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NIR and Visible spectroscopies coupled with chemometrics for the evaluation of edible seed oils quality evolution during storage under different illumination conditions

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Preservation from uncontrolled temperature and light conditions plays a paramount role in the nutritional and organoleptic properties of food during shelf-life. In particular, bottled edible seed oils are remarkably sensitive to thermal- and photo-degradation if poorly stored, leading to a potential negative impact on the consumer's expectations and experience (Spatari et al., 2017).

This study was focused on evaluating the effects of different lighting conditions on the quality composition of seed oils, during shelf-life, by simulating the daily storage conditions of a common supermarket. The oils were obtained, using a screw press, from three different vegetable seeds, such as hemp, linseed, and sunflower, then promptly placed in dark glass bottles and stored under controlled temperature (20°C). The bottles were divided into two sets, which were exposed to different artificial light sources (neon and LED) with the same colour temperature (6500K) and light intensity (1500 lumen). The study was carried out for 12 months, sampling, every two months, one bottle of each set for each seed oil. Samples were analysed using NIR and Visible benchtop spectrometers. Seven analytical time points were thus considered (including the oil just after extraction), and a total of 351 NIR and 351 Vis spectra (including replicates) were obtained.

Principal component analysis (PCA) and multivariate curve resolution (MCR) models proved the capability of both NIR and Visible spectroscopy to detect the effect of storage time. For all the oil types, the most noticeable changes occurred within two months of storage while, after eight months, a remarkable oxidation was found. Moreover, differences between the illumination sources were pointed out, especially in the case of hemp oil, which was found to be more prone to photodegradation using neon rather than LED lamps.

Keywords: seed oils, lighting conditions, shelf-life, Vis-NIR spectroscopy, chemometrics

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