BASE FREE, ONE-POT SYNTHESIS OF LACTIC ACID FROM GLYCEROL USING A BIFUNCTIONAL Pt/Sn-MFI CATALYST

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Glycerol, an inevitable by-product from biodiesel production, is potentially obtained from non-edible biomass such as microalgae, cellulose and its derivatives. The conversion of glycerol to commodity chemicals not only reduces the chemical waste but also provides a sustainable and green pathway for our society. Lactic acid has been considered as one of the top 14 chemical building blocks produced from biomass conversion by US Department of Energy at 2010. Compared to glycerol, lactic acid (LA) and alkyl lactates have a higher value and offer important applications as green solvents, platform chemicals and precursors for the synthesis of polylactate or polylactic acid (PLA), the second most manufactured bioplastic of the world. LA can be produced from petroleum feedstocks in high yields using mineral acid catalysts. However, the use of toxic chemicals (e.g. hydrogen cyanide) and the high cost for product separation could lead to significant environmental issues. Therefore, currently LA is mainly manufactured by the fermentation of carbohydrates. However, the efficiency and productivity of the fermentation process are still low and need substantial improvements because of the high cost of enzyme catalysts and the need for precise control of operating conditions. There is thus a persistent need to develop efficient thermochemical pathways for the production of LA from new starting materials.

In this study, we report a base free one-step reaction pathway to selectively produce LA with high yields from the oxidation of glycerol over a bifunctional Pt/Sn-MFI catalyst under mild reaction conditions. 80.5% selectivity to LA was achieved at 89.8% conversion of glycerol.[1] In the cascade reaction route, the selective oxidation of glycerol into glyceraldehyde proceeds on Pt catalyst. Sn-MFI exhibits outstanding Lewis acidity for converting glyceraldehyde into dihydroxyacetone and dihydroxyacetone into the final product LA. The superior performance is mainly due to its microporous structure, accessible Sn site and Lewis acidity.

[1] Cho, H. J.; Chang, C.-C.; **Fan, W.***, *Base free, one-pot synthesis of lactic acid from glycerol using a bifunctional Pt/Sn-MFI catalyst*, **Green Chemistry.** 2014, 16, 3428-3433.