Mechanochemical Synthesis of Sustainable Amide Functionalized MOFs for Water Remediation – "SAFeMOFs"

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Water contamination – pollution constitutes one of the major natural disasters, affecting not only humans but also all living organisms and vegetation that survives in water. Despite the fact that several water treatment options are already in place, new high-efficiency and cost-effective technologies must be developed to confront water contamination.

Metal-organic frameworks, MOFs have emerged as leading materials in a wide range of applications, including water remediation, as they integrate the properties of **ideal sorbents**, namely high surface area and binding site density. However, the tendency of MOFs to degrade in water and their costly synthetic procedures (solvothermal) coupled with the use of highly toxic organic solvents, hinders their implementation in industrial scale processes.

Mechanochemistry and **Accelerated Aging** have been proven as excellent tools for the synthesis of a wide variety of materials with the most prominent ones in the field of MOFs and coordination polymers. The hallmark of **Mechanochemistry** (i.e. chemical reactivity induced by mechanical force, milling or grinding) is achieving chemical transformations in the solid state without the need of bulk solvents.

Herein we provide our preliminary results on developing benign solvent-free routes for the synthesis of new multifarious (i.e. one given material integrates multiple functionalities) amide functionalized MOFs as unique candidates for multiple wastewater remediation processes. More specifically, we use amide functionalized organic ligands to synthesize MOFs based on high valence metal ions (e.g. Zr^{4+}, Ce^{4+}, Al^{3+}, Cr^{3+}, Fe^{3+} etc.) which have been reported to exhibit exceptional water stability. By deploying **benign synthetic methodologies**, that do not require the use of bulk solvents and are adapted to the principles of green chemistry, we developed safer, scalable and cost-effective methodologies required for the implementation of MOFs in industrial applications. The duality of the proposed research will provide a step forward to **overcome the long-standing challenges** in this field that hinder the **commercialization of MOFs in water purification processes**.

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