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Fermentation as a Tool to Revitalise Brewers' Spent Grain and Extend the Microbial Shelf Life of High Fibre Bread

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Introduction

Brewers spent grain (BSG) is the most abundant by-product of the brewing process which, despite its relatively high fibre and protein contents, remains largely unutilised. Incorporation of BSG in bread is challenging and requires additional processing. Fermentation represents a promising tool to elevate ingredient functionality and improve bread quality and shelf-life. In this study, the impact of BSG and fermented BSG inclusion on the microbial shelf-life of bread was investigated.

Methodology

- BSG was fermented (FBSG) with *Lactiplantibacllus* plantarum F10 as described by patent no/ WO/2018/033521
- 'High In fibre' (HF; 6g/100g) and 'Source of fibre' (SF; 3g/100g) breads containing BSG and FBSG were produced. Baker's flour (BF) and wholemeal flour (WMF) breads were included as controls
- Ten centre slices of 25 mm thickness (two bread loaves) per batch were placed on a sterile metal rack.
- The bread crumb of both sides of the bread was exposed to the environment for 5 min.
- Bread slices were packed singly in sterile bags and heat-sealed.
- A filter pipette was placed in each bag to allow for consistent aerobic conditions to prevail.
- Bread samples were stored at 20 ± 1 ◦C and 50% relative humidity in a sterilised and temperature- controlled chamber for 14 days.
- Mould growth of each bread slice was visually analysed daily, and mould growth was rated as "mould free", "mould growth <10%", "10–24% mould growth", "25–49% mould growth" and "mould growth >50%".

Results

- The breads produced in this study are shown in Figure 1
- The first mould growth on the control BF bread occurred on day 4, while the shelf life of WMF bread was 5 days (Figure 2)
- The inclusion of BSG SF did not affect the microbial shelf life, whereas FBSG SF resulted in a prolonged shelf life by one day.
- Inclusion of HF levels of both BSG or FBSG resulted in breads with a shelf life of 5 days.
- Although day of the first mould growth was very similar, the kinetics of mould growth were different, particularly when FBSG was used as a fibre ingredient.
- Inclusion of FBSG appeared to exhibit some anti-microbial properties and slowed the kinetics of microbial growth over time compared to BSG → likely due to production of anti-fungal phenolic compounds and organic acids
- The denser crumbs in the high-fibre breads may also have contributed to the extended microbial shelf life due to potential restriction of aeration required for microbial growth

***Figure 1**: Images of breads produced in this study. BSG and FBSG denote brewers' spent grain and fermented brewers' spent grain breads, respectively. SF and HF stand for "source of fibre" and "high in fibre" addition levels, respectively*

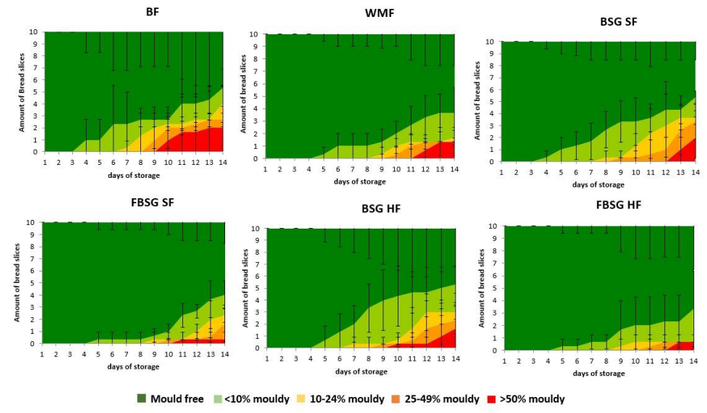

***Figure 2**: Shelf-life plots from 14-day analysis of breads. The amount of bread slices which contained each mould group (mould free, <10% mouldy, 10–24% mouldy, 25–49% mouldy and >50% mouldy) was counted over a period of 14 days. The graph represents mean values obtained across three independent batches with standard deviations included as error bars*

Conclusions

The results from this study highlight the great potential of fermentation as a tool to functionalise BSG and turn it into a food ingredient, which elevates the nutritional value of bread by increasing protein and fibre content and simultaneously ensuring higher bread quality. In addition to the improved bread quality, fermentation of BSG resulted in an ingredient that prolonged microbial shelf life and reduced the staling of bread.

Literature cited and aknowledgment

https://www.mdpi.com/2304-8158/10/7/1639/htm

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Further information

www.master-h2020.eu/publications.html