Technical Note

Application in minimally processed lettuce (*Lactuca sativa* var. capitata)

Evaluating enzymatic browning in minimally processed vegetables and fruits by image analysis: A potential tool to reduce food quality loss and mitigate economical loss in the supply chain.

Nowadays the minimally processed vegetable and fruit industry is looking for innovative solutions to reduce economical losses linked to food quality loss. Loss of visual appearance due to enzymatic browning is the main quality limitation of the shelf-life in minimally processed lettuce, pears, apples, champignons, and bananas, among others. The development of enzymatic browning can be affected by different factors along the supply chain, such as extreme mechanical damage during processing, inadequate modified atmosphere packaging, and temperature abuse through transportation and/or storage. An innovative way to address these challenges will be monitoring the development of browning in real-time along the supply chain.

At Quality by Images, we have developed an image analysis method that can be used as a tool to monitor enzymatic browning in minimally processed lettuce (see the application example in the figure below). Two hundred grams of minimally processed lettuce were placed in a glass jar and covered with perforated film. The sample was stored at 5°C for six days, and after six days it was left at room temperature for one day in order to mimic temperature abuse conditions. The development of enzymatic browning was quantified and expressed in percentage as “brown area fraction” (BA).

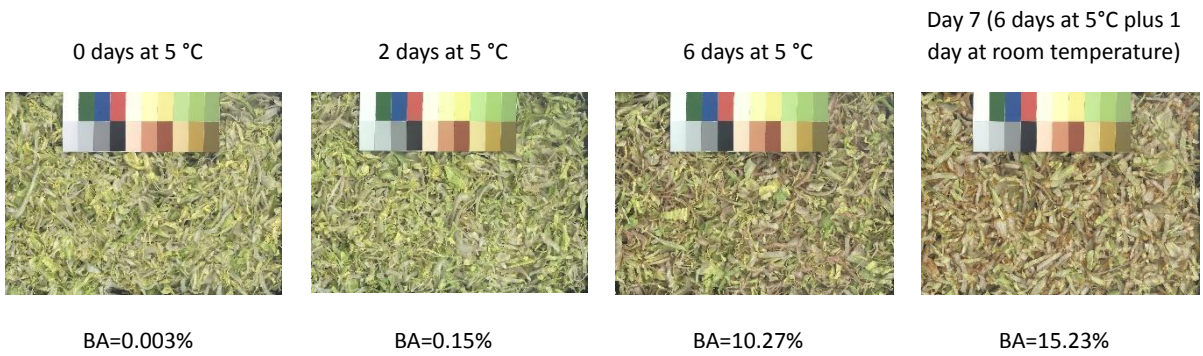

Figure 1. Development of enzymatic browning in cut lettuce at different storage conditions

The conclusions drawn from this work were:

- Our image analysis method can measure the development of enzymatic browning in minimally processed lettuce. As storage time increased, the cut lettuce gradually turned brown. This process is accelerated under temperature abuse reducing the shelf-life of the product.
- Our image analysis method is empowered with cloud services and the internet, allowing accessibility and communication between the local and global supply chains. Thus, our customers can answer **when, where, and why** the product has started to lose its appearance and take corrective actions to reduce food loss and waste, mitigating economic loss.
- Our image analysis method can overcome the challenge of obtaining a reliable quantification of color on a product of irregular shape and size, like cut lettuce, with a high degree of reproducibility and better color representation.
- Our image analysis method can monitor enzymatic browning in other products, such as minimally processed pears, apples, mushrooms, etc.

Would you like to find out more about our technology and how Quality by Images can assist you to monitor browning and reduce food waste? Feel free to reach out to kdeza@qualitybyimages.dk.