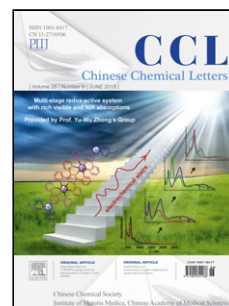


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Review

Recent advances in formaldehyde-responsive fluorescent probes

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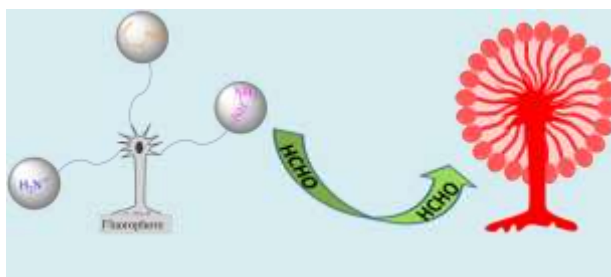
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Graphical Abstract



Formaldehyde is one of the simplest reactive carbonyl species. In view of the harmfulness of formaldehyde in nature and humans, it is of great significance to further elucidate roles and functions of formaldehyde by a noninvasive detection approach. Fluorescent probes have become a popular tool to track and detect formaldehyde *in vitro* and *in vivo*, which have attracted more and more interest recently. This review focuses on various reaction mechanisms to design the fluorescent probes for detecting formaldehyde.

ABSTRACT

Formaldehyde, as one of the simplest reactive carbonyl species (RCS), is regarded as a potential carcinogen and a sick house syndrome gas. Recent studies have shown that abnormally high levels of formaldehyde may result in cognitive decline and spatial memory deficits, asthmatic symptoms, Alzheimer's disease, and cancer. Due to the harmfulness of high levels of formaldehyde in nature and humans, it is of great significance to further elucidate the roles and functions of formaldehyde by a non-invasive detection approach. Fluorescence imaging has become a powerful and popular tool in monitoring bio-species owing to their high sensitivity and selectivity, excellent spatiotemporal resolution and non-invasion nature. Therefore, fluorescent probes are widely applied to track and detect formaldehyde *in vitro* and *in vivo* which have attracted more and more interest recently. This review focuses on various strategies to design the fluorescent probes for detecting formaldehyde based on different recognition groups.

Keywords:

Formaldehyde

Fluorescent probes

Bioimaging application

Sensing mechanism

1. Introduction

Formaldehyde is the simplest aldehyde and widely used in the chemical industry for producing detergent, plastics, wood processing, corrosion remover, drugs and so on [1,2]. Formaldehyde presents in food such as vegetables, fruits, meat and seafood. In addition, formaldehyde is usually used as a food preservative agent, whereas the formaldehyde residues in food may bring about severe threat for human health [3]. Environmental formaldehyde is prevailingly generated from natural and anthropogenic industrial activities and combustion of biofuels. Environmental formaldehyde has emerged as one of the ubiquitous chemical pollutants in indoor environments, which resulted from formaldehyde-containing building materials. Formaldehyde has become a heavy threat to human health. Exposure

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