Smart Absorbance Analysis of Frozen Food Properties

Fabio Giovanardi[1,2*], Michele Sozzi[2], Alessandro Tonelli[3], Alessandro Candiani[3], Stefano Selleri[1,2]

[1] University of Parma, Department of Engineering and Architecture, Parco Area delle Scienze 181/A, 43124 Parma, Italy
[2] Centro Interdipartimentale sulla Sicurezza, Tecnologie e Innovazione Agroalimentare – SITEIA, Tecnopolo Padiglione 33 Campus Universitario, 43124, Parma (PR)
[3] DNAPhone s.r.l., Viale Mentana, 150, 43121, Parma, Italy
**fabio.giovanardi@unipr.it*

This work shows a methodology to analyse and monitor the properties of frozen food along the cold chain process. The pigment colour is extracted through a simple procedure and analysed by means of a low-cost spectroscopy device.
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1. Introduction

Nowadays rapid and low-cost analysis represents a crucial key in the food safety sector. The widespread availability of smart and universal electronic devices is opening new exciting possibilities in the area of biological and chemical assays. This work is focused on the usage of a smart methodology [1, 2] to monitor frozen products in the food cold chain process using a battery-powered portable spectrophotometer. In particular, absorption spectroscopy analysis is performed to determine the degradation of the product.

2. Material and Methods

The optical setup is composed of a LED custom broadband light source in the visible range (400 nm-700 nm). A lens is placed to focus the beam into the sample contained into a transparent cuvette. A broadband photodiode measures the intensity of the light.

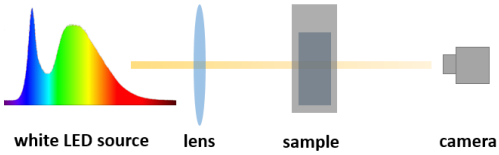

Figure 1. Schematic representation of the optical setup

The data are elaborated in android environment with an algorithm that takes into account the spectrum of the source. The absorbance is calculated according to the formula:

$$A = log \frac{I_0}{I}$$

where I_0 is the input light intensity of the source and I is the output intensity measured with the sample.

A frozen puree of a mixture of carrot and pumpkin is considered in the experiment. The method used allows extracting the pigments at the standard condition of temperature and pressure. The extraction was done with acetone for 3 hours. Quantitation of the colour change was based on the measurement of the CIELab values [3]. In addition, it is possible to quantify the lightness L, whose values range from 0 (completely opaque) to 100 (completely transparent).

3. Results

The absorbance spectrum is measured from five samples derived by the same puree mixture. The results are shown in figure 2.

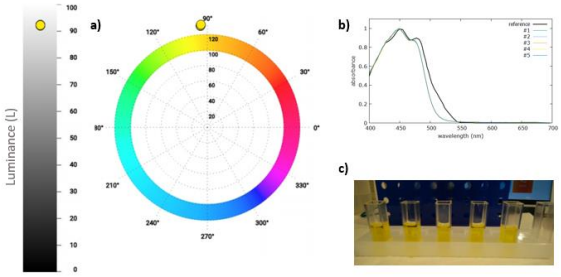

Figure 2. a) data displayed in CIELab diagram; b) Normalized absorbance spectrum of five samples (colored lines) and reference of beta-carotene absorbance spectrum (black line) [4]; c) samples of extracted pigments

4. Conclusion

The absorbance spectrums obtained confirm a good agreement with the reference, and the CIELab diagram shows good reliability of measurements. Moreover, thanks to the characteristics of the used device, rapidity, portability and cheapness became a crucial added value.

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