Municipal sludge as a water treatment solution

A part of sludge treatment by chemical and electro-chemical system

Sludge is considered as a byproduct from the wastewater treatment plants (WWTPs) containing certain chemicals, heavy metal, pathogen as well as nutrient. The safe disposal of this element becoming as the most emerging concern to the WWTPs. In many countries, traditional methods like landfilling, ocean dumping, incineration, conversion to fertilizer became restricted nowadays due to environmental concern [1]. Biomaterials application as adsorbent suggested a long before but lower surface area with sorption part limit its usage in large scale application [2]. Here, we tried to prepare sludge beads after Fenton and HCl treatment to remove REEs from aqueous solution.

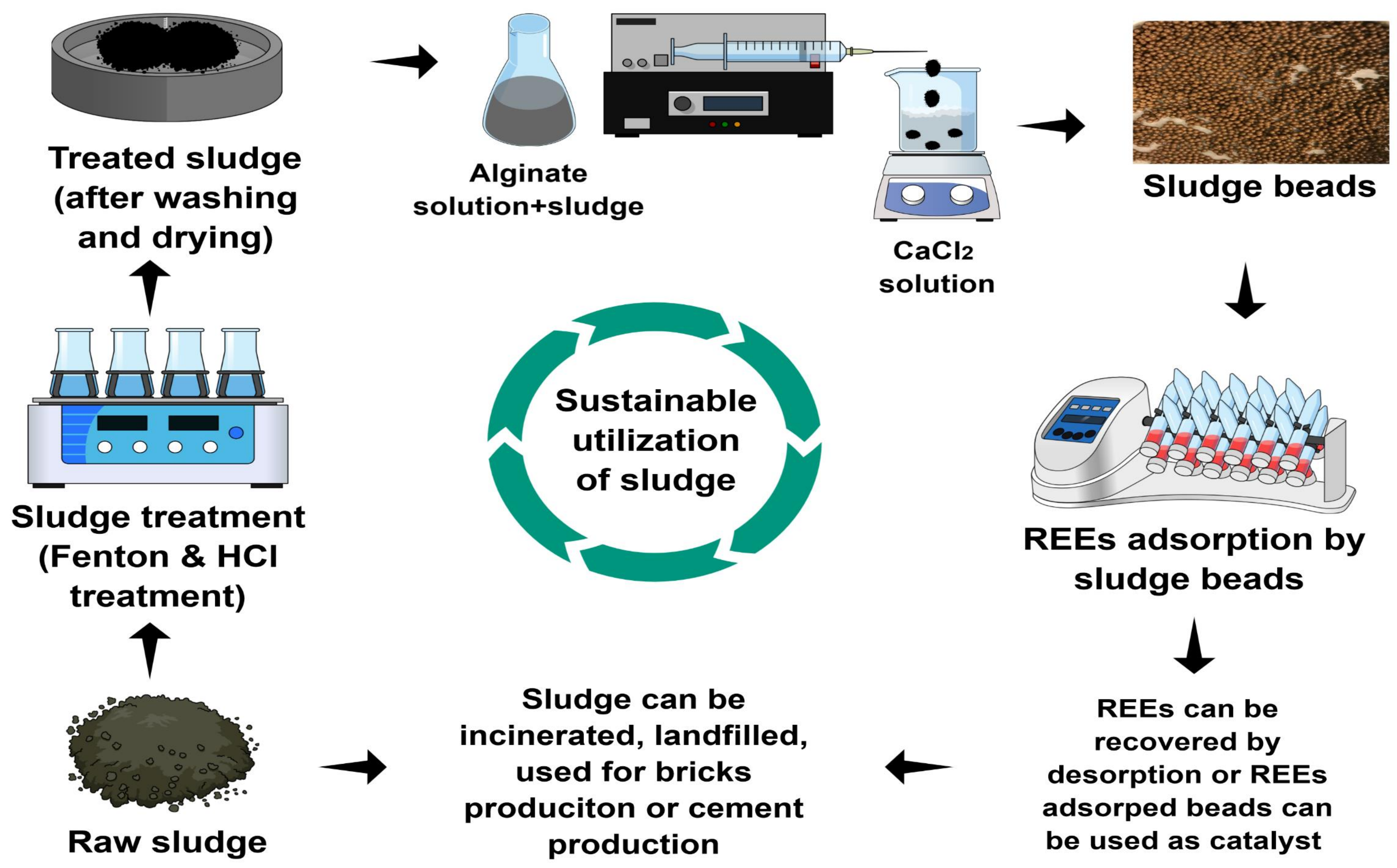

Fig. 1: Sludge beads preparation and disposal after REEs removal

Aim of the work and methodology

The adsorption capacity of sludge beads by REEs recovery from aqueous solution was investigated here. To enhance surface chemical modification and metal removal from sludge, acid activation (1M HCl) was used. In order to continue my previous work 'Sludge treatment by Fenton process (at pH 3, Fe^{2+}:H_2O_2=36mM:360mM)', I have also taken the Fenton treated sludge for beads preparation. Sludge beads were prepared by adding sodium alginate and pH, adsorbent dose checked for rare earth elements (REEs) removal from aqueous solution [3].

