Chemical remediation: Squaramide Magnetic Iron Nanoparticles for Removal of Toxic Metals ions in Water

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Elimination of toxic heavy and transition metal ions, such as: Hg^{2+}, Pb^{2+}, Cd^{2+}, Cr^{3+} and its compounds in the environment is of great interest because of their high toxicity. For example, Pb^{2+} ion can affect almost every organ and system in the human body, particularly in children, causing various symptoms such as anemia, kidney damage, and a disorder of the blood, memory loss, muscle paralysis, and mental retardation by lead poisoning. [1] Also, there are many reports on the toxicity of Cd^{2+} to procreation, bones, kidneys, nerve system, and tissues, consequently resulting in renal dysfunction, calcium metabolism disorders, and an increased incidence of certain forms of cancers. [2].
Especially in this regard, the Hg^{2+} ion is considered highly dangerous because both elemental and ionic mercury can be converted into methyl mercury by bacteria in the environment, which subsequently bio accumulates through the food chain. [3]

The iron nanoparticles were synthesized as described by Sun.[4] Here we report a simple approach to conjugate monodisperse Fe_3O_4 nanoparticles with a squaramide-dopamine unit.

