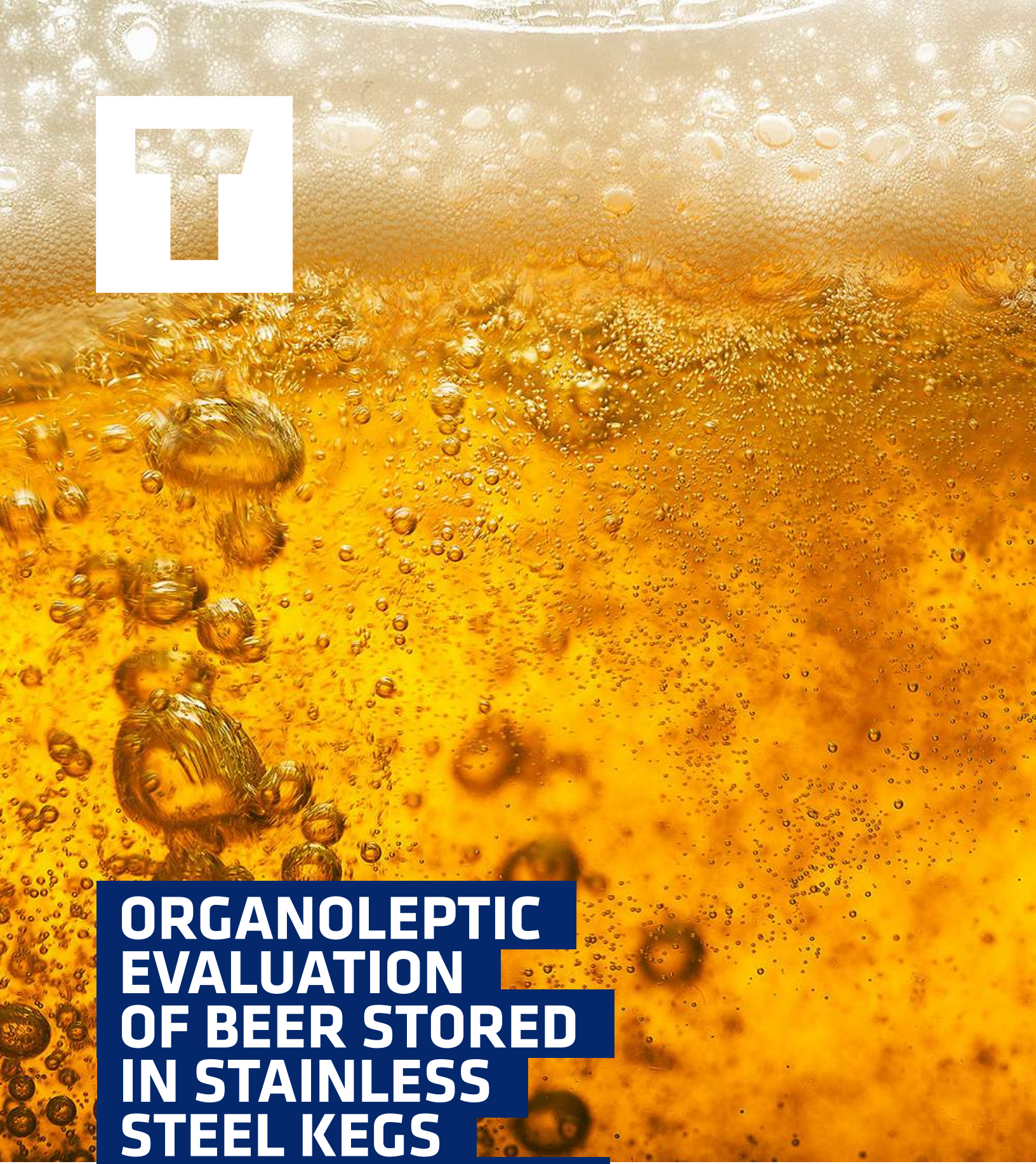

ORGANOLEPTIC EVALUATION OF BEER STORED IN STAINLESS STEEL KEGS vs PLASTIC KEGS

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THIELMANN
THE CONTAINER COMPANY

