Recyclable Aqueous Droplets for Sustainable NHC Organocatalysis: A Greener Synthetic Alternative

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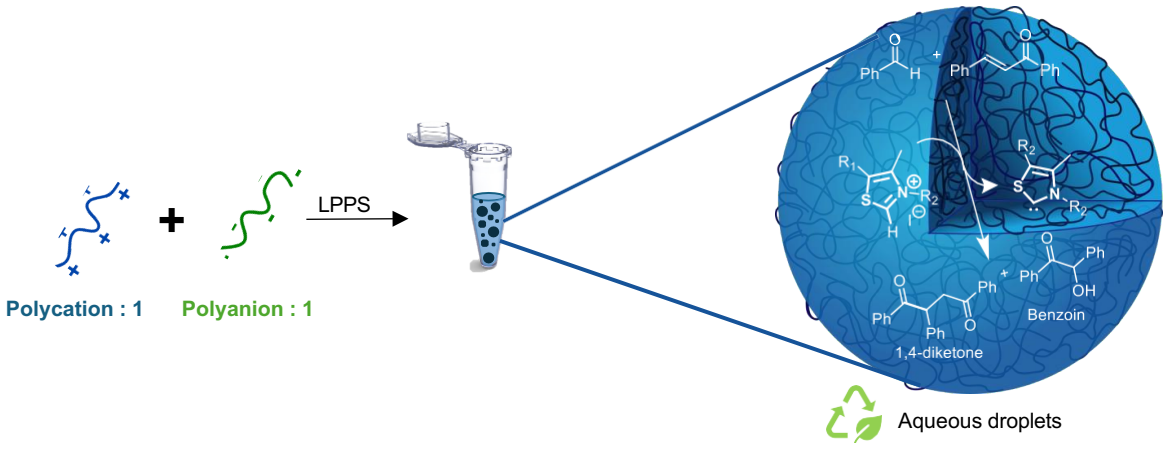
In response to growing environmental concerns, synthetic chemistry is increasingly shifting toward greener and more sustainable methodologies[1]. A major objective in organic synthesis is the efficient formation of carbon–carbon (C–C) bonds to build complex molecules from simple precursors. Traditional catalytic systems often rely on transition metals that are costly, toxic, and sourced from non-renewable resources. Organocatalysis[2] offers a powerful metal-free alternative, reducing environmental impact while maintaining high synthetic efficiency.

Among organocatalysts, *N*-heterocyclic carbene (NHCs)[3] are particularly attractive for C–C bond-forming reactions. Generated from azolium salts and bioinspired by the natural cofactor thiamine diphosphate, NHCs enable umpolung reactivity and diverse transformations. However, their application in water remains challenging due to their intrinsic instability in protic media and the risk of competing side reactions. Pursuing greener chemistry, bioinspired methods and replacing organic solvents with eco-friendly alternatives like water[4] are especially relevant.

Herein, we report an efficient Stetter[5] [6] reaction conducted in a novel, recyclable aqueous environment. A series of azolium-derived catalysts was designed and synthesized to evaluate the influence of catalyst structure on reactivity and selectivity in water[7]. Our findings reveal a pronounced concentration-dependent efficiency, suggesting that the formation of recyclable aqueous droplets provides a favorable microenvironment for NHC-mediated reactions. This approach offers a robust and reusable platform for greener C–C bond construction without conventional organic solvents.



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