Tailoring Nano Adsorbent Surface For Recycling of Rare Earth Based Magnets

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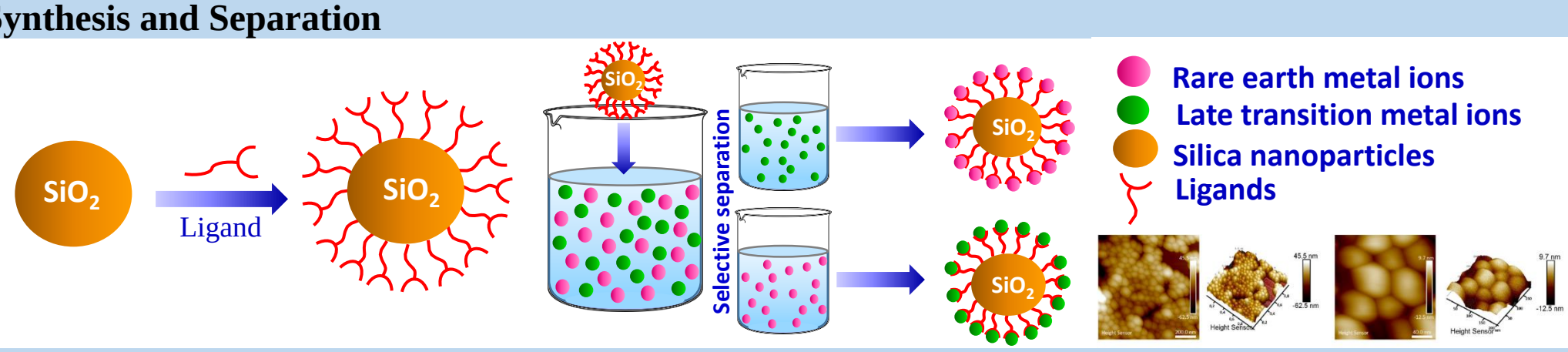
Background

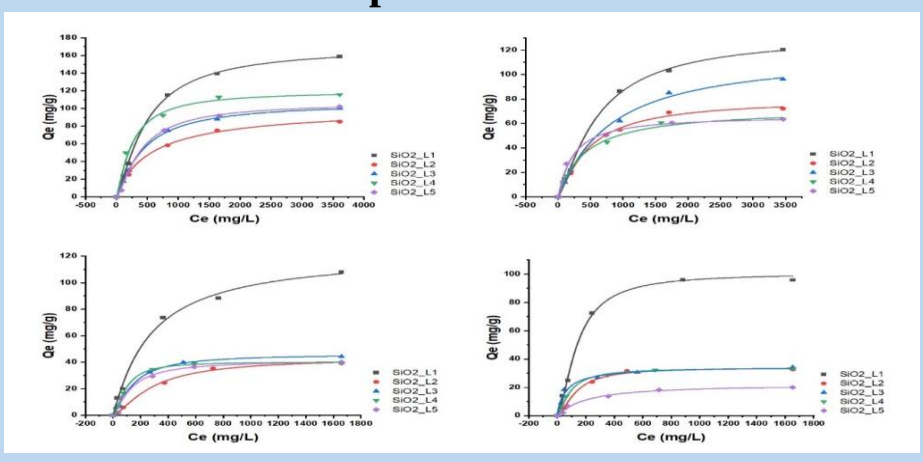
Novel silica based adsorbents were synthesized by grafting the surface of SiO_2 nanoparticles with amine and sulfur containing functional groups. Produced nanomaterials were characterized and tested for adsorption and separation of rare earth elements (REE) (Nd^{3+} and Sm^{3+}) and late transition metals (LTM) (Ni^{2+} and Co^{2+}) in single and mixed solutions.

