

Introduction

The purpose of this method is to create a cold water extract of hops for sensory analysis. The water extract or "hop tea" can be used to assess the potential aroma quality of hops.

Materials

Reagents

- Filtered water at 25°C
- Hop pellets or whole cones

Apparatus

- *Glass French Press*, 1.5L
- *Thermometer*, standard, 0-200°C
- *Glass Nalgene*, 1.0L, screw-top liquid container PP/PE/PET
- *Magnetic Stir Bar*, 2 x 5/16
- *Stir plate*
- *Timer*
- *Blade Grinder*, Magic Bullet™ (or equivalent), 2 cup capacity
- *Mass Balance*, capable of weighing 50g ± 0.01g

Method

1. Weigh out 20g hop pellets or 24g cones (add a 20% multiplier when using cones to achieve similar aroma intensity).
2. Using a blade coffee grinder, grind the hop material for about 10 seconds for pellets and 20 seconds for cones or until a fine powder is achieved.



Method

3. Fill a graduated cylinder with 25°C water up to the 1L mark
4. Place a 2 x 5/16 inch magnetic stir bar in the bottom of the glass French Press
5. Add the ground hop material to the bottom of the French Press beaker
6. Gently add 1L 25°C water to the French press beaker being sure to completely submerge the hop material with water. Attach the lid plunger and depress the plunger so it gently rests above the material
7. Place the full French Press on the stir plate and set the mixing speed to about 180 RPM (or about 4 if using a stir plate that does not have RPM settings) and allow the hop water solution to stir for 20 minutes.
 1. Note: the liquid should be in constant motion but should not be spinning fast enough to have a "tornado" effect.
8. After 20 minutes, turn off the stir plate and remove the beaker.
9. Press down on the plunger filter to strain the hop tea and remove the hop particulate. Decant the hop tea into a 1.0L glass Nalgene screw-top liquid container, and use for sensory analysis immediately or refrigerate for storage.
 1. Note: Do not store for longer than 5 hours. If refrigerating, bring the teas back up to room temperature (~21°C) before evaluation.



Collaborator	Pellet Repeatability			Cone Repeatability		
	Correct Identifications	Significant at $\alpha=0.10$	Critical Response	Correct Identifications	Significant at $\alpha=0.10$	Critical Response
1	8 out of 18	No	10	10 out of 18	Yes	10
2	9 out of 20	No	10	3 out of 15	No	8
3	3 out of 11	No	7	5 out of 10	No	6
4	5 out of 9	No	6	1 out of 9	No	6
5	5 out of 11	No	7	4 out of 10	No	6
6	3 out of 14	No	8	4 out of 14	No	8
7	7 out of 15*	No		0 out of 10	No	6
8	11 out of 19	Yes	10	8 out of 20	No	10
9	4 out of 11	No	7	1 out of 11	No	7
Total	48 out of 113			36 out of 117		
	55 out of 128*					

*results compromised, not included

Collaborator	Small Difference Pellet			Small Difference Cone		
	Correct Identifications	Significant at $\alpha=0.10$	Critical Response	Correct Identifications	Significant at $\alpha=0.10$	Critical Response
1	14 out of 18	Yes	10	10 out of 16	Yes	8
2	12 out of 17	Yes	9	14 out of 16	Yes	8
3	5 out of 11	No	7	7 out of 11	Yes	6
4	7 out of 9	Yes	6	7 out of 9	Yes	5
5	6 out of 11	No	7	7 out of 10	Yes	5
6	11 out of 14	Yes	8	13 out of 19	Yes	9
7	9 out of 12	Yes	7	8 out of 10	Yes	5
8						
9	7 out of 11	Yes	7			
Total	71 out of 103			66 out of 91		

Large Difference Pellet

Collaborator	Large Difference Pellet			Large Difference Cone		
	Correct Identifications	Significant at $\alpha=0.10$	Critical Response	Correct Identifications	Significant at $\alpha=0.10$	Critical Response
1	13 out of 16	Yes	8	15 out of 16	Yes	8
2	12 out of 14	Yes	7	12 out of 13	Yes	7
3	8 out of 11	Yes	6	7 out of 11	Yes	6
4	8 out of 9	Yes	5	6 out of 9	Yes	5
5	7 out of 11	Yes	6	9 out of 10	Yes	5
6	18 out of 19	Yes	9	17 out of 19	Yes	9
7	13 out of 21	Yes	10	10 out of 11	Yes	6
8	9 out of 11	Yes	6	12 out of 19	Yes	9
Total	88 out of 112			88 out of 108		

Results

The hops used in this study were 2015 Idaho Cascade, 2014 Oregon Cascade, and 2015 Oregon Centennial, for both the pellet and cone samples. The hops used in the repeatability tests were 2015 Idaho Cascade. To assess the level of sensitivity two different tests were run. For large differences samples from different varieties were used and for moderate differences the same variety, but from different years. The hops used in the "moderate" difference tests were 2015 Idaho Cascade and 2014 Oregon Cascade. The hops used in the "large" difference test were 2014 Oregon Cascade and 2015 Oregon Centennial. Each test was completed with pellet and cones, respectively.

To assess repeatability, the same hop sample was prepared by two different technicians in the same laboratory according to the Hop Tea method. The hop tea samples were served to a sensory panel and a triangle test was administered. The number of panelists who correctly identified the odd sample in the triangle was recorded. If samples prepared by two different technicians were not significantly different ($\alpha=0.10$), the Hop Tea method was considered to be repeatable. Conversely, the method could be considered sensitive if there was a significant difference ($\alpha=0.10$) in the tests between the 2015 Idaho Cascade/2014 Oregon Cascade and 2014 Oregon Cascade/2015 Oregon Centennial. The hop tea samples were served to a sensory panel and a triangle test was administered. The results from the 9 different sensory panels that participated in this study are presented in the tables.

Conclusion

At a confidence level of 90% this method was deemed repeatable, with 7 out of the 8 collaborators (88%) not finding a significant difference, for both pellet and cone repeatability trials. This success rate was deemed suitable and within the range of acceptable variation by the committee. All of the sensitivity tests were significant, meaning differences could be picked out with this method. This is a simple and cost effective method that could be used in quality control of hop inventory, sensory assessment of new varieties, training a sensory panel on the characteristics of new hop varieties or as an alternative to the hop rub.

