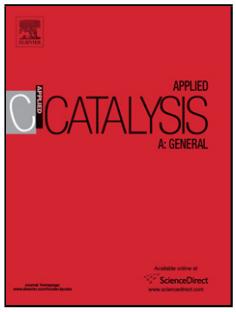

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PII: S0926-860X(18)30072-3
DOI: https://doi.org/10.1016/j.apcata.2018.02.014
Reference: APCATA 16554

To appear in: *Applied Catalysis A: General*

Received date: 8-12-2017
Revised date: 4-2-2018
Accepted date: 13-2-2018

Please cite this article as: Godard N, Collard X, Vivian A, Bivona LA, Fiorilli S, Fusaro L, Aprile C, Rapid Room Temperature Synthesis of Tin-based Mesoporous Solids: Influence of the Particle Size on the Production of Ethyl Lactate, *Applied Catalysis A, General* (2010), https://doi.org/10.1016/j.apcata.2018.02.014

Rapid Room Temperature Synthesis of Tin-based Mesoporous Solids: Influence of the Particle Size on the Production of Ethyl Lactate

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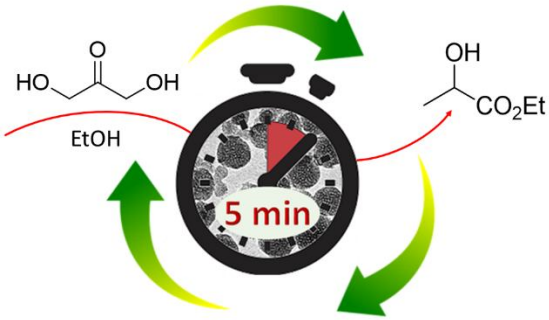
Graphical abstract



Highlights

- A rapid room temperature synthesis protocol was successfully conceived
- A series of porous solids bearing Sn inserted as single site was prepared
- The solids were obtained with a precise control of the particle size
- An excellent correlation between particles size and catalytic activity was observed
- The best catalyst allows obtaining a full conversion of DHA with total selectivity

Abstract

A series of tin-based mesoporous catalysts was prepared via a novel straightforward sol-gel procedure leading to an extremely short synthesis time decreased up to 5 min at room temperature. This synthesis, together with the precise control of the selected particle size, represents an advancement compared to the state of the art and be can easily applied to large scale production. Characterization of the materials revealed the presence of MCM-41 like architecture with a high specific surface area, narrow pore size distribution, insertion of tin in tetrahedral coordination and a good balance of Lewis/Brønsted acidity. Moreover, all these characteristics were almost identical for the entire series thus making these solids an ideal case study to investigate the influence of the particle size on the catalytic behavior. The Sn containing materials were tested as catalysts in the conversion of dihydroxyacetone into ethyl lactate. The excellent correlation between particles size and catalytic performances proves the importance of the size control. In addition, the absence of leaching was proved via hot filtration experiments and the materials preserved their activity in multiple catalytic cycles.

Keywords: mesoporous materials; fast synthesis; size control; heterogeneous catalysis

1. Introduction

Mesoporous materials containing different metal elements as single sites within the silica structure may act as highly efficient catalysts for various applications including epoxidations [1], Baeyer-Villiger oxidations [2], Meerwein-Ponndorf-Verley-Oppenauer redox reactions [3],