Synthesis and Separation



Results and discussion

Adsorption Isotherms



Adsorption Kinetics

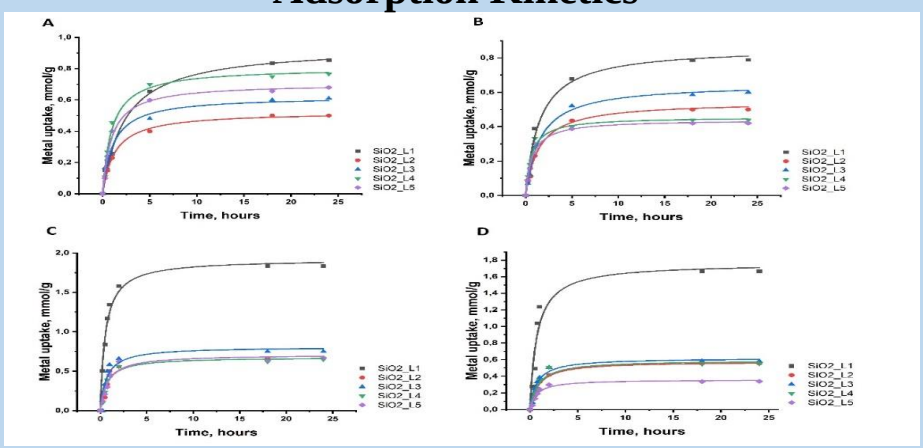
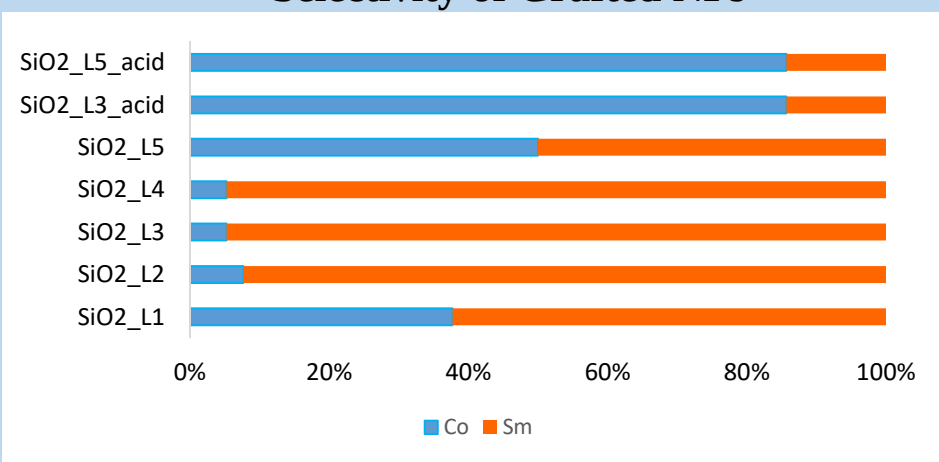


Figure 1. Adsorption isotherms and kinetics of REE and LTM onto grafted SiO_2 NPs

Selectivity of Grafted NPs



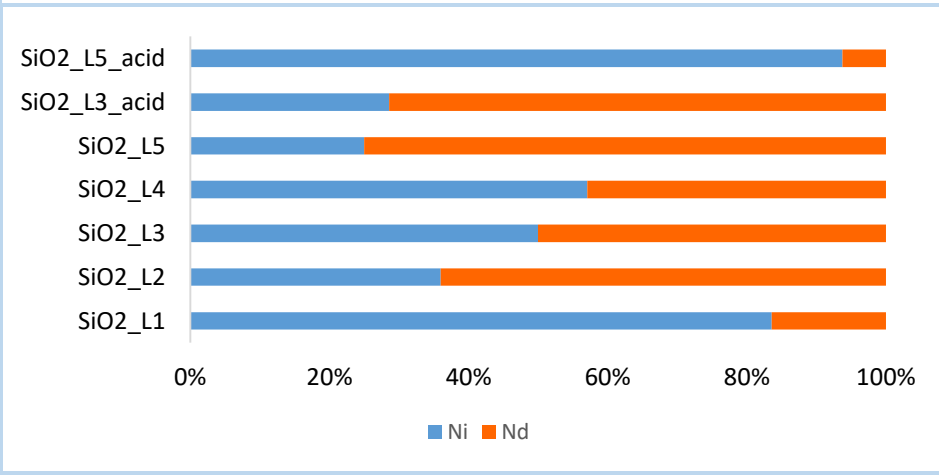


Figure 2. Molar ratios of Co and Ni against Sm and Nd by EDS analysis

Conclusions

- Grafted SiO_2 nano sorbents showed high adsorption capacities ranging from 0.5 – 1.8mmole/g for different metal ions.
- The selectivity tests demonstrated higher affinity towards REE, however denser functionalized NPs showed a shift towards LTM.

Acknowledgments

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