Near Infrared Spectroscopy: a tool for on-line monitoring of beverage quality

Prades Alexia[1], Assa Rebecca Rachel[2], Dornier Manuel[1], Pain Jean-Pierre[3]

Coconut water (the limpid juice enclosed in the coconut fruit) is a tropical drink known for its refreshing and isotonic properties. It is a fragile liquid subjected to rapid deterioration. As a consequence, assessing its quality during processing and storage still remains a challenge. Among other food quality control methods, Near Infrared Spectroscopy (NIRS), a simple and non destructive analytical tool, should be a good challenger.

The aim was to investigate the ability of a NIRS portable device to assess on-line coconut water postharvest quality.

Immature coconut fruits (Guinea Equatorial Green Dwarf variety from Côte d'Ivoire) were harvested at two grades of maturity (7 and 9 months old). Aseptically collected coconut waters were homogenised and stored into a 2 litres glass reactor. The liquid temperature was maintained at $30\pm0.5°C$ using a double jacket water circulation. Temperature, electrical conductivity, pH and dissolved O_2 were on-line recorded every 30 minutes during 27 and 48 hours (7 and 9 months old nuts respectively). During the experiment, NIRS spectra were continuously acquired with a LabSpec® Pro spectrophotometer. Additional parameters such as soluble solids, titrable acidity, turbidity or polyphenoloxidase activity (PPO) were measured every 30 minutes on aliquots. Data processing was done using descriptive statistics and principal component analysis (PCA).

The monitoring of physico-chemical parameters showed that coconut water deterioration encountered four stages for both grades of maturity: (i) a first stage where dissolved O_2 increased by 3 mgl^{-1} whereas pH and titrable acidity showed a slight decrease, (ii) a second stable stage, (iii) a third stage where dissolved O_2 fall down to 0 mgl^{-1} whereas titrable acidity raised, (iv) a fourth stage where pH and titrable acidity showed clear antagonistic trends. The same four stages were highlighted by PCA performed on NIRS spectral data. The latter also identified an additional phase during stage 2, suggesting that NIRS was more sensitive than physico-chemical monitoring. The potential of NIRS for on-line monitoring of global coconut water quality was demonstrated.

NIRS could be considered as a high sensitive engineering tool for on-line monitoring of beverage quality.

[1]CIRAD, UMR Qualisud, 73 rue JF Breton, Montpellier, F-34398 France

[2]CNRA, Programme Cocotier, 07 BP 13 Abidjan 07, Côte d'Ivoire

[3]UM2, UMR Qualisud, Place E. Bataillon, Montpellier, F-34095 France