

**SULFONIC ACID FUNCTIONALIZED MESOPOROUS MOLECULAR SIEVES
AS CATALYSTS FOR THE SYNTHESIS OF ADIPIC ACID FROM
2,5-TETRAHYDROFURANDICARBOXYLIC ACID**

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Adipic acid (AA) is a key monomer in the production of nylon-66, a variety of plasticisers, resins, and polyurethanes, and is also used as a food (E355) and pharmaceutical additive. However, the traditional process for AA production, which utilises petroleum-derived feedstocks, is characterised by high energy consumption and the emission of nitrogen oxides into the atmosphere. Alternative methods employ 5-hydroxymethylfurfural (5-HMF) and its derivatives obtained from biomass processing. This process involves several stages: the conversion of 5-HMF to tetrahydrofuran-2,5-dicarboxylic acid, followed by furan ring opening. This work investigates the catalytic process for the synthesis of adipic acid (fig. 1) from tetrahydrofuran-2,5-dicarboxylic acid (2,5-THFDCA) [1,2].

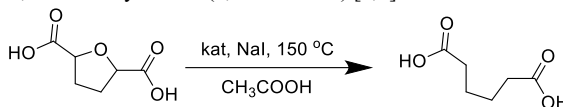


Fig. 1. Scheme of obtaining adipic acid from tetrahydrofuran-2,5-dicarboxylic acid

To improve the synthesis conditions and efficiency, the use of an appropriate acid catalyst is essential. In particular, SBA-15 materials functionalized with sulfonic acid groups are promising due to their open mesoporous structure, high specific surface area, and large pore sizes, which together provide sufficient catalytically active sites.

A series of catalysts based on sulfo-group-modified SBA-15 mesoporous molecular sieves was obtained (Fig. 2). The samples can be divided into two series: one prepared by post-synthetic modification of detemplated SBA-15 with 3-mercaptopropyltrimethoxysilane (MPTMS) (Fig. 1), and the other by incorporating MPTMS directly into the reaction mixture.

The synthesised materials exhibited high selectivity for the production of adipic acid from tetrahydrofuran-2,5-dicarboxylic acid, achieving 100 % selectivity for AA. The conversion of 2,5-THFDCA varies from 28–45 %, depending on the sample.

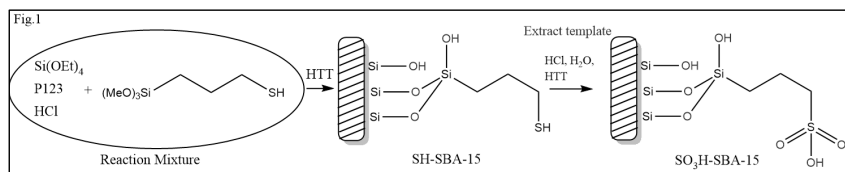


Fig. 2. Scheme of preparation of the catalysts based on sulfo-group-modified SBA-15 mesoporous molecular sieves

1. Vy Tran, Anh, et al. "Efficient Production of Adipic Acid by a Two-Step Catalytic Reaction of Biomass-Derived 2, 5-Furandicarboxylic Acid." *ChemSusChem* 15.10 (2022): e202200375.

2. Gilkey, Matthew J., et al. "Adipic acid production via metal-free selective hydrogenolysis of biomass-derived tetrahydrofuran-2, 5-dicarboxylic acid." *ACS Catalysis* 7.10 (2017): 6619-6634.