Ale Yeast and High Gravity Brewing

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Introduction

Although High Gravity Brewing (HGB) techniques are now well established production practices, their application for ales is not as well established as it is for lagers. Usually high gravity worts are considered to range from 16 to 20°P, and the term very high gravity is used for those worts greater than 20°P. The benefits of high gravity brewing in the production of lagers are well documented (for example Jakobsen *et al.*, 1989; Verbelen *et al.*, 2008 Stewart, 2010) as tools for increasing capacity without significant capital expenditure. The challenges to yeast associated with high gravity brewing are also well documented in the case of *Saccharomyces pastorianus* (reviewed by Stewart, 2014), but not to the same extent for *Saccharomyces cerevisiae* (Yu *et al.*, 2012) . The work presented in this poster is part of ongoing research activity with the aim of addressing this gap.

Materials and Methods

Wort (OG 1.042) was produced on the 2 HL pilot brewery at the ICBD. using 100% extra pale malt (Crisp Malt, UK) and Columbus hops (Type 90 pellets, Hop Growers of America, USA) with a target of 22 IBU. Gravity was adjusted with distilled water or glucose as required to 1.040 (10˚P), 1.060 (15 ˚P) and 1.080 (20 ˚P). Density readings were taken using a DMA46 (Mettler-Toledo Ltd, UK). Ester and higher alcohol analysis was carried out using GC-FID. A selection of ale (*S. cerevisiae)* strains were used in the experimental work using lager yeast (*S. pastorianus*) as a control. Flocculation was determined by ASBC Yeast 11B. All chemicals were purchased from Fisher Scientific (UK) or Sigma Aldrich (UK).

Results and Discussion

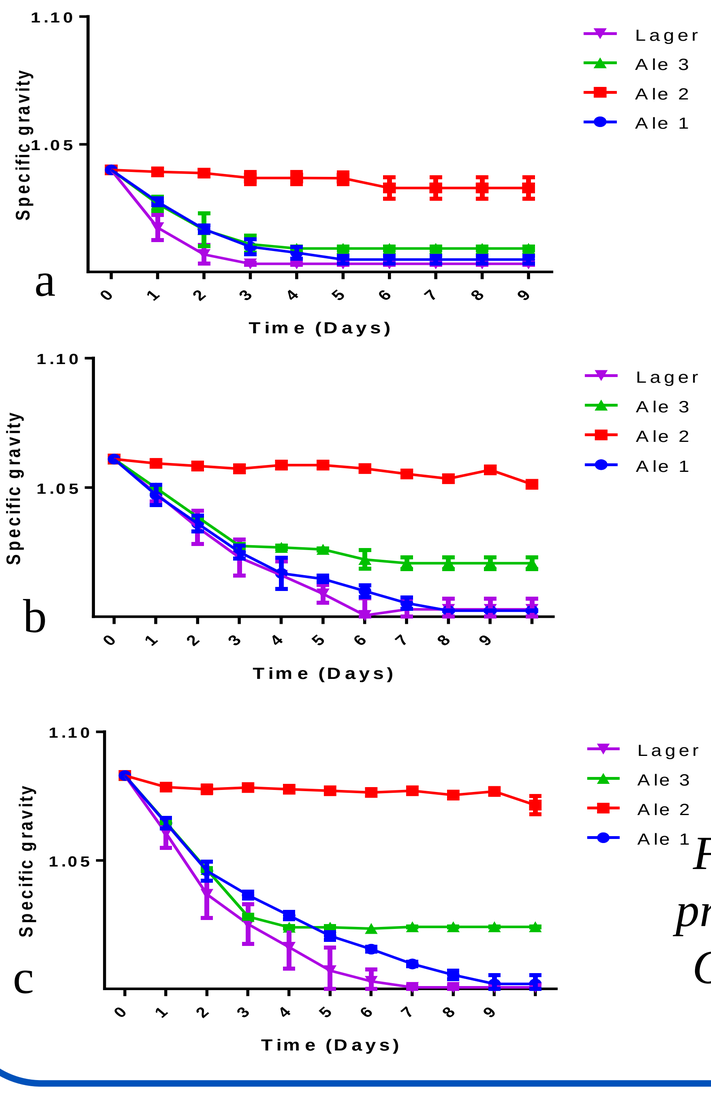

Figure 1. Fermentation profiles of worts with an OG of a) 1040, b) 1060 and c) 1080.

