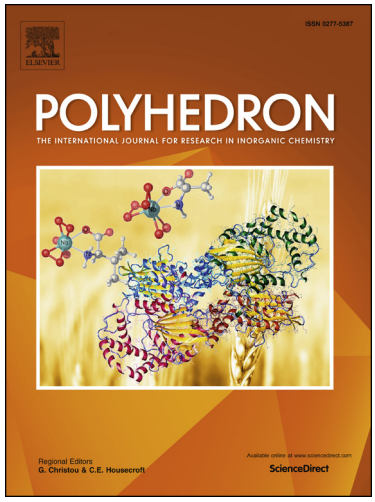

Synthesis, structure and magnetic studies of lanthanide metal-organic frameworks (Ln-MOFs): Aqueous phase highly selective sensors for picric acid as well as the arsenic ion

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Synthesis, structure and magnetic studies of lanthanide metal-organic frameworks (Ln-MOFs): Aqueous phase highly selective sensors for picric acid as well as the arsenic ion

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Abstract

A series of three lanthanide metal-organic frameworks (Ln-MOFs) consisting of a planar functionalized dicarboxylic acid was synthesized. The Ln-MOFs, with the composition $[Ln_3(PDC)_3Cl_3(H_2O)]_n$ [Ln= La (**1**), Nd (**2**) or Pr (**3**), $PDCH_2$ = pyridine-2,6-dicarboxylic acid], were characterized employing spectral, time resolved fluorescence, magnetic, single crystal X-ray and PXRD analysis. X-ray crystallography confirms that the structure of the Ln-MOFs is constructed by trinuclear (Ln_3) units and the deprotonated PDC^{2-} ligand, which is simplified into a 3-c, uninodal net having the vab topology with the 10^3-point symbol. The variable temperature magnetic susceptibility data indicate that there are antiferromagnetic interactions between $Ln^{III}\cdots Ln^{III}$ ions in **2** and **3** with Curie constants of 5.917 (**2**) and 5.231 (**3**) cm^3 K mol^{-1}, Weiss constants -60.71 (**2**) and -48.43 (**3**) K, and zJ' values -0.98 (**2**) and -0.31 (**3**) cm^{-1}. The 3D polymers **1**–**3** are characterized as being highly selective, sensitive and discriminative dual chemosensors for picric acid (PA) and the arsenite (AsO_3^{3-}) ion in aqueous medium. The sensing pathways were investigated by spectral titrations, time decay and DFT (B3LYP/def2–SVP) studies. The lowest detection limit has been discovered for the La analogue towards the sensing of both PA and AsO_3^{3-} {or As(III)} ions with ~0.22 and ~1.46 ppb, respectively. Such MOFs exhibiting bifunctional sensing behaviour for an