

# FORMATION OF SILICA NANOTUBES USING CITRIC ACID AS STRUCTURE STABILIZER VIA SOL-GEL PROCESS

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## ABSTRACT

Silica nanotubes with pore diameters varying from 2.0-2.8 nm have been prepared by sol-gel process in the presence of citric acid in basic condition. Based on computer modeling and experimental work, it is suggested that the formation of nanotube is due to the stabilization effect of ammonium citrate inside the tube structure. The nanotubes were formed after washing with water and calcining at ~ 600°C. The samples were characterized by TGA, SEM, TEM and porosimeter. The results of the analysis revealed the important role played by citric acid in the tube formation. The results indicated that the surface area of materials increases with increase in the amount of citric acid up to 11%. The nanotubes formed are of different range of sizes with outside diameter 200-300 nm, inside diameter 70-100 nm and > 300 nm in length.

## 1. INTRODUCTION

Recent developments in the synthesis of nanosize silica of different morphology have contributed to the various technology applications. Many synthesis routes and strategies have been developed based on sol-gel process that was introduced for the first time by Stober et. al.<sup>1</sup> The silica produced can be modified to various morphology or size from nano to macro, or from solid to porous material via changing process parameters such as pH, water ratio, solvent, aging time and mixing mode.<sup>2-7</sup>

The synthesis and application of silica porous materials have been studied extensively after the discovery of the mesoporous MCM41 material by a group of researchers from Mobil Corporation.<sup>8,9</sup> In most cases, these materials were synthesised using surfactant as template for directing the formation of porous silica.<sup>10-11</sup> Others<sup>13-16</sup> reported that different morphology of mesoporous silica can also be produced using non-surfactant templates.

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