

Comparing Chemical and Sensory Analysis of Beer Stored Under Different Shelf-Life Conditions

Maxim Croitor, Reed Johnson, Raymond Morgan, Nicholas Ogimachi, Colorado State University



Introduction

Horse and Dragon Brewing Company recently installed a new canning line in their facility and wanted to begin a framework for shelf-life testing for two of their most popular beers, Sad Panda (coffee stout) and Adventure On (IPA). The goal of this work was to determine if we could use accelerated temperature aging to mimic conditions that were observed for samples stored at traditional shelf-life temperature conditions for 30 days in an effort to expedite future investigations. We monitored several chemical parameters over time and under different storage conditions to determine if storage in cans versus kegs noticeably affected the chemical parameters we monitored. Additionally, we performed basic sensory analysis to determine if consumers could distinguish the treated samples versus control samples. Analysis of the collected chemical and sensory data indicates that accelerated shelf-life testing mimics chemical changes in samples at 30 days of standard shelf life temperatures, but it does not recapitulate perceived sensory characteristics relative to traditional shelf-life samples.

Objectives

- To identify if accelerated shelf life testing at high temperatures is comparable to shelf life testing at refrigerated (4°C) and room temperature (~22°C) under different storage container conditions.

Methods and Materials

Cans and kegs were stored at room temperature and 4°C for 30 days and measurements were recorded on days 0, 14, and 30. Additionally, cans were stored at 50°C for 1, 3, and 7 days to accelerate age reactions and to compare those results to the others to determine whether accelerated methods were a good representation of traditional shelf-life samples.

Each sample was tested using an Anton Paar DMA4500 and Alcozyler. ASBC methods were used to test the samples for changes in color, pH, turbidity, bitterness, and polyphenols. Each sample was degassed and centrifuged before analysis except for turbidity which only got degassed. We conducted a blind triangle test to test the effects of storage as measured by consumer sensory analysis. The sensory panel was a mix of trained and untrained volunteers in order to give a representation of the consumer market. Sensory analysis consisted of a triangle test of about 15 participants at Horse and Dragon Brewery. Participants were given 3 - 2 oz samples, with two of the samples being the control and one sample being the treated unknown.

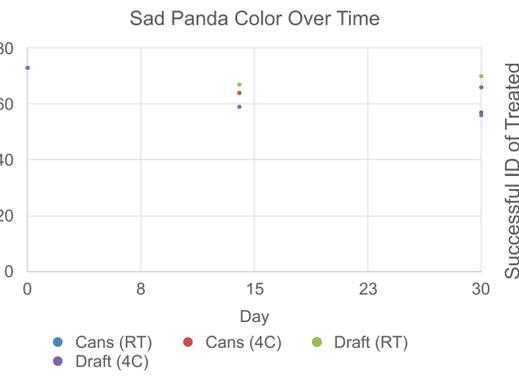
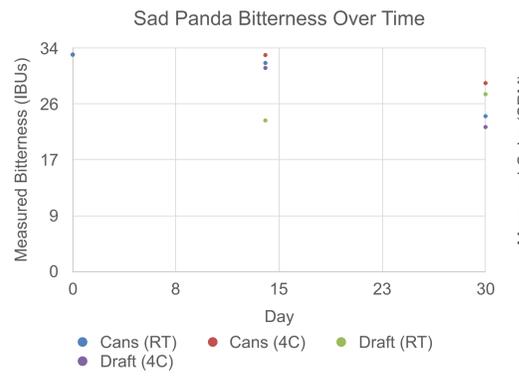
References

- Gabriel, Sladky, & Sigler. (2016). A new rapid high-throughput method for prediction of beer colloidal stability. *Journal of the Institute of Brewing*, 122(2), 304-309.
- Parker, D. (2012). Beer: Production, sensory characteristics and sensory analysis-6. In *Alcoholic beverages* (pp. 133-158).
- Barnett, A., & Spence, C. (2016). Assessing the effect of changing a bottled beer label on taste ratings. *Nutrition and Food Technology: Open Access*, 2(4).

