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MASTER BREWERS ASSOCIATION OF THE AMERICAS

A Clear Choice for Haze-Free Beers

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Background

Consumers of filtered beers generally expect the product to be bright, clear and without haze when poured into the waiting glass.

Beer hazes are biological or non-biological in nature. The most common non-biological haze in beer is composed largely of complexes of proteins and reactive polyphenols (flavanoids).

This haze forms at around 0 °C (32 °F) (chill haze), but re-dissolves when the beer is warmed to around 15 °C (59 °F). After further storage of the beer, strong bonds can form between the polyphenols and the proline-rich proteins forming an irreversible, permanent haze.

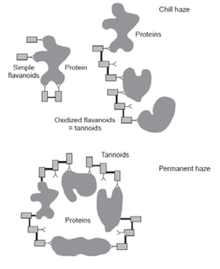

Fig. 1: Models of chill and permanent haze formation in beer[1]

The most reactive polyphenols are proanthocyanidins and in beer 70-80% are derived from the malt and the remainder from hops.

Proanthocyanidins belong to the flavonoid group of polyphenols and are located in the testa of all traditional barley varieties.

Cold storage of beer at -1 to -2 °C (30-28 °F) can be used to bring about a degree of haze stability, but brewers frequently wish to accelerate the process of haze stabilisation and achieve greater stability than is possible through cold conditioning alone.

This necessitates the use of processing aids that either remove potential haze forming proteins (such as silica hydrogel) or remove polyphenols (such as PVPP treatment).

Introduction

An alternative means to bring about haze stability is through the selection of brewing raw materials which limit the levels of haze precursors.

One such means is the use of proanthocyanidin-free malt. This malt is produced from barley varieties which are proanthocyanidin-free.

Varieties of this type were first developed at the Carlsberg Research Centre in the mid-1970's by inducing mutations within the *ant* genes involved in the proanthocyanidin biosynthetic pathways[2].

Crisp Malting Group has been producing malt from proanthocyanidin-free barley varieties for over 20 years and has recently re-launched this malt type to the craft sector as the ***Clear Choice Malt*** range.

The work described here provides initial information on brewing trials recently undertaken to re-evaluate the impact of this malt type on aspects of beer quality and data on the malting performance of a new proanthocyanidin-free barley variety.

Methodology

Beer Quality Evaluation

Clear Choice ale malt was provided to Hepworth & Co Brewers, Horsham, UK to brew 'Clear Choice Golden Ale'. Grist was composed entirely of ***Clear Choice*** ale malt. Prior to filtration and bottling, beer was conditioned at +4°C in the absence of chemical stabilisers.

Bottles of Clear Choice Golden Ale, along with bottles of a commercially available Golden Ale brewed with conventional malt varieties, were sent to Brewlab, Sunderland, UK for chemical analysis, flavour profiling and forced shelf-life testing. Beers were tasted at the equivalent of 3 months and 8 months post-bottling. Comparative shelf-life testing will continue up to 24 months post-bottling.

New proanthocyanidin-free variety performance

Variety 7769-04-1 was grown at three trial locations with Sanette as control. Yield and disease performance was evaluated. Harvested grain was micromalted and analysed at Crisp Malting Group.

Results

Parameter	Clear Choice Golden Ale	Control Golden Ale
OG	1041.1	1043.0
PG	1008.8	1008.7
ABV (%)	4.2	4.4
pH	4.40	3.96
Colour (EBC)	9.8	17.4
Bitterness (EBU)	22.6	29.0
Start haze at 0°C	0.66	0.57
End predictive haze at 0°C	1.22	1.02

Table 1: Comparative analysis of Clear Choice and Control Golden Ales

Start haze and end predictive haze values for both Golden Ales were very similar indicating that the higher conditioning temperature of the Clear Choice Golden Ale without chemical stabilisation was not detrimental to long-term haze stability.

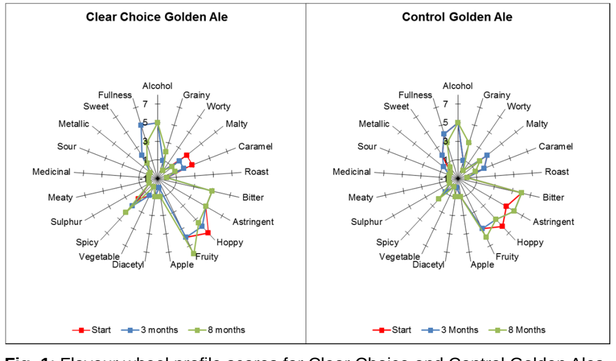

Fig. 1: Flavour wheel profile scores for Clear Choice and Control Golden Ales

Forced shelf-life testing was used to assess the impact of ***Clear Choice Malt*** on long-term flavour stability. After the equivalent of 3 months, Clear Choice Golden Ale was showing little change in flavour profile. After the equivalent of 8 months, both beers show a slight reduction in malty character with Clear Choice Golden Ale showing enhanced spicy and fruity character. It was noted that the Control Golden Ale had some light oxidation after 3 months and staling after 8 months.

Parameter	Sanette	7769-4-1
Moisture (%)	4.9	4.5
IOB Extract 0.7mm (L°/kg, dry)	319	319
IOB Colour Visual (EBC)	3.6	4.2
Total Nitrogen (%, dry)	1.41	1.51
IOB Total Soluble Nitrogen (%, dry)	0.74	0.74
IOB Soluble Nitrogen Ratio	52.4	49.3
IOB FAN in Wort (mg/l)	129	159
Friability (%)	97	96
Homogeneity (%)	100	100
Partly Unmodified Grains (%)	0.2	0.2
Whole Glassy Corns (%)	0	1
Alpha Amylase (DU, dry)	79	80
Diastatic Power (°IoB, as is)	153	137
IOB Beta Glucan in Wort (mg/l)	78	82
IOB Wort Viscosity (mPa.S)	1.38	1.38

Table 2: Comparative micromalt analysis of Sanette and 7769-04-1

Breeding of new proanthocyanidin-free varieties continues. In 2013 crop trials, 7769-04-1 yielded equivalent to Sanette which is the current highest yielding HGCA Recommended List spring malting barley variety. Malt quality was very similar to Sanette with good cell wall and protein modification.

Summary

Advantages of craft brewing with proanthocyanidin-free malt includes:-

- ✓ Removal of the need to use processing aids such as silica hydrogel or PVPP for stabilisation with associated cost savings
- ✓ Possibility to cold condition at up to +4°C (37-39°F) leading to savings in refrigeration time and costs
- ✓ Reduced cold conditioning time resulting in higher vessel utilisation and greater volume output
- ✓ Possibility to increase hop loading as no polyphenol contribution from the malt
- ✓ Proportional improvements when used as a partial grist replacement

References

1. Gopal, C. and Rehmanji, M. (2000) Brewers' Guard., 129 (5).
2. Erdal, K. (1996) J. Inst. Brew.,92, (220).