A Preliminary Prototype System for UV Optical MeSA Monitoring in Agriculture Field

Ivana Di BARI - *Institute for Microelectronics and Microsystems (CNR-IMM) – Catania*

Institute for Microelectronics and Microsystems (CNR-IMM) - Catania

This work presents the development of a novel portable spectroscopic system based on solid-state technology for real-time monitoring of Methyl Salicylate (MeSA). MeSA is a volatile organic compound (VOC) emitted by plants under stress, serving as a biomarker of plant health in agricultural environments. As a proof of concept, the proposed system exploits the optical absorption of MeSA at 310 nm, utilizing a Deuterium lamp, properly filtered, as the excitation source and a Silicon Carbide (SiC) based visible-blind UV homemade photodetector to achieve high sensitivity and selectivity. Initial laboratory tests demonstrated the capability to detect MeSA at concentrations down to tens of parts per billion (ppb), with a detection limit as low as 2.94×10^{-7} M, comparable to stress-induced MeSA emission levels. The sensor response exhibited a linear correlation to MeSA concentration and showed immunity to interference from concurrent metabolites such as Methyl Jasmonate (MeJA). A portable prototype system features aluminum housings that enclose a 307 nm LED as the light source and compact SiC UV detector. This optical setup allows for a high degree of miniaturization and stability in UV detection, leveraging the inherent "visible blindness" of the SiC sensor to eliminate interference from unwanted fluorescence in the visible range.
Ongoing work is focused on optimizing the design and materials of the CISC (Chemical Interactive System Chamber) to achieve chemical inertness, durability, and minimal optical scattering and absorption, with the aim of realizing a compact, handheld, and cost-effective device for on-site and long-term deployment in precision agriculture and greenhouse monitoring. This technology provides a promising approach for non-invasive, real-time plant stress monitoring, advancing sustainable crop management practices.