VIETNAM NATIONAL UNIVERSITY – HCMC
HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY

SOCIALIST REPUBLIC OF VIETNAM
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DISSERTATION INFORMATION

Thesis title:	***Research on utilizing natural alum-ferric water to synthesize dual-functional adsorption-ion exchange materials for water treatment***
Major:	**Environmental engineering**
Major code:	**62520320**
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Major Contributions of This Dissertation:

The natural iron alum water is considered a polluted water source and the main pollutants in natural iron alum waterare metals such as iron, aluminum, calcium and magnesium. These metals in water are considered toxins. However, the previous studies have shown the use of these metals to synthesize materials capable of treating phosphate in water. In which iron was used to synthesize a material capable of processing phosphate on anion exchange resin and the result was high activity and good mechanical durability. Besides, recent studies often create monofunctional adsorbent materials, which is a major disadvantage when compared with other materials and applied to actual wastewater treatment processes when considering in terms of cost and usable area. Therefore, this study uses metals in natural iron alum waterto synthesize dual-functional adsorption and ion exchange materials for water treatment.

The material was synthesized from iron and recovered metals with the name HIAO/225H, through material characteristics (FTIR, XRD and SEM) showed the formation of FeOOH on the surface of ion exchange resin, in addition to the presence of Al, Ca and Mg in the material. The equilibrium adsorption time was determined to be 50 hours, pH 6, dosage 10

g/L and HCO_3^- ion had the most impact on the adsorption capacity of the material. HIAO/225H material shows about 1.4 times higher phosphate adsorption efficiency than FeOOH/225H material. This study shows that the presence of Ca and Mg in the material has improved the adsorption efficiency through the formation of many FeOOH groups on the surface of the material. On the other hand, the presence of Ca and Mg cations in the solution increases the phosphate adsorption capacity by 1.2 times from 1.52 mg/g to 1.825 mg/g, the processing capacity of material HIAO/225H (26.825 mg/g) compared to ion exchange resin (cation and anion) MB6SR (12.7 mg/g), this has shown that the functional material HIAO/225H has better treatment efficiency than the ion exchange resin MB6SR on the market. Besides, the adsorption process can shorten the adsorption time from 50 hours to 3.5 hours by applying stirring at 150 rpm. When comparing the adsorption efficiency of both wastewater, domestic wastewater and seafood processing wastewater, HIAO/225H showed effective phosphate removal and met wastewater discharge standards. In which, the results showed that the adsorption capacity of HIAO/225H material is better than the popular material on the market, activated carbon. And the ability to handle hardness (ion exchange) is better than bifunctional materials on the market (MB6SR). In addition, the ability to regenerate after 10 times was also tested and the results showed that the material still had 80% of its treatment efficiency compared to the original.

Overall, this thesis used metals in natural iron alum water to create a new dual-functional adsorption-ion exchange material through the precipitation method. This material has shown the ability to simultaneously treat both phosphate anions and Ca^{2+} and Mg^{2+} cations and can be applied to wastewaters containing these components at the same time with better treatment efficiency than commercially available monofunctional materials and ion exchange resin (cation and anion) MB6SR, contributing to reducing costs for wastewater treatment and minimizing environmental pollution.

Advisors		**PhD Student**
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