The response to increasing original gravity (OG) appeared to be strain specific (Figure 1). The strain Ale 2 did not respond well to any of the fermentation conditions used, the reasons for this are unknown.

Results and Discussion

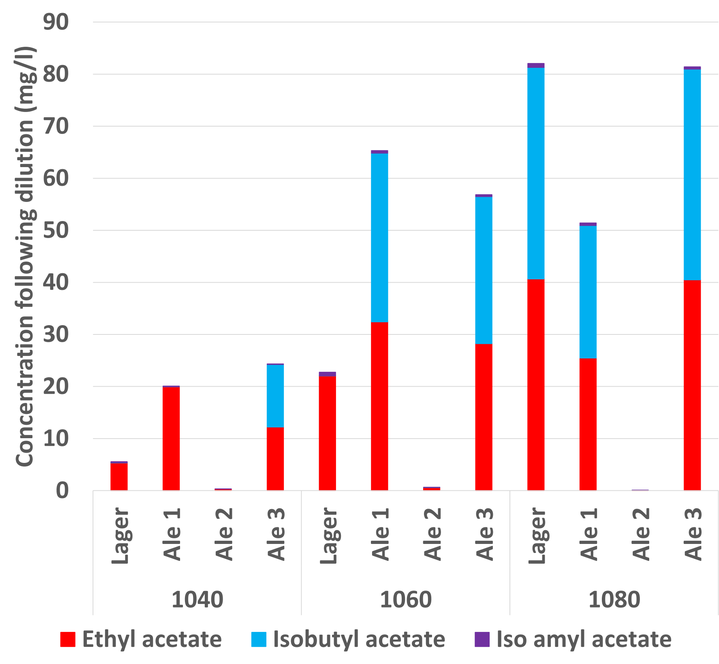

Figure 2. Acetate esters levels at the end of fermentation.

The production of esters also appeared to be strain specific, however generaly an increase in gravity associated with increased acetate ester formation (Figure 2). The exception was Ale 2 which behaved as a stuck fermentation.

The production of higher alcohols also appeared to be strain specific however generally levels decreased in line with increasing OG (Figure 3). Gravity also influenced the proportion of higher alcohols produced. Viability was assessed using methylene blue and a haemocytometer, for the ale strains this was found to be greater than 90% at the end of fermentation at all gravities. The impact of an increasing gravity on flocculation was also examined (data not shown). The Lager strain and Ale 1 were found to be moderately flocculent, a propensity which became greater with the increase in gravity. Strain Ale 2 and 3 were determined to be non-flocculent, the flocculence value decreased with increase in OG. The results suggest that the response of ale strains of *Saccharomyces cerevisiae* to high gravity conditions merits further investigation.

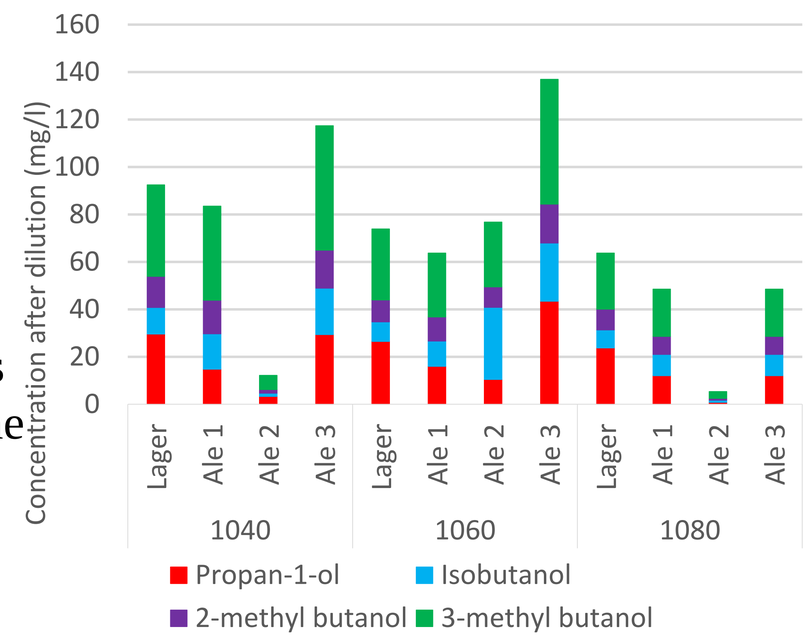

Figure 3. Higher alcohols at the end of fermentation.

References

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