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Hydrogen-transfer conversion of furfural into levulinate esters as potential biofuel feedstock

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*Beijing National Laboratory of Molecular Science, Key Laboratory of Green Printing, Institute of Chemistry, Chinese Academy of Sciences, Beijing 100190, China***Abstract:**

Furfural is directly converted to levulinate esters (isopropyl levulinate and furan-2-ylmethyl-levulinate) as potential biofuel feedstocks, through a combined catalytic strategy. Nb₂O₅-ZrO₂ mixed oxide microspheres are used as bifunctional catalysts for hydrogen-transfer hydrogenation and acid-catalyzed alcoholysis in isopropanol. Bifunctional catalysts improve sustainability of furfural conversion through process intensification. Hydrogen transfer hydrogenation from isopropanol avoids dangerous hydrogen gas, and abates process and environmental costs. Isopropyl levulinate and furan-2-ylmethyl-levulinate are the main products that can be applied as blending components in biodiesel or hydrocarbon fuels.

Key words: Furfural; Bifunctional catalyst; Transfer hydrogenation; Solid acid; Levulinate esters***Corresponding author.** Tel: +86-10-62634920; Fax: +86-10-62559373;

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1. Introduction

Biomass resources are abundant and renewable feedstock for sustainable production of fuels and chemicals. Levulinic acid (LA) is regarded as one of most important platform molecules of carbohydrate [1], which can be converted into many high-value-added products [2]. LA and its derivatives are widely used in many fields such as medicine, agriculture, food, cosmetics and spice industry and biofuels. Levulinate esters are versatile chemical feedstock as spices in flavoring and fragrance industry or as blending components in biodiesel [3].

LA can be produced through hydrolysis or alcoholysis of furfuryl alcohol (FA) [4–7] and direct biomass conversion [8–12]. Both conversions usually involve mineral acids or solid acids. Direct

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