Colour measurement as an indicator of lettuce freshness

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INTRODUCTION

Freshness is generally considered as a desired quality factor for food. Consumers value freshness and it is closely related to physical appearance (Dinnella et al., 2014). Food colour has significant association with the tendency to select fresh foods instead of non-fresh (Lee et al., 2013). However, due to long supply chains and transportation times, fresh products are challenging when served in large-scale food processes (Bramsiepe et al., 2012). Based on our previous study, consumers react to the improved sensory quality for example in a typical working lunch service (Kumpulainen et al., 2016). Consumers can also tell the difference if the product is freshly prepared or not. Due to continually increasing consumers' quality standards, different methods of retaining fresh-like qualities are constantly developed. Different packaging and slicing technologies can be used to retain the fresh-like qualities of vegetables (Barry-Ryan and O'Beirne, 1999)(Rojas-Graü et al., 2009). For better quality control instrumental measurement of the product freshness are needed.

RESULTS AND DISCUSSION

Based on the results from instrumental measurements, modified atmosphere packaging and tearing instead of cutting the lettuce retains the colour with least changes.

- Vacuum packaging caused the greatest changes in colour (Figure 1).
- Cutting induced greater colour difference than tearing (Figure 2).
- Cutting also induces greater generation of brown surface area on lettuce than tearing (Figure 3).
- Lightness of lettuce decreases as a function of storage time and the modified atmosphere induced the least changes (Figure 4).

Figure 1. Colour differences of three types of lettuce with different types of packaging (packaged for 7 days)

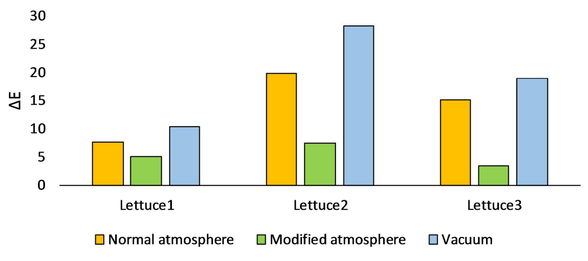
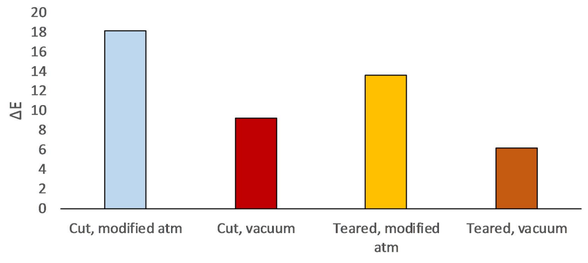
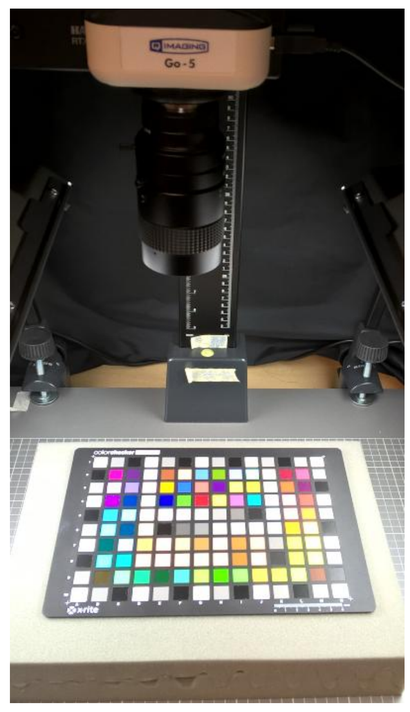


Figure 2. The effect of packaging type and processing on the colour difference of lettuce (packaged for 7 days)





Colour measurement device

Figure 3. The surface area of brown colour [%] as a function of processing type and storage time of lettuce

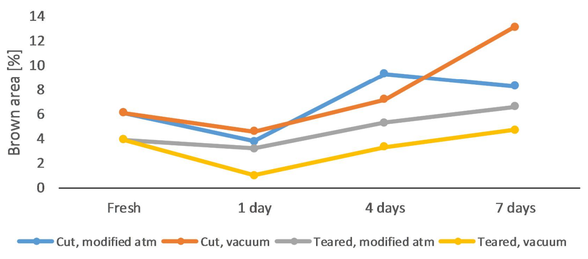
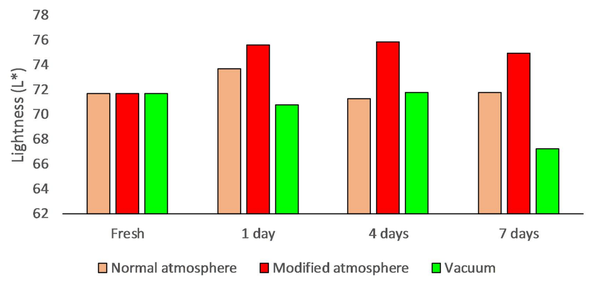


Figure 4. The effect of packaging type on the lightness of lettuce as a function of storage time



MATERIALS AND METHODS

In this study the two types of processing methods (knife cutting or tearing) and the three types of packaging (modified atmosphere, normal atmosphere or vacuum) to maintain freshness of lettuce were compared. For the modified atmosphere, 90 % N_2/5 % O_2/5 % CO_2 gas mixture was used. The effect of packaging was tested with three types of lettuces. The effect of processing and packaging to quality changes related colour properties were examined with instrumental colour measurement (CIELAB). The change in colour is expressed as colour difference, $\Delta E = [(L^*_2 - L^*_1)^2+(a^*_2 - a^*_1)^2+(b^*_2 - b^*_1)^2]^{1/2}$ Also a preliminary sensory study (n = 4) was executed applying quality scale from 0 to 5.

CONCLUSIONS

Even small differences in processing conditions may improve freshness and thus palatability of fresh foods. By simply replacing cutting with mechanical tearing retains the cell wall intact and the fresh-like qualities of product. Modified atmosphere packaging seems to be the best option from the tested methods. Better colour retention of lettuce retain the fresh-like qualities of final product. The results indicate that instrumental colour measurement can be a valuable tool for quality control to evaluate the freshness of vegetables. Based on the sensory study, modified atmosphere packaging and tearing induced the least changes on the sensory quality during storage period.

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