175

WORLD BREWING CONGRESS 2016

THE HOT STEEP SENSORY METHOD: A RAPID AND STANDARDIZED SENSORY EVALUATION METHOD FOR MALT FLAVOR

C. Liscomb, *Briess Malt & Ingredients Co.,* **L. Barr,** *New Belgium Brewing Co.,* **K. Arnberg**, *Allagash Brewing Co.,* **D. Bissmeyer**, *The Wolf Group,* **P. Combs**, *Avery Brewing Co.,* **A. Choy**, *MillerCoors,* **B. Donaldson**, *Lagunitas Brewing Co.,* **M. Peltz**, *Sierra Nevada Brewing Co.,* **A. Sauls**, *Highland Brewing Co., and* **A. Schultz**, *New Belgium Brewing Co.*

World Brewing Congress
August 13-17, 2016
Sheraton Downtown Denver
Denver, CO 80202, U.S.A.

ABSTRACT

A methodology for the rapid and standardized sensory evaluation of malt flavor was proposed and validated by members of the ASBC Sensory Technical Subcommittee. A series of triangle tests were performed by nine different sensory panels in a collaborative study to determine if the method was both repeatable and sensitive. The method proved to be repeatable when the same malt samples that were prepared by two different technicians in the same laboratory were not found to be significantly different at a confidence level of 90%. Similarly, the method proved to be sensitive when two different malt samples that were prepared by the same technician in the same laboratory were found to be significantly different at the 90% confidence level. Based on the results of the collaborative validation study, the subcommittee recommends that the Hot Steep method be published in the ASBC Methods of Analysis, where it may be utilized as a rapid and standardized sensory evaluation method for malt flavor.

INTRODUCTION

Background
The brewing industry is in need of a rapid and standardized wort preparation method to evaluate the extractable flavors that are present in malt. Maltsters, researchers, and select brewers have historically evaluated malt flavor by tasting Congress Wort prepared from the Congress Mash (1,2). Changes in the dynamics that make up the brewing industry, specifically the recent growth of the craft brewing segment, have created demand for a fast and affordable malt sensory method that is both sensitive and repeatable. Such a method is needed to serve as a resource for quality programs to evaluate malt as a raw brewing material and for research programs to explore potentially unique or desirable flavors in developing barley varieties.

Benefits of the Hot Steep method
The Hot Steep method offers the following advantages over the traditionally used Congress Mash: the wort can be prepared in a shorter period of time, with wort being produced in approximately 30 minutes as opposed to approximately 3 hours. The method can be performed using significantly less expensive supplies, most of which can be purchased from a general retailer. Lastly, the Hot Steep method is optimized for flavor, whereas the Congress Mash is optimized for extract. By reducing the conversion time and temperature, malt flavor compounds may be perceived without the intense sweetness that is characteristic of Congress Wort.

EXPERIMENTAL

Samples
The malt samples used in this study were provided by Briess Malt & Ingredients Co. Malt #1 was Briess Pale Ale Malt, Lot 160314D and malt #2 was Briess Brewers Malt, Lot 160224A. Both were produced in Manitowoc, Wisconsin, USA and malted from 2015 crop year Pinnacle 2-row barley grown in North Dakota, USA.

Standardized wort preparation method
Approximately 52 g of malt was ground in an electric grinder for 10 seconds or until a coarse flour consistency was achieved (3 oz. volume, 200-watt, KRUPS F203 or similar). 50.0 ± 0.1 g was weighed into an insulated 24-oz. stainless steel *Thermos*®. 400 mL of 65°C deionized water was poured into the *Thermos*® and the cap was secured before vigorously shaking for 20 seconds to ensure the grist was properly wetted. The *Thermos*® was left to sit for 15 minutes to allow proper time for conversion of the starch material to take place. Upon completion of the 15 minute soak, the *Thermos*® was again shaken for 20 seconds to mix the settled grist back into solution. Then the cap was quickly removed and the mash liquor was immediately filtered (fluted filter paper, 32 cm diameter, Ahlstrom No. 515 or similar). The first 100 mL of filtrate was poured back into the *Thermos*®, swirled to collect any remaining grist from the container walls, and poured back into the filter. The wort was allowed to filter to completion and cool to room temperature before sensory evaluation was performed the same day.

Discrimination Testing
The wort samples were served to a sensory panel according to the Triangle Test method (1). The number of panelists who correctly identified the odd sample in each triangle was recorded. Results were interpreted using a 90% confidence level (α = 0.10).

Validation of the standardized wort preparation method
To assess repeatability, the same malt sample (malt #1) was prepared by two different technicians in the same laboratory according to the Hot Steep method. If the standard wort samples were not found to be significantly different in the Triangle Test, the method was considered to be repeatable. To assess sensitivity, two different malt samples (malt #1 and malt #2), deemed to be similar but distinguishable, were prepared by the same technician according to the Hot Steep method. If the standard wort samples were found to be significantly different in the Triangle Test, the method was considered to be sensitive.

RESULTS AND DISCUSSION

Interpretation of Data
The number of panelists who correctly identified the odd sample in the repeatability and sensitivity triangle tests is shown in Table I. The critical number of correct responses represent the number of panelists, for a given panel size at a given alpha risk value, that must correctly identify the odd sample in order to conclude that a significant difference in flavor exists amongst the samples presented in the triangle test. Interpretation of results for this study is based on a 90% confidence interval (alpha risk = 0.10).

