HIS for quality evaluation of vitamin C content in Acerola fruit

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Acerola (Junco cultivar), a typical Brazilian fruit, is considered a super-fruit due to its high content of ascorbic acid, an excellent antioxidant of the free radicals in water phase. The aim of this work is to evaluate, by HIS, vitamin C distribution in acerola fruit as discriminant quality parameter so to deliver the product to the industry according to the fruit quality.

Ten different acerola fruits picked up according to two different stages of maturity, based on the colour of the peel (5 green and 5 red acerola), were analysed. The colour of the fruits is not only a sign of pigment transformation on the outer surface but it is also related to complex biochemical changes during ripening on the tree. A NIR device (Perkin Elmer Frontier FT-Spectrometer) was used to acquire the spectra of vitamin C powder, pure and added (5% w/v) to acerola juice. The device was equipped with a Reflectance Accessories (NIRA) and worked in the range of 12000 – 4000 cm-1, 8 cm-1 resolution, 32 scans for sample and background. The hyperspectral images of sliced acerola were caught with a SisuChema Spectral Camera operating in the range of 900 - 2500 nm; the camera was equipped with a 50 mm lens with a minimum resolution of 150 μm.

The NIR spectra of acerola juice were pre-processed with SNV and smoothing (11 pts, 2 polynomial order), whereas the HS images were previously masked for background removal and then equally pre-processed. The spectra of pure vitamin C powder and acerola juice, fortified with 5% of vitamin C, were used as references for computing models with two different correlation techniques: Spectral Angle Mapping (SAM) and correlation coefficient. The abovementioned data analyses were performed by HYPER-Tools, working under MatLab (v. 7.4, The MathWorks).

The calculation of correlation coefficients, a useful technique when having a priori information, gave high maximum coefficients (0.9) when applied to pure vitamin C spectrum. Lower coefficients were obtained when correlating the images with the spectrum of acerola juice fortified with 5% of vitamin C. These high coefficients, for both green and red fruits, could be influenced by light scattering effect.

Through SAM, the cosine of the angle between the target spectrum and each spectrum of the images was calculated, thus permitting to describe the dissimilarities, i.e. the variance between them. Results obtained by using both reference spectra showed maximum coefficients near to 0.7. The normalized coefficients (between 0 and 1) allowed the comparison between models obtained

with different reference spectra, thus visualizing the spatial distribution of pixels highly correlated (>0.8) with powder and juice spectra.

In conclusion, HSI combined with correlation techniques proved to be promising for qualitative evaluation of vitamin C content in acerola fruit. In particular, they are encouraging for future application focused on small range of the spectrum strictly linked to vitamin C absorption bands.