Photonics Application in Agrofoods and Environment

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ABSTRACT

At the Photonics for Agrofoods and Environment Laboratory of IESL, we exploit our expertise in the field of the interaction of light with matter to develop and demonstrate specialized optical spectroscopic analysis methods in the field of agrofoods and the environment.

AGROFOODS

Specifically, we record the optical spectrum (from Absorption, Fluorescence, FT-IR and Raman Spectroscopy) that is the characteristic "fingerprint" and reflects the chemical composition of an agrofood sample. The optical spectrum is used to determine the agrofoods origin and to assess their quality and authenticity. Furthermore, we employ an innovative approach based on the combination of optical spectroscopy with machine learning algorithms for

a) Classification: The comparison of samples for investigation of similarities or differences and their grouping leads to conclusions for geographical origin [1], variety [2], age etc.

b) Regression: The correlation of optical spectroscopy results with results measured from other methods (e.g., classical analytical techniques) of the same samples allows the prediction of properties of a new unknown sample without any chemical analysis.

ENVIRONMENT

Greenhouse gas (GHG) emissions locally produced from small-scale human activities and natural phenomena have a massive environmental impact and thus require continuous monitoring. To that end, developing robust, accurate and cost-effective GHG monitoring instruments is critical. A ground-based, integrated path, differential absorption (IPDA) device is presented equipped with two low optical power DFB diode lasers for the detection of CO_2 and CH_4[3]. The atmospheric background concentration of these two GHG was measured with an accuracy of 5 ppm and 90 ppb, respectively. The calculation of the GHG concentration is performed using the differential absorption lidar (DIAL) equation which requires the spatial extent of the laser beam.

The device comprises a sealed waterproof case containing the components of the device, which is placed onto a 3.5m long pole. Moreover, it operates autonomously and can be rotated to a selected angle horizontally.

REFERENCES

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