (diacetyl, acetoin) (Fig.2)
- Effects were attributed to **cavitational forces of US**:
 - **increased availability of substrate** might have increased fermentation rate and consequently yoghurt aroma compounds
 - **conformational changes** might have **altered hydrophobic regions** on the surface of the proteins → detaching of the **hydrophobic, reversibly bound off-flavour-related** compounds
 - promotion of **aldol reactions** and **Schiff base formations** contributing to the **reduction of off-flavours**
- Structure of homogenisation system might affect off-flavour reduction: HPH = closed system vs **US = open system** (aromas can evaporate)

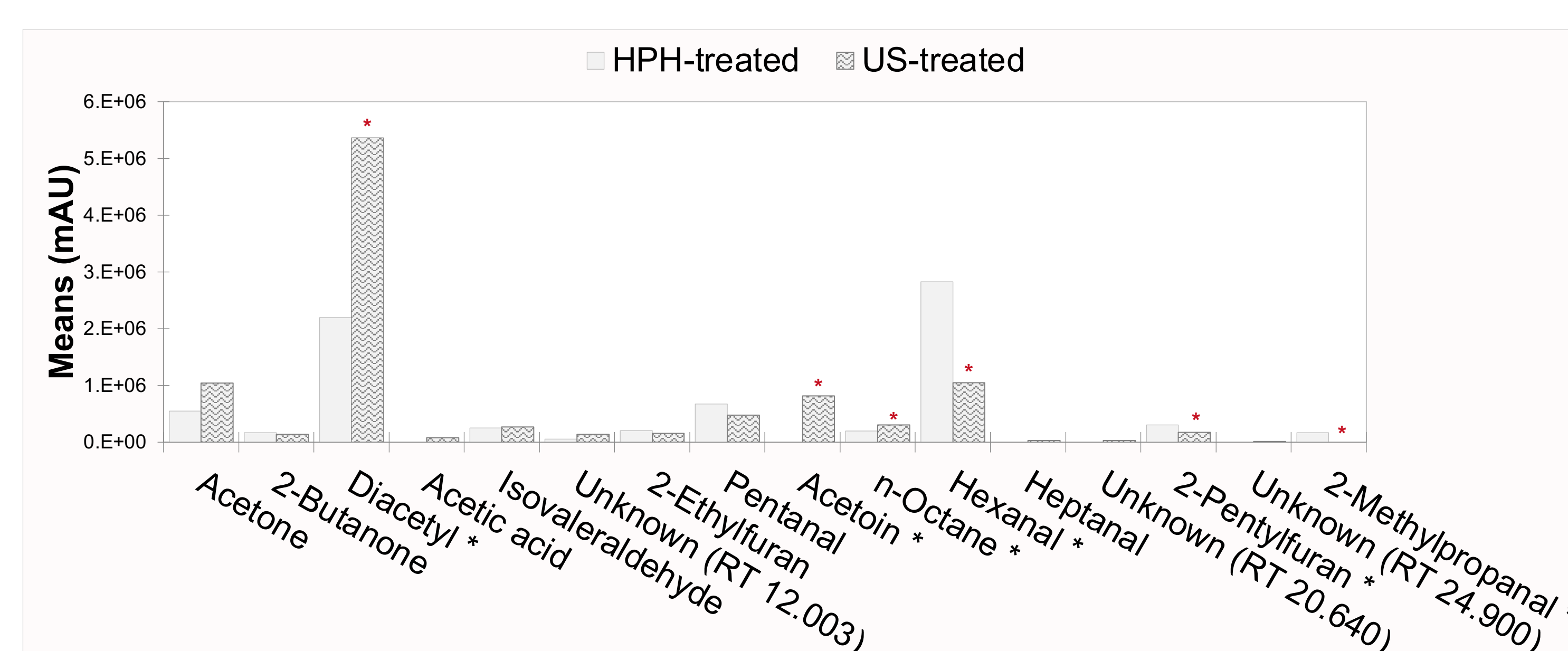


Figure 2: Effects of US on aroma profile of the yoghurt alternative. Results of an ANOVA followed by a Tukey's post hoc test with interactions between US-treated and HPH-treated yoghurt alternatives. Showing the means of the detected volatile organic compounds. Significant differences marked by *.

