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Communication

Red-emitting salicylaldehyde Schiff base with AIE behaviour and large Stokes shift

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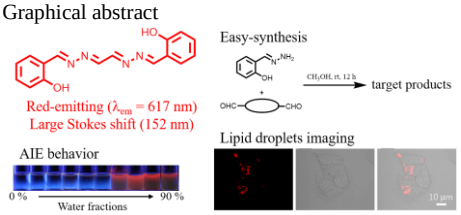
Graphical abstract



Three salicylaldehyde Schiff base (SSB) with AIE behaviour were designed and facilely synthesized through a condensation reaction. In solid and aggregation states, these SSB dyes exhibited yellow to red emission with large Stokes shift. One of SSB dyes could specifically stain lipid droplets in living cells.

ABSTRACT
Three salicylaldehyde Schiff base (SSB), *iso*-PBP, PBP and EPB, were facilely synthesized and exhibited aggregation-induced emission. The introduction of C=N-N=C moiety in these SSB dyes largely extend the conjugation system and push their emission to yellow to red spectral region. These SSB dyes were negligibly fluorescent in dilute THF solution. In THF/water mixtures with high water fractions, they displayed strong yellow to red fluorescence (up to 617 nm) and large Stokes shifts (up to 152 nm). Single crystal analysis on EBP showed the longer emission of in aggregated state was attributed to the molecular packing effect as compared with that in dilute solution. The bio-imaging application indicated EBP could specifically accumulate in lipid droplets in living cells.

Keywords:
Aggregation-induced emission
Salicylaldehyde Schiff base
Red-emitting
ESIPT
Aldehyde-amine condensation

Red-emitting fluorophores such as rhodamines, BODIPY derivatives and some coumarins have been widely applied as bio-imaging agents, photo-sensitizers and optical materials [1-5]. Usually, these dyes are strongly fluorescent in dilute solutions, however, are weakly fluorescent in high concentration and/or in solid state due to the aggregation-caused quenching (ACQ) effect [6-8]. In 2001, multiphenylsiloles had been discovered to display strong emission in high aggregation and solid state and are weakly fluorescent in dilute solutions, which is called aggregation-induced emission (AIE) [9,10]. Later on, more materials have been found to exhibit AIE properties with different features and functions [11-19]. The typical prototypical AIE luminogens (AIEgens) such as 1-methyl-1,2,3,4,5-pentaphenylsilole and tetraphenylethylene (TPE) emit in a short-wavelength spectral region [20,21]. To date, not many AIEgens with simple structures have exhibited emissions in red/NIR spectral region. It is well known that fluorophores with long-wavelength emissions are more favorable because long-wavelength photos have deeper tissue penetration, less photodamage to the biological tissue, and less interference from auto fluorescence in organism. Therefore, it is very meaningful to develop new red-emitting AIEgens.

Most of the reported red-emitting AIEgens are subjected to complicated preparation [22]. Salicylaldehyde Schiff base (SSB) dyes could be easily obtained and were reported as AIEgens by Tong's group in 2009, which displayed a large Stokes shift due to the excited