AUTHORS

JOSE MANUEL PICADO GONZÁLEZ *is the Manager of the Department of Innovation & New Products. He has a degree in Aeronautical Engineering and a Masters Degree in Quality Assurance and Innovation Management. He started his career at THIELMANN PORTINOX SPAIN SA in 1995 with the objective of implementing the standard ISO-9001. Since then, he has been involved in the development of innovative stainless steel containers such as those for LPG storage. His experience, academic training, and continuous learning have given him a strong understanding of materials, quality and innovation.*

RAQUEL S. MANZANO *joined THIELMANN PORTINOX SPAIN SA in 1998. With a Degree in Industrial Engineering, she started working in the Department of Quality Management, where she has collaborated to develop and homologate different types of stainless steel containers. Her experience and methodical character led her to manage the Quality Department. Since then she has gone on to join the Department of Innovation & New Products in 2015.*

DR. ANGELA GARCIA-MARAVER *joined THIELMANN PORTINOX SPAIN SA in 2015 to become part of the Department of Innovation & New Products. Her professional career has always been linked to R&D&I, with previous experience in the Department of Civil Engineering of the University of Granada, where she was working as a lecturer and researcher. Dr Garcia-Maraver has an International Doctorate Degree in Chemical Engineering, as well as a professional background in research and development in industry and academia.*

UNIVERSITAS Miguel Hernández

The results shown in this report have been obtained in collaboration with the Department of Agro-Food Technology of the University Miguel Hernández (Spain).
The Department of Agro-Food Technology is involved in programs on Agricultural Engineering, Food Science and Technology and Enology, and has extensive experience in applied research in the fields of production, packaging and storage of foods and beverages, as well as in the analysis of their quality and in sensory evaluation.

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AIM AND SCOPE

The objective of this research has been to evaluate the preservation of commercial beer in THIELMANN stainless steel kegs and to compare these results with those obtained from the preservation of the same beer in plastic kegs using a system called “bag-in-ball”, which consists of an alufoil bag inside a PET vessel.

For a better evaluation, this study considered the most important quality parameters demanded by consumers, including physical, chemical and sensory analysis.

MATERIALS AND METHODS

EXPERIMENTAL SETUP

Commercial beer stored in 30 liter THIELMANN stainless steel kegs was sent to **Miguel Hernandez University (UMH**). Once the beer was properly distributed in stainless steel and plastic kegs, the starting point of the experiment was follows::

18 STAINLESS STEEL KEGS, 30 LITERS IN VOLUME:

- 3 kegs were used as day 0 sample in order to define the initial physical, chemical and sensory properties of the beer;
- 3 kegs were tapped with modified couplers to allow the extraction of the gas from the headspace during the first 3 months of storage for measurement of the carbonation level;
- 12 kegs were used to test the physical, chemical and sensory properties of the beer every 1.5 months over 6 months, using 3 kegs for each test to ensure the reliability of the results.

15 PLASTIC KEGS, 20 LITERS IN VOLUME:

- 3 kegs were tapped with modified couplers to allow the extraction of the gas from the headspace during the first 3 months of storage for measurement of the carbonation level;
- 12 kegs were used to test the physical, chemical and sensory properties of the beer every 1.5 months over 6 months, using 3 kegs for each test to ensure the reliability of the results.

BEER PROPERTIES ANALYZED

A) CO2 concentration in the headspace by Gas Chromatography

B) Beer color in EBC units and CIELab Color

C) pH

D) Bitterness IBUs

E) Sensory determinations: color, foam head retention, malt and cookie flavor, toasty flavor, hoppy flavor, floral flavor, citrus flavor, metallic flavor, herbaceous flavor, yeast flavor, alcohol flavor, sweet flavor, sour flavor, bitterness, beer carbonation, body, aftertaste.