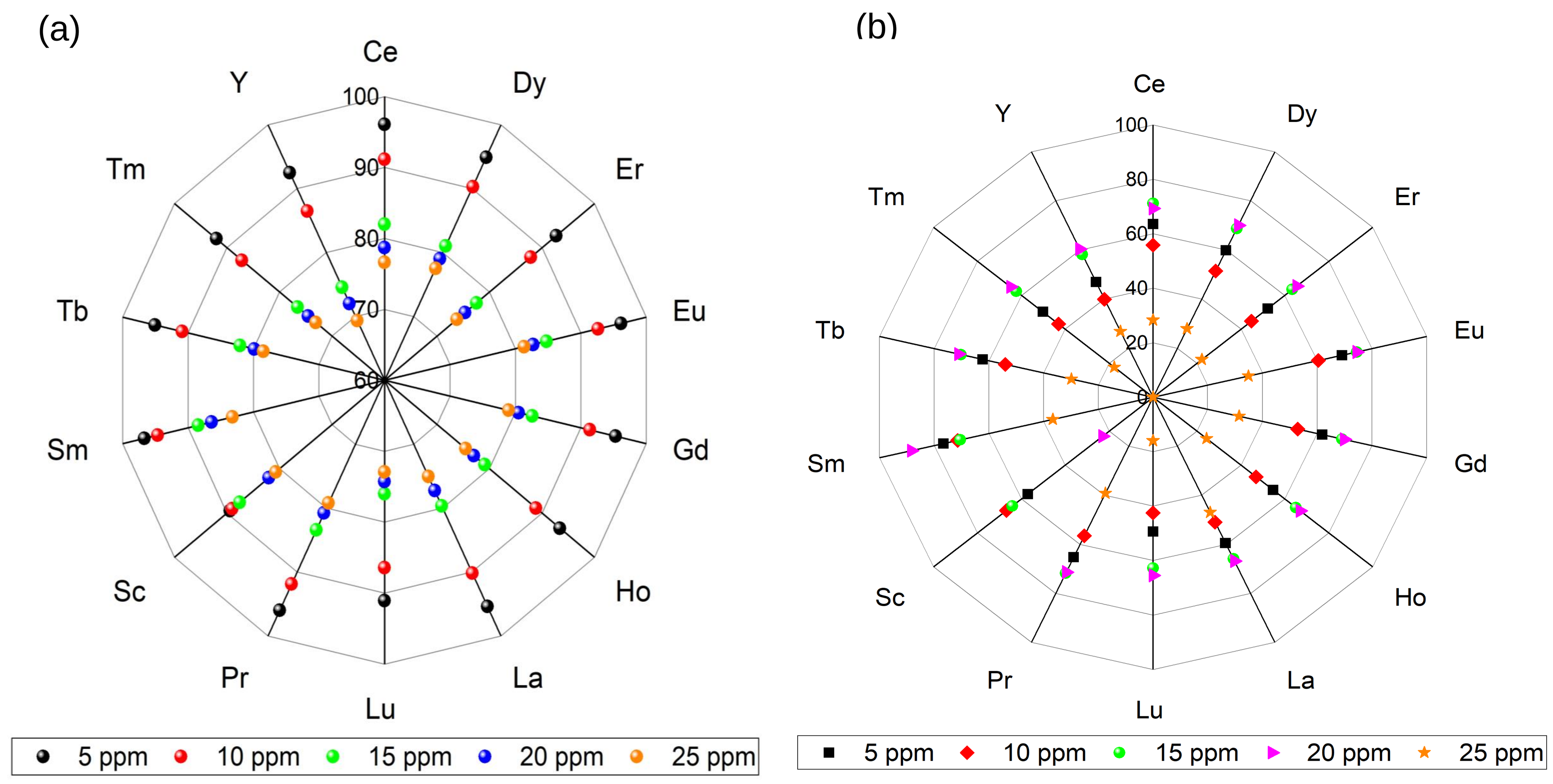

Fig. 2: (a). REEs removal by Fenton treated sludge at pH 5 (b). REEs removal by HCl treated sludge at pH 5

Discussion

Adsorption of rare earth elements (REEs containing seventeen elements including fifteen lanthanides plus Sc and Y) and recovery from wastewater has been considered as attractive and economically feasible in recent timing [4]. Effect of pH on the adsorption of different REEs were studied by HCl treated (HT) & Fenton treated (FT) sludge. Nearly 80% removal of REEs shown in Fig.2 (a) at pH 5 by FT sludge and 70% removal by HT sludge for 15 ppm of REEs. Moreover, digestion with lower pH can solubilize the available metal from the sludge by enhancing cell lysis and chemical breakdown of extracellular polymeric substances [5]. Even this digestion can work as activators to enhance adsorption by changing surface chemical properties [6]. So, sludge beads can also be alternatively used as REEs removal adsorbent from wastewater.

Future prospect

Adsorption process became popular due to low operational costs, high level of efficiency, and a minimal degree of toxicity or low-cost adsorbents [7]. REEs can be recovered by desorption from sludge or REEs loaded adsorbent can be also used as catalyst. Sludge can be disposed by landfilling, incineration or can be used bricks production else energy recovery [8]. REEs loaded adsorbent used for phenol or bisphenol demineralization and for even tetracycline degradation [9], [10], [11]. So, sludge adsorbent can be considered as a promising material by considering their reusability or converting waste to resources.

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