A novel, simple, non-destructive and user-friendly analytical tool for the detection of nitrites in red tuna by means of hyperspectral imaging technique: A preliminary study

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The illegal treatment of tuna with high concentrations of nitrite to obtain a significant improvement in appearance prolonging the shelf-life is a significant concern in food safety. The food safety risk can be not only due to the high concentration of nitrite, but also to the possible increase of free amines concentration (particularly biogenic amines) and N-nitrosamines, other than the microbial growth, particularly pathogens (if any).

This study describes the preliminary tests carried out in order to develop a simple, non-destructive and user-friendly analytical tool for detecting the addition of nitrite in fresh red tuna samples. This tool is based on a hyperspectral method and chemometrics to identify the best few wavelengths to be used to detect nitrite addition.

Nitrite treatment was standardized in order to achieve a proper stabilization of the red colour of tuna in a 5-days period, under refrigeration. First, a portion of fresh red tuna samples, as collected on the market, was analysed for the detection of two food additives which can influence the study: sulphites and ascorbic acid. Then, they were placed for 1 minute, at ambient temperature, in solutions containing 0.4% (w/v) $NaNO_2$ and 10% (w/v) NaCl, and then re-analysed for nitrite quantification.

The chemical parameters determined by means of ion chromatography with conductivity detection (sulphites and nitrite) and HPLC/UV-DAD (ascorbic acid), reported the absence of sulphites, and the presence of about 80 mg kg^{-1} and 200 mg kg^{-1} of nitrite and ascorbic acid, respectively.

Regarding novel analytical tool under development, at least five wavelengths in the visible region were identified as able to detect the illegal treatment of tuna with nitrite solutions. This points out the potential of image analysis methods to identify nitrites at concentration of 80 ppm or more. This first result could be the way to develop and optimize an industrial on-line application to inspect tuna in objective and non-contact manner.

Acknowledgements

Thanks to the Italian Ministry of Health who financed the Research Project IZS PB 05/21 RC