RESULTS AND DISCUSSION

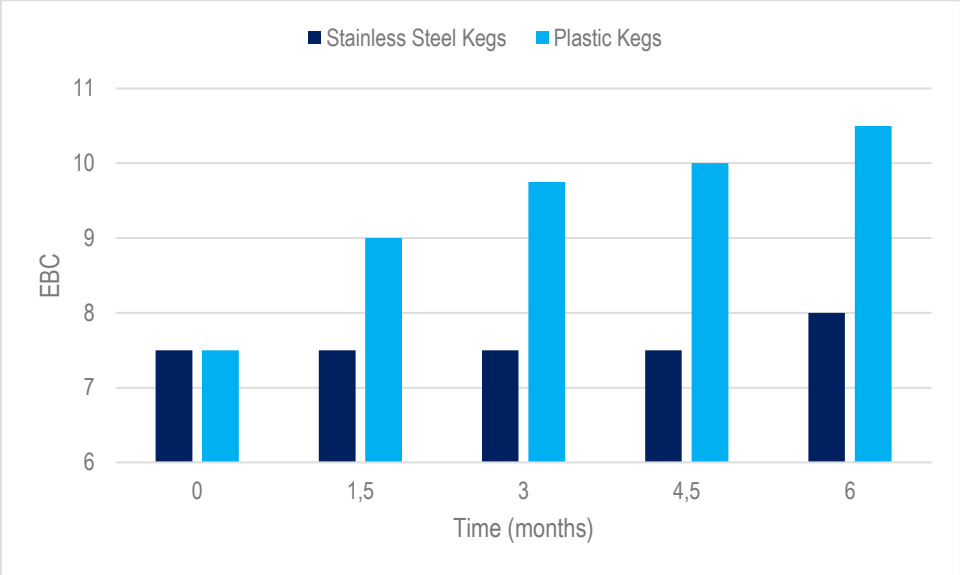
It is important to highlight that the evaluation of the physical, chemical and sensory properties has to consider the initial value as a reference. The aim of kegs as packaging is to keep the original properties and flavor of beer for a long period of time, with minimum alterations in the increase or decrease of any parameter.

CARBONATION LEVEL

The keg material has no effect in the CO2 content of the vessel's headspace.

BEER COLOR

Beer in stainless steel kegs kept the color values constant over the 6 months, whereas the beer stored in plastic was progressively altered during the storage period. Given that both vessels were stored in the same conditions (dark storage at a temperature of 20±5°C in UMH facilities), and that CO2 headspace concentration values were quite similar, it is concluded that opacity differences in the packaging material impacts polyphenol oxidation; it is significantly higher in plastic barrels, even when both vessels have been stored avoiding direct sunlight or artificial ight.



PH

The keg material does not affect the pH of beer. All kegs maintained maintained a pH level of ~4 during the storage period. This value is correct and acceptable in these type of beverages according to food safety requirements.

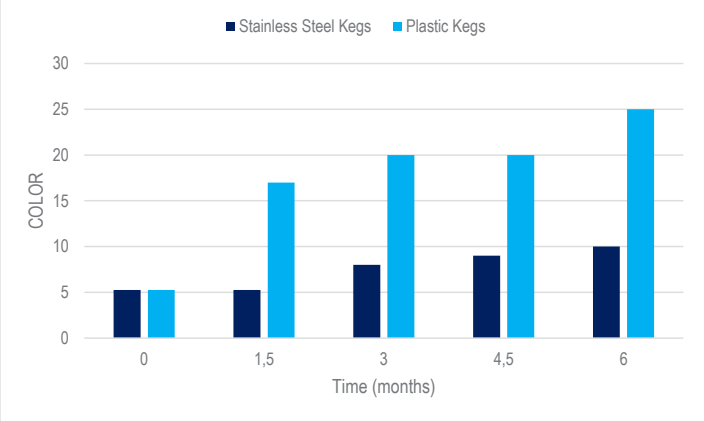
BITTERNESS

The keg material does not affect the bitterness of beer, which showed a gradual decrease over the 6 months storage period in both types of kegs.

SENSORY DETERMINATIONS

COLOR

A noticeable increase of darkening/browning was observed in beer stored in plastic kegs. This result was already noticable in the beer at the initial 1.5 month inspection. This darkening increased gradually during the experiment. These results agree with those obtained by the spectrophotometric method.



