ABSTRACT

The thesis entitled, "**N-rich Functional Metal Organic Frameworks (MOFs) and Metalo H-Bonded Organic Frameworks (MHOFs): Design, Syntheses and Potential Applications**" has been divided into six chapters.

Chapter **1** gives a brief account of the areas which are of relevance in this thesis, *viz.* MOFs, functional MOFs, their applications in various fields, MHOFs and the scope of the present work.

Chapter **2** of the thesis deals with selective separation of CO_2 from N_2 and CH_4 by a humid stable azo-functionalized microporous 3D Co(II)-MOF. High separation selectivity supported with high loadings in the mixed gas phase were achieved through IAST calculations.

Chapter **3** deals with the syntheses of three different free $-NH_2$ group containing MOFs of varying dimensionality. Structural analysis, CO_2/N_2, CO_2/CH_4 separation selectivities and selective cationic dye sorption studies are presented.

Chapter **4** is divided into two sections. Section **A** deals with three different luminescent MOFs, each having functional bare Lewis basic azo sites for selective detection of Fe^{3+}, Al^{3+} and nitromethane. In section **B**, a strategy to achieve the ultrahigh performance for Al^{3+} detection by a MOF-based sensor is presented attributed to the synergistic effect of fast diffusion of Al^{3+} into the large pores to get exchanged with cationic guests and enhanced biding with highly dense free basic sites decorating the pore walls.

Chapter **5** deals with a simple yet powerful template assisted strategy for synthesizing proton conducting MOFs where the templates remained in the frameworks with charge assist proportions. Having different degree of protonation and carrier concentration these templates generates intricate array of H-bonded platforms responsible for superprotonic conduction as high as 10^{-1} S cm^{-1} at 80 °C and 98% RH.

Chapter **6** describes judiciously selected cationic metal complex and anionic disulfonates/dicarboxylates for the construction of three MHOF materials through charge assisted H-bonds for their exploration as superprotonic conductors for the first time.

The thesis ends with a conclusion and provides the scopes for the further research in these areas.

Keywords: *Gas sorption, Gas separation, Luminescence sensing, MHOFs, MOFs, Proton Conduction.*