**UGC Minor Research Project 2016-18**; **Name of the PI**: Dr. Paulson Mathew, Dept of Chemistry

**Title of the Project**: Design of Mesoporous Silica Supported Acid-Base Bifunctional Catalysts

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**EXECUTIVE SUMMARY**

The synthetic versatility of mesoporous silica makes it immensely popular as a support material in catalytic processes. Tethering the acid and base functionalities to the surface of the silica allows them to be close enough to each other such that they retain their natural acidic and basic characters without annihilating each other. Well-defined hexagonal or cubic mesoporous silicas such as MCM-41 and SBA-15 were synthesized and utilized as model hosts for catalytic and adsorption applications. The hexagonal MCM-41 was synthesized following the specifications of Bore *et al.* (2006). Silica source used was fumed silica (Aldrich). The template molecule was cetyltrimethylammonium bromide (CTAB), a surfactant with well known aggregation behaviour. SBA-15 was synthesized by method of Zhao and coworkers. Pluronic P123 was used as the structure directing agent. Tetraethylorthosilicate (TEOS) was used as the silica source. In both cases the surfactants were removed from the porous structure by calcination at 550 °C for 5 hrs.

Functionalization of mesoporous SBA-15 via co-condensation of tetraethoxysilane with aminopropylsilane was carried out. Metal loading was carried out to transform the supported materials into bifunctional catalyst. Transition metals like Fe, Co, Ni, Cu, Mo etc were loaded using their aqueous salt solution. All the supports as well as the bifunctional catalysts were characterised using SEM. TEM, IR and powder XRD analysis. The catalysts prepared were tested for their efficiency in the following reactions (a) benzyl alcohol to the corresponding ether, (b) oxidation of toluene to benzaldehyde and (c) homo coupling of alkynes. SBA-15 supported FeCo catalyst was found to be effective for reactions (a) and (b) whereas MCM-41 supported FeCu was found to be very effective for the homo coupling of alkynes.