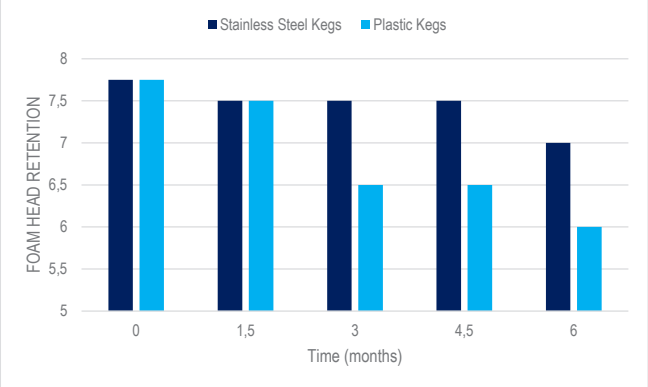
Plastic Kegs Stainless Steel Kegs

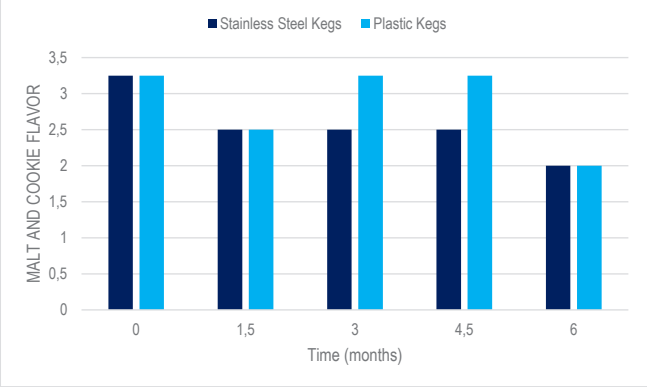
FOAM HEAD RETENTION

Foam head of beer stored in stainless steel kegs is maintained until 4.5 months of storage, and was evaluated as slightly worse just at the end of the experiment. Plastic kegs showed a lower foam head retention from the 3rd month.

MALT AND COOKIE FLAVOR

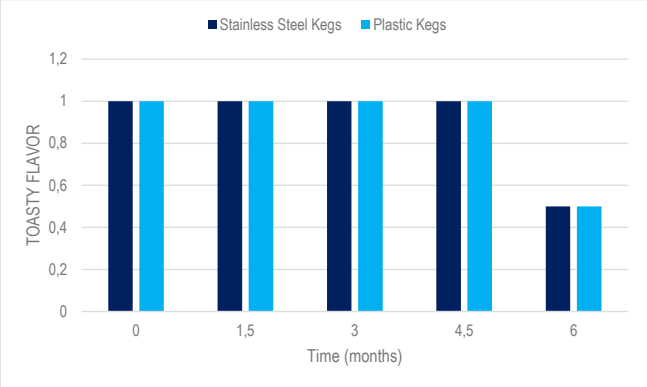
Minor changes were appreciated from the 3rd month in beers stored in plastic kegs, which could be due to beer oxidation in this type of keg.





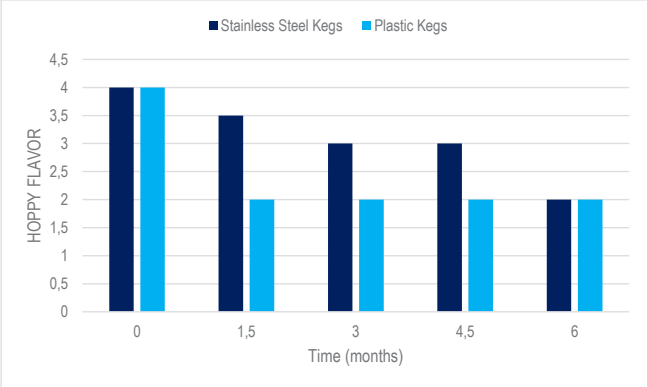
TOASTY FLAVOR

No significant variations.



