Authentication and quality control of edible insects using portable infrared spectroscopic devices

Carmen Méndez-Sánchez1, Silvia De Lamo-Castellví2\*

1 Departament d'Enginyeria Química, Universitat Rovira i Virgili, Avinguda Païssos Catalans, Tarragona, Spain, carmen.mendez@urv.cat

2 Departament d'Enginyeria Química, Universitat Rovira i Virgili, Avinguda Païssos Catalans, Tarragona, Spain, silvia.delamo@urv.cat  
\*Corresponding author

Analytical chemistry is moving towards simpler, and less time-consuming methods. Progress in miniaturization of vibrational spectroscopy components (micro-electro-mechanical systems (MEMS), solid-state lasers, optical components, wavelength selectors, and detectors) has allowed the development of portable or hand-held systems. These devices are simple to use, require minimal or no sample preparation with higher operational speed. Moreover, these spectrometers perform similar than laboratory benchtop instruments without compromising spectra sensitivity and quality (Rodriguez-Saona et al., 2020; Yan and Siesler, 2018).

By miniaturizing vibrational spectroscopy equipment, the food industry can monitor food products and production processes in-situ and in real-time to ensure product safety, quality assurance, authentication, and detection of adulteration, and contaminants in foods (Rodriguez-Saona et al., 2020; Shiroma and Rodriguez-Saona, 2009).

This technology can be easily applied to the emerging insect sector. As an alternative to ensuring food and feed security, edible insects are being considered, are good source of nutrients such as proteins, lipids, minerals, and chitin. Additionally, insects are considered an innovative technology for waste management (Gkinali et al., 2022).

The present study evaluates a new approach to predict the amount of lipids present in commercial edible *Tenebrio molitor* using near infrared mini spectrometer. Insect powders were placed inside a polyethylene bag of 7 x 11 cm (30 g, 1 cm of height). The spectra were collected by direct contact between the detector and the plastic bag from 7750 to 3750 cm-1. Principal Components Analysis (PCA) model was to build up to identify the differences among the samples tested and Partial least squares regression (PLSR) model was used to quantify the amount of lipids present in the insect powder.

**Keywords:** miniaturization, chemometrics, NIR, food safety, edible insects

**Acknowledgements:** This project was financially supported by the fundings from the Ministerio de Ciencia e Innovación PGC2018-097095-B-I00 and the Universitat Rovira i Virgili under the Martí Franquès Research Fellowship Programme 220PMF-PIPF-30.

REFERENCES

Gkinali, A.-A., Matsakidou, A., Vasileiou, E., Paraskevopoulou, A., 2022. Trends in Food Science & Technology 119, 495–507.

Rodriguez-Saona, L., Aykas, D.P., Borba, K.R., Urtubia, A., 2020. Current Opinion in Food Science 31, 136–150.

Shiroma, C., Rodriguez-Saona, L., 2009. Journal of Food Composition and Analysis 22, 596–605.

Yan, H., Siesler, H.W., 2018. NIR news 29, 8–12.