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A Reduction-Based Sensor for Acrolein Conjugates with the Inexpensive Nitrobenzene as an Alternative to Monoclonal Antibody

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Abstract

© 2016 The Author(s).Acrolein, a highly toxic α, β-unsaturated aldehyde, has been a longstanding key biomarker associated with a range of disorders related to oxidative stresses. One of the most promising methods for detecting acrolein involves the use of antibodies that can recognize the acrolein-lysine conjugate, 3-formyl-3, 4-dehydropiperidines (FDP), within oxidatively stressed cells and tissues from various disease states. We have uncovered here that FDP could reduce nitroarenes in high yields at 100 °C in the presence of excess CaCl 2 as a Lewis acid promoter. This unique transformation allowed for the development of a de novo method for detecting levels of FDPs generated from proteins in urine or blood serum samples. Thus we successfully converted a non-fluorescent and inexpensive 4-nitrophthalonitrile probe to the corresponding fluorescent aniline, thereby constituting the concept of fluorescent switching. Its sensitivity level (0.84 nmol/mL) is more than that of ELISA assays (3.13 nmol/mL) and is already equally reliable and reproducible at this early stage of development. More importantly, this method is cost effective and simple to operate, requiring only mixing of samples with a kit solution. Our method thus possesses potential as a future alternative to the more costly and operatively encumbered conventional antibody-based methods.

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