Effects of US on texture characteristics

- **No sign. differences** between texture characteristics of US-treated compared to HPH-treated yoghurt alternatives.
- Assumed that energy input of US and HPH might have been at similar levels.

Effects of fibres on texture characteristics

- **3 % fibre enrichment: increased syneresis** by 30 %, **inhomogeneous gel networks** of the yoghurt alternatives (Fig.3, Yo_US vs Yo_f_US)
- Assumed that **fibre particles interfere with the protein-protein interactions** of the yoghurt gelation, competing for water
- Different fibres behave differently in yoghurt matrix, depending on fibre's water-solubility (Fig.3).

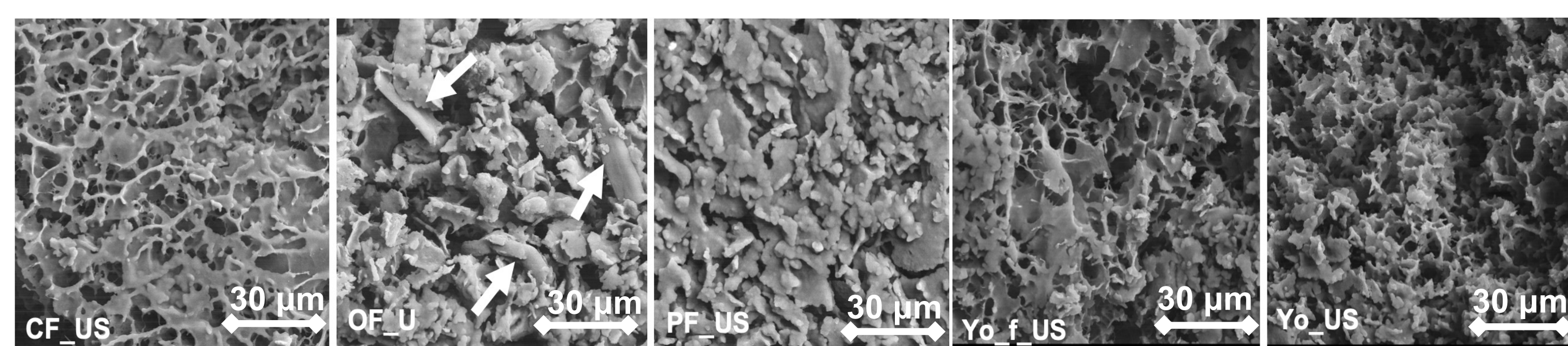


Figure 3: SEM images of different pea protein-based yoghurt alternatives with citrus fibre (CF_US), oat fibre (OF_US), and pea fibre (PF_US), in comparison to a pea protein-based yoghurt alternative enriched with citric, oat, and pea fibre (Yo_f_US) and without fibres (Yo_US), at 1000-fold magnification. The arrows are pointing at possible fibre fragments.

Effects of fibres on aroma profile

- **No sign. differences** between aroma profiles of yoghurt alternatives with and without 3 % of fibres.

Conclusion

- This study showed the **potential of US** as an alternative homogenisation treatment **for the off-flavour reduction** of a pea protein-based yoghurt alternative.
- US might be a **promising tool to increase consumer acceptance for plant protein-based products** as a more sustainable alternative to animal proteins.
- **No masking effect of fibres** on off-flavours was detected by HS-GC/MS.
- **Additional sensory analysis is recommended** to investigate effects of US and fibres on consumer acceptance since flavour perception is a multisensorial mechanism.

References

- [1] NutriAct, online: <http://www.nutriact.de/> (14.05.22). This work was supported by NutriAct - Competence Cluster Nutrition Research Berlin-Potsdam founded by the Federal Ministry of Education and Research (BMBF) (FKZ:01EA1806).
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