

Progress in the Development of Reaction-Based Sensors for Detection of Acrolein in Biological Samples

Pradipta A., Saigitbatalova E., Takamatsu M., Kurbangalieva A., Tanaka K.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016, Springer Science+Business Media New York. Acrolein, a highly toxic α,β -unsaturated aldehyde, occurs as pollutant in the environment (e.g., tobacco smoke and exhaust gas) and ubiquitously generated in biosystems (e.g., lipid peroxidation process and metabolism of polyamine or amino acids). High accumulation of acrolein in the body is often linked pathologically with several oxidative stress-related diseases, including cancer and Alzheimer's. Accordingly, acrolein holds great potential as key biomarker in oxidative stress-related diseases, and direct measurement of acrolein in biological samples is becoming important to provide information for diagnosis and therapeutic purposes. The available conventional analytical method for detection of acrolein, e.g., high-performance liquid chromatography (HPLC) analysis after derivatization with 3-aminophenol under harsh reaction conditions, is not suitable for high-throughput assay and inconvenient for measurement in clinical practice. A monoclonal antibody can be used for detection of acrolein-lysine adducts; however, this method is time-consuming and expensive. Consequently, developing new analytical tools that are straightforward, cost-effective, and selective for acrolein detection in live cells remains highly important for the diagnosis and therapeutic treatment of oxidative stress-related diseases. In this review, we will discuss several commonly used classical methods for detecting acrolein from biological samples, and describe our recent findings on the simple but robust method for detecting and visualizing acrolein generated by live cells in the context of oxidative stress processes or introduced via environmental exposure.

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Keywords

Acrolein, Click reaction, Fluorescent, Oxidative stress, Phenyl azide, Sensors