



## Synthesis of MIL-88(Fe) by "green" method for drug delivery purpose

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### ABSTRACT

MIL-88(Fe), a metal-organic framework material has been synthesized by "green" ultrasound method. The MIL-88(Fe) samples were synthesized from a mixture of ferric chloride and 1,4-benzenedicarboxylic acid (H<sub>2</sub>BDC) in N,N-dimethylformamide (DMF) at room temperature for 15 mins. The MIL-88(Fe) was characterized by X-ray powder diffraction (XRD) and N<sub>2</sub> adsorption porosimetry (BET). MIL-88(Fe) crystals synthesized under ultrasonic condition produced small and homogeneous crystals. The SEM images of the particles synthesized from this method have approximated dimensions of 200-300nm and hexagonal morphologies. This size reduction is typical of crystals synthesized under ultrasonic condition - a phenomenon which can be attributed to make up uniform and rapid nucleations. The small MIL-88(Fe) crystals are especially effective in the drug delivery fields.

## 1. Introduction

Metal-organic frameworks (MOFs) are crystalline materials constructed from metal ions or clusters and organic ligands. In recent years, MOFs have attracted considerable attention for their potential applications in many areas such as gas storage, separation, catalysis, optics, photonic, ion exchange, molecular array, biomedicine, sensing and drug delivery [1-8]. The structure and morphology of these materials have to be determined by a proper choice of metals, ligands, and reaction conditions for different purposes.

MIL-88(Fe) (MIL stands for Material of Institute Lavoisier) is the mesoporous iron (III) di-carboxylate MOFs, appears to date as the most promising one, in terms of green synthesis, physicochemical stability, high loading capacities and good degradation/release profile [9-11]. MIL-88(Fe) nanoparticle are built from trimers of iron (III) octahedral connected via ion - ovalent bonds to the terephthalate linker, creating a

three-dimensional cubic structure.

In this study, we tried to synthesis MIL-88(Fe) nanoparticle by "green" method for loading 5-fluorouracil as drug delivery system.

## 2. Experimental

### 2.1. Material Synthesis

By ultrasound method: MIL-88(Fe) nanoparticles were synthesis at room temperature by an ultrasonic method. 0.270 g FeCl<sub>3</sub>.6H<sub>2</sub>O is dissolved in distilled water and added 0.166 g terephthalic acid (H<sub>2</sub>BDC) in 5 ml DMF for 5 to 15 mins in ultrasonic machine with a frequency of 20 kHz and capacity of 400 W.

By hydrothermal method: Each reaction mixture was prepared by dissolving 0.270 g of FeCl<sub>3</sub>.6H<sub>2</sub>O and 0.166 g of H<sub>2</sub>BDC in 5 mL of DMF. The solution was then transferred to a sealed pressurized PTFE vessel and heated for 2-8 hours at 110°C in an oven.