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Fluorescent Organic Polymer-Based Sensors for the Detection of Ethylene Gas During Fruit Ripening

The detection of ethylene gas remains a high priority for food and agricultural industries due to its critical role in the aging and ripening of certain fruits. Current detection methods rely heavily on mass spectrometry-based[1] or electrochemical methods,[2] which are time-consuming and expensive. Recently, the Swager group at Massachusetts Institute of Technology (MIT) has developed a fluorescent organic polymer-based sensor for the rapid, sensitive, and selective detection of ethylene gas.[3] The system relies on the fluorescence turn-on of a conjugated polymer coordinated to a copper(I) complex. The role of the copper(I) complex is to mimic the ethylene receptor (ETR1) naturally found in plants. The copper-polymer complex exhibits a weak fluorescence signal in solution; however, in the presence of ethylene gas, the copper(I) complex selectively binds to ethylene and no longer quenches the fluorescence signal of the polymer. This method was successful in detecting low levels of ethylene gas (micromolar concentrations). Additionally, the selectivity for ethylene gas in samples containing common fruit metabolites was determined through fluorescence spectroscopy, in order to potentially use this sensory concept to develop solid-state detectors to be used for the practically applicable detection of ethylene gas during fruit ripening. These experiments resulted in high selectivity for ethylene gas with little to no interference by fruit metabolites. The high selectivity, sensitivity, and practical applicability of this method have significant potential in the development of practical sensors to be used for the detection of ethylene gas during fruit ripening.

1 Pham-Tuan, H.; Vercammen, J.; Devos, C.; Sandra, P. “Automated Gas Chromatographic System to Monitor Ethylene Emitted from Biological Materials.” *J. Chromatogr. A* **2000**, *868*, 249-259.
2 Jordan, L. R.; Hauser, P. C.; Dawson, G. A. “Portable Trap-Sensor System for Monitoring Low Levels of Ethylene.” *Analyst*, **1997**, *122*, 811-814.
3 Esser, B.; Swager, T. M. “Detection of Ethylene Gas by Fluorescence Turn-On of a Conjugated Polymer.” *Angew. Chem. Int. Ed*., **2010**, *49*, 8872-8875.