

One-flow Direct Syntheses of Diverse Heterocyclic Furanic Compounds from Fructose via Tandem Transformation Platform

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We introduce a novel chemical platform system for multicomponent cascade transformation of natural biomass, sustainable green resources. We demonstrate the concept by developing an integrated continuous two-step microfluidic system as a tandem transformation platform for direct conversion of fructose to diverse furan chemicals with excellent yields up to 99% via various reaction of 5-hydroxymethylfurfural (HMF) intermediate. A sequential two-step process is utilized to complete dehydration of fructose in the surface acid-catalyst at 150 °C for 6 min, which is followed by four types of HMF conversion in binary or ternary phase to produce furfuryl alcohol (FFA) (94% yield), 5-ethoxymethylfurfural (EMF) (99%), 2,5-diformylfuran (DFF) (82%) and 2,5-dimethylfuran (DMF) (90%) with magnetic-based heterogeneous catalysts at 70~150 °C for 6~60 min. This innovative tandem microfluidic platform enables precise control of reaction temperature and time for each individual biomass conversion step in a one-flow manner without separation and purification steps for intermediates and catalysts.