CONCLUSIONS
In the present endeavour zirconium phosphate (ZP) and a novel hybrid metal phosphonate zirconium hydroxy ethyldene diphosphonate (ZrHEDP) of the class of tma salt has been synthesized by sol gel method.

Based on physical, chemical and spectral methods of characterization, it is observed that both ZP and ZrHEDP are amorphous microporous materials possessing structural hydroxyl groups, the H⁺ of the OH groups being the cation exchange sites.

Both ZP and ZrHEDP exhibit good chemical resistivity (acid and organic solvent media) and thermal stability which are important characteristics for materials to behave as cation exchangers.

Based on kinetics and thermodynamics of exchange as well as adsorption isotherms studied, in general, it can be concluded that ZP and ZrHEDP can be used as cation exchangers.

ZP and ZrHEDP exhibit efficient selectivity for Pb(II), being 3800 mLg⁻¹ in case of ZP and 1760 mLg⁻¹ in case of ZrHEDP.

Efficient binary separations carried out using ZP and ZrHEDP indicate good potential for these materials to be used as cation exchangers.

Being cation exchange materials, both ZP and ZrHEDP exhibit good sorption for cationic dyes and medicinal dyes.

Both ZP and ZrHEDP also exhibit good elution behaviour. Due to presence of structural hydroxyl groups in ZP and ZrHEDP, the dyes are bound by hydrogen bonds or weak van der Waals forces, making sorption and desorption easy and possible.

The studies indicate ZP and ZrHEDP to be promising candidates for removal of dyes.