Results

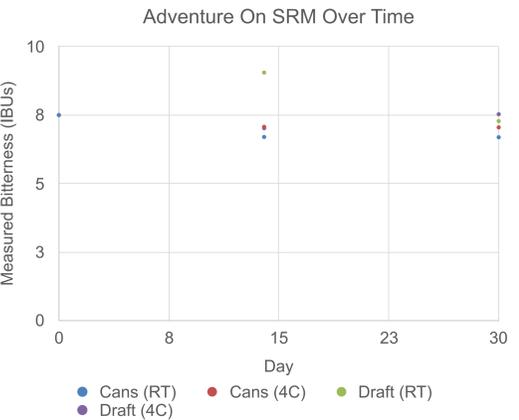
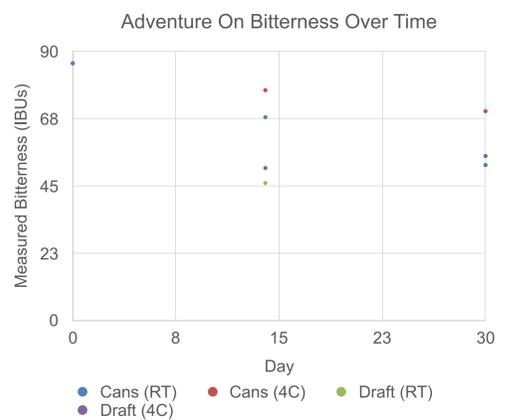
Storage Condition	Day	Sad Panda IBUs		% Change	
		Cans	Keg	Cans	Keg
RT	0	33	33	0%	0%
RT	14	32	23	-4%	-30%
RT	30	24	27	-28%	-18%
4C	0	33	33	0%	0%
4C	14	33	31	0%	-6%
4C	30	29	22	-13%	-33%

Storage Condition	Day	Sad Panda SRM		% Change	
		Cans	Keg	Cans	Keg
RT	0	73	73	0%	0%
RT	14	59	67	-19%	-8%
RT	30	56	70	-23%	-4%
4C	0	73	73	0%	0%
4C	14	64	64	-12%	-12%
4C	30	57	66	-22%	-10%



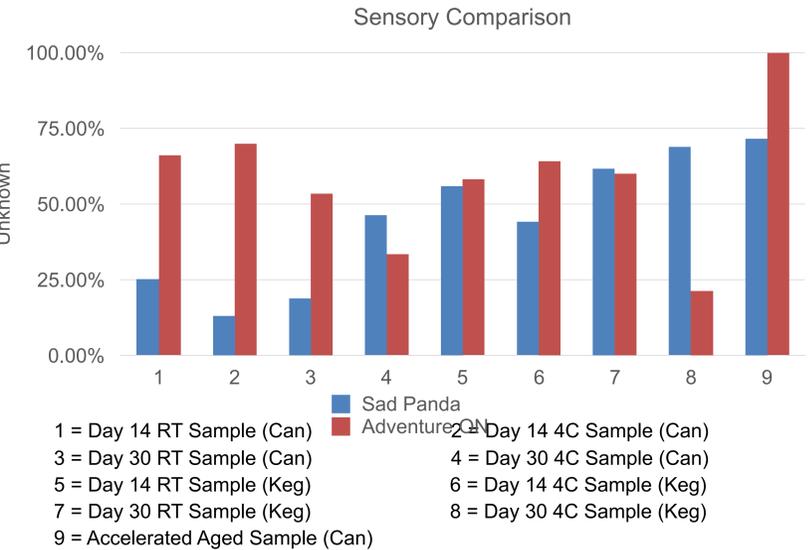
Storage Condition	Day	Adventure On IBUs		% Change	
		Cans	Keg	Cans	Keg
RT	0	86	86	0%	0%
RT	14	68	46	-21%	-47%
RT	30	52	52	-40%	-40%
4C	0	86	86	0%	0%
4C	14	77	51	-10%	-41%
4C	30	70	55	-19%	-36%

Storage Condition	Day	Adventure On SRM		% Change	
		Cans	Keg	Cans	Keg
RT	0	8	8	0%	0%
RT	14	7	9	-11%	21%
RT	30	7	7	-11%	-3%
4C	0	8	8	0%	0%
4C	14	7	7	-6%	-6%
4C	30	7	8	-6%	0%



Results Cont.

Accelerated Aging Results					
Storage Condition	Day	Sad Panda Cans		Adventure On Cans	
		IBUs	Color (SRM)	IBUs	Color (SRM)
50C	0	33	73	86	8
50C	1	30	70	83	7
50C	3	26	82	74	7
50C	7	22	70	38	8



Conclusion

Samples exposed to accelerated aging conditions had similar chemical profiles to samples treated with 4C and RT aging conditions. However, accelerated samples did exhibit the same sensory characteristics as 4C and RT samples based on rudimentary sensory analysis. Additionally, there were no significant differences in samples stored in kegs versus cans based on chemical measurements.

Acknowledgements

Special thanks to Kelley Freeman and Evan Beyers of Beyers Analytical Brewing Science for the use of their lab, patience, and the enjoyment of them being our mentors. Also thank you to Josh Evans and Horse and Dragon Brewing for providing us with the samples, their tap room, and hospitality to perform tests with their beer. Lastly, thank you to everyone for donating their time to our education and helping us gain applicable experience for the future.