Repeatability Results
88% of the sensory panels did not find a significant difference in flavor amongst the malt samples prepared for the repeatability triangle tests.

Sensitivity Results
100% of the sensory panels did find a significant difference in flavor amongst the malt samples prepared for the sensitivity triangle tests.

DATA

Table I

Collaborative study triangle test results

	Repeatability			Sensitivity		
Collaborator	**No. of correct identifications**	**Critical number of correct responses**	**Significantly different at α = 0.10**	**No. of correct identifications**	**Critical number of correct responses**	**Significantly different at α = 0.10**
1	8 out of 26	13	NO	22 out of 24[c]	12	YES[c]
2	1 out of 8	5	NO	6 out of 8	5	YES
3	8 out of 20	10	NO	12 out of 20	10	YES
4	5 out of 18	10	NO	14 out of 20	8	YES
5	5 out of 13	8	NO	12 out of 16	7	YES
6	13 out of 15[c]	8	YES[c]	19 out of 20	10	YES
7	3 out of 12	7	NO	11 out of 12	7	YES
8	22 out of 50	21	YES	38 out of 58	25	YES
9	12 out of 30	14	NO	21 out of 30	14	YES

[c]Data excluded due to experimental error

CONCLUSIONS

A methodology for the sensory evaluation of malt flavor was proposed and validated in this study, where it was found to be sensitive by 100% of participating sensory panels and repeatable by 88% of participating sensory panels. The Sensory Technical Subcommittee recommends that the Hot Steep method be published in the ASBC Methods of Analysis, where it may be utilized as a rapid and standardized sensory evaluation method for malt flavor.

ACKNOWLEDGMENTS

We would like to thank Briess Malt & Ingredients Co for generously supplying all the malt for this collaborative study.

HOT STEEP METHOD

Reagents

(a) Whole kernel malt
(b) Deionized water

Apparatus

(a) Thermos®, insulated, stainless steel, 24 ounce volume
(b) Thermometer, standard, 0-200°C
(c) Heating apparatus, capable of heating water to 65°C
(d) Funnel, plastic, short stem, 16 cm in diameter or similar
(e) Filter paper, fluted, 32 cm in diameter (Ahlstrom No. 515 or similar)
(f) Electric Grinder, 3 ounce volume, 200-watt (KRUPS F203 or similar)
(g) Glass Beaker, tall, 600 mL volume
(h) Graduated cylinder, 500 mL volume
(i) Analytical balance, capable of weighing 50.0 g (± 0.1 g)

Place approximately 52 grams of malt in electric grinder. Close lid and grind for 10 seconds, or until a coarse flour consistency is achieved (see Notes 1-2). Weigh 50 ± 0.1 g malt flour into *Thermos*®. Pour 400 mL of 65°C distilled water into *Thermos*®. Cap and vigorously shake contents of *Thermos*® for 20 seconds to ensure malt grist is completely wetted and mixed into solution. Let *Thermos*® sit for 15 minutes. During this time, place filter paper inside funnel and wet paper with deionized water to minimize aroma contribution. Position filter and funnel over mouth of 600 mL glass beaker where it will remain for wort collection. When 15 minute timer ends, vigorously swirl contents of *Thermos*® for 20 seconds to bring settled particles back into solution, then uncap and quickly pour all of the mash liquid into the filter (see Note 3). Collect and pour first 100 mL of filtrate back into the *Thermos*®. Swirl *Thermos*® to collect any grist that remains inside, then gently re-pour back into the filter. Allow wort to filter to completion (see Notes 4-6).

Notes

1.Evaluate base malts with 50 g of sample (100% inclusion), specialty malts with 25 g of sample and 25 g of brewers base malt (50% inclusion), and dark roasted specialty malts with 7.5 g of sample and 42.5 g of brewers base malt (15% inclusion).
2.If different malts are to be milled, clean electric grinder with a dry rag in between samples to prevent cross contamination.
3.Entire contents must be poured though filter at once so that the grain bed can settle without being disturbed. Filter paper should be free of aromas and large enough to hold the entire contents of the *Thermos*®
4.Filtration rate and sample yield will be influenced by malt type and modification level. Approximately 300 mL of wort can be collected in 30-45 minutes (serves 6-8 tasters).
5.In the event that a large batch of wort is needed to accommodate more than 6-8 tasters, the method can be scaled up by a factor of x, with x being equal to the amount of *Thermos*® containers, filter papers, funnels, and glass beakers that are required. Blend the wort collected to obtain a homogenous sample.
6.Perform wort sensory evaluation within four hours of filtration. Serve at room temperature.

LITERATURE CITED

1. American Society of Brewing Chemists. *Methods of Analysis*, Malt-4 Extract; Sensory Analysis-7 Triangle Test. ASBC, St. Paul, MN, 1992.
2. Coghe, S., Martens, E., D'Hollander, H., Dirinck, P.J., and Delvaux, F.R. Sensory and instrumental flavor analysis of wort brewed with dark and specialty malts. *J. Inst. Brew.* 110(2): 94-103, 2004.