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Organo-functionalized Silica with High Selectivity for Vanadium Adsorption

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In recent decades, economic and industrial growth has led to water contamination from potentially toxic metal ions, creating a global environmental issue. Vanadium is a newly recognized contaminant found in wastewater as a result of expanded mining, smelting, vanadium ore recovery, as well as its use in various industries. Extracting and recovering this metal is considered an important strategy [1]. Therefore, this work focuses on developing chemical systems to create new materials with high specificity for capturing and recovering metal ions from wastewater. Hence, a polyhedral oligomeric silsesquioxane (POSS) was synthesized and functionalized with the molecule 2-(((pyridin-2-ylmethyl)amino)methyl)phenol. The organic molecule was characterized using infrared (FTIR) and ^{1}H and ^{13}C nuclear magnetic resonance (NMR) spectroscopies. POSS was characterized by FTIR, solid-state ^{13}C and ^{29}Si NMR spectroscopy, elemental analysis of carbon, hydrogen, and nitrogen (CHN), and thermogravimetric analysis (TGA). The analyses confirmed the successful synthesis of the ligand and POSS. The POSS has a degree of functionalization of 2.09 mmol/g of silica. The adsorption capacity, in percentage, of cobalt, nickel, copper, zinc, lead, aluminum, manganese, vanadium, chromium, arsenic, beryllium, selenium, cadmium, barium and uranium by POSS was evaluated (Fig. 1). The multi-element solution (~5 ppm) was exposed to POSS (10 mg) in batch for 24 h. According to Fig. 1, POSS showed higher selectivity for vanadium adsorption than other elements. Almost total adsorption (99%) of V *vs* around 19% of Cu, 7% of Pb and U, and 1% of Be. There was no adsorption of other elements.

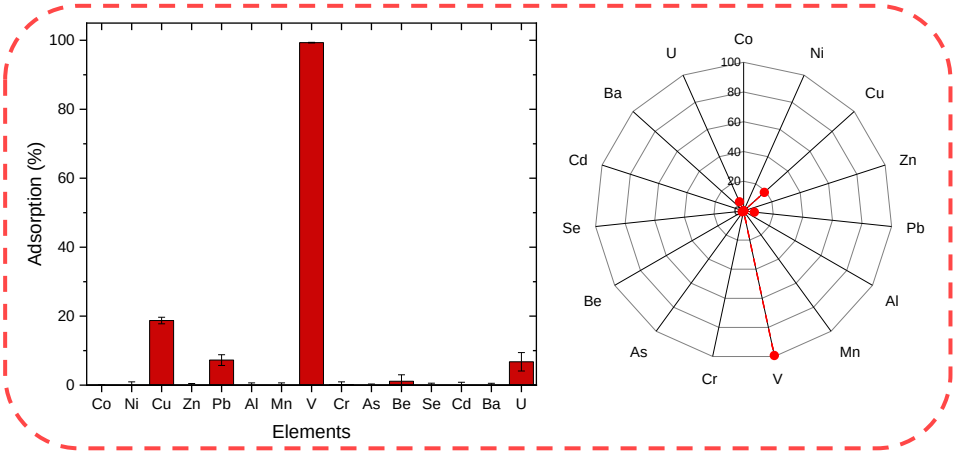

Figure 1. Adsorption by the POSS of different metal ions contained in a multi-element solution.

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References

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