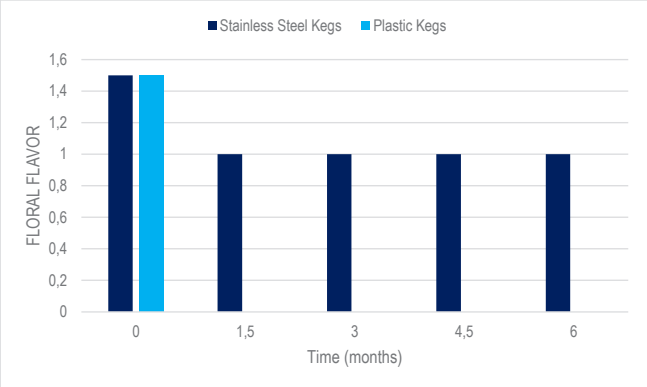
HOPPY FLAVOR

Higher in stainless steel kegs until month 4.5, where both samples showed similar results.



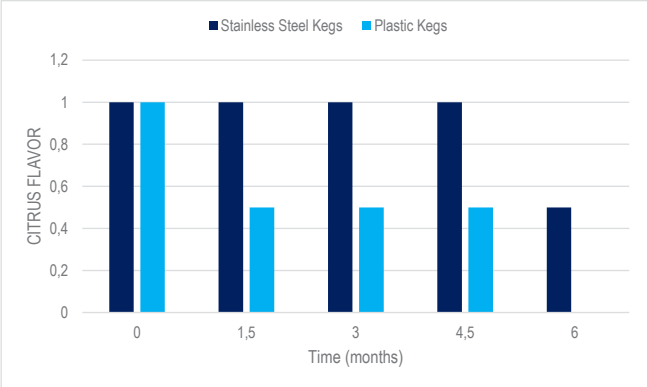
FLORAL FLAVOR

This flavor became undetectable in the plastic kegs, but the variations were not significant.



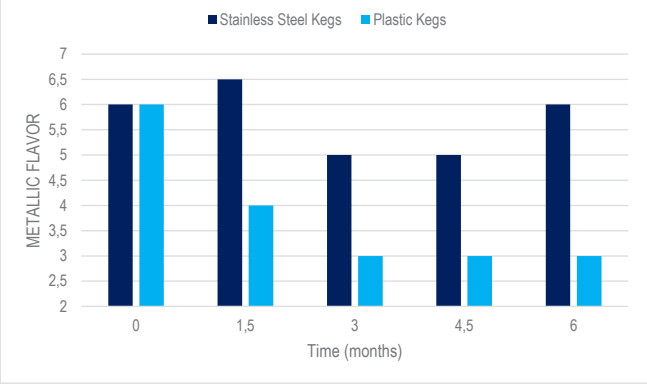
CITRUS FLAVOR

Higher and constant in stainless steel kegs. Decreasing in plastic kegs until becoming undetectable.



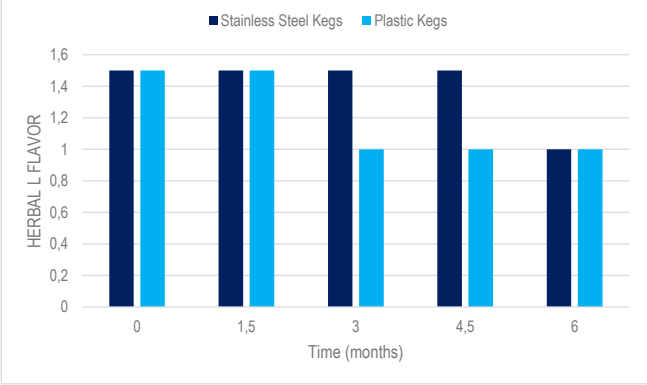
METALLIC FLAVOR

The beer stored in both types of kegs showed a certain metallic flavor, but it remained almost constant only in beer stored in stainless steel kegs, whereas it decreased significantly in plastic kegs.



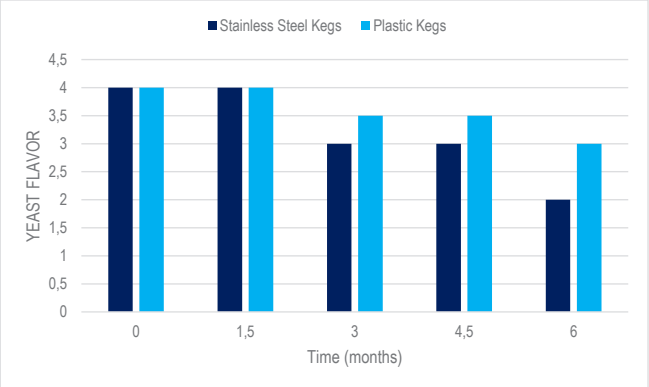
HERBACEOUS FLAVOR

No significant variations.



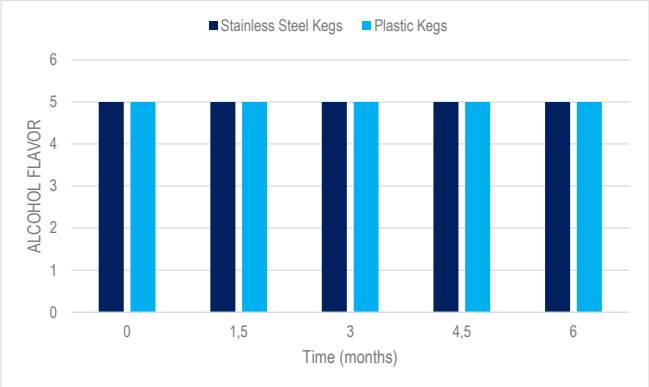
YEAST FLAVOR

Slightly higher in plastic kegs, which kept this flavor almost constantly but with no significant variations.



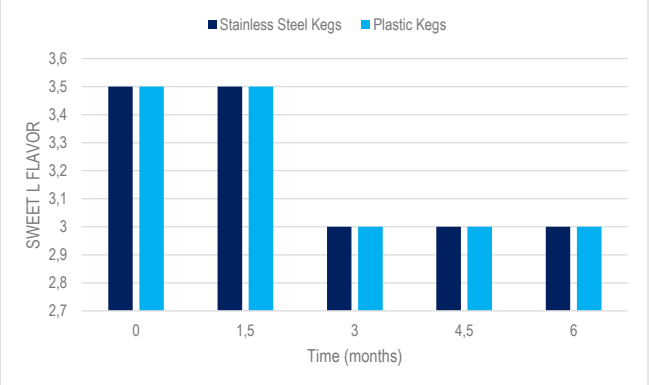
ALCOHOL FLAVOR

No variations detected.



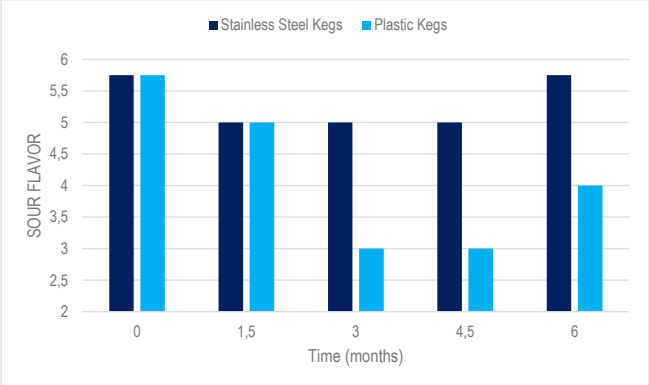
SWEET FLAVOR

No variations detected.



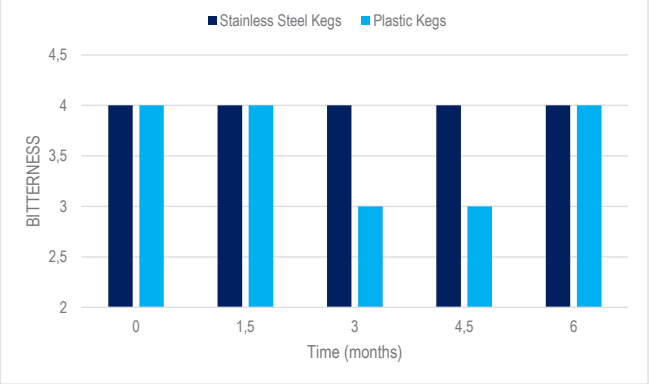
SOUR FLAVOR

Sour flavor had a constant value in stainless steel kegs during the 6 months of storage; significantly lower in beer stored in plastic kegs from the 3rd month through to the end of the experiment.



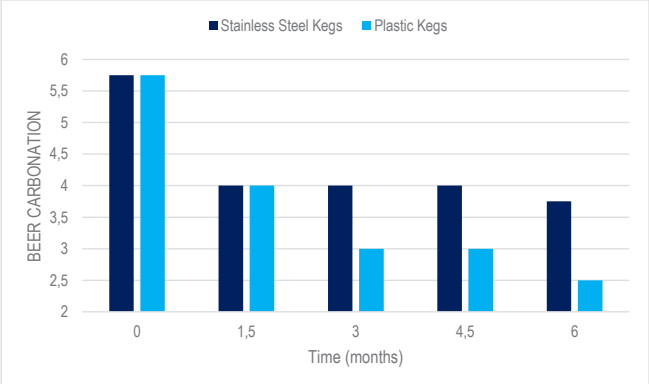
BITTERNESS

Slightly higher in stainless steel kegs, which kept this flavor almost constant. No significant variations with respect to plastic kegs.



BEER CARBONATION

Beer carbonation level showed a significant decrease in plastic kegs, which is a characteristic directly related to a loss in quality. Beer in stainless steel kegs decreased at month 1.5, and then remained constant until the end of the storage period.

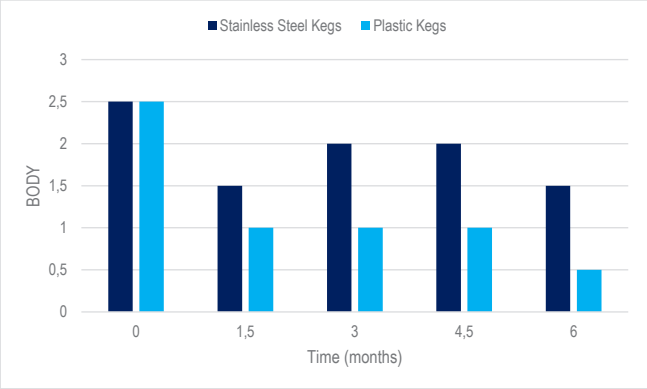


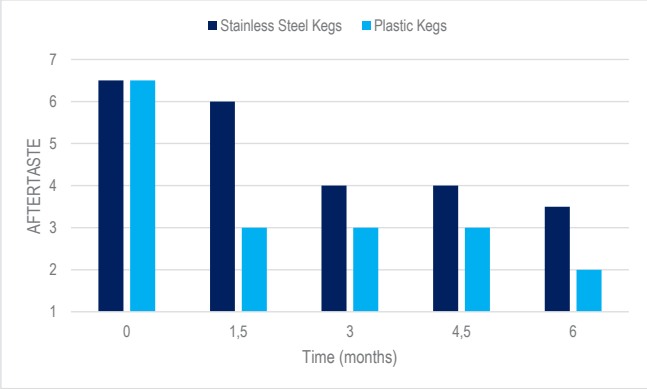
BODY

Slightly higher in stainless steel kegs, which kept this flavor almost constant. Beer in plastic kegs showed a progressive decrease until being almost undetectable. This results in a lower satisfaction level achieved by the consumer.

AFTERTASTE

Highly significant differences were found in this attribute between the beers stored in stainless steel kegs and plastic kegs, especially until 1.5 month. From that point the differences were not so high but beer in stainless steel was always closer to the original aftertaste level, resulting in a higher satisfaction level of the consumer.





CONCLUSIONS

• CO_2 concentration in keg headspace is not affected by the type of keg used.

• Beer preserves its initial color for longer periods when stored in stainless steel kegs, whereas beer in plastic kegs is oxidized. This fact was determined by the chemical analytical results and also by the sensory analysis.

• Bitterness is an attribute not affected by the type of keg used.

• Sensory analysis shows that beer stored in stainless steel kegs preserves its initial characteristics.

As a final conclusion of the tests, it can be confirmed that **beer storage in stainless steel kegs results in a better preservation given that the beer keeps its original physical, chemical and sensory properties for longer periods of time.**

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sales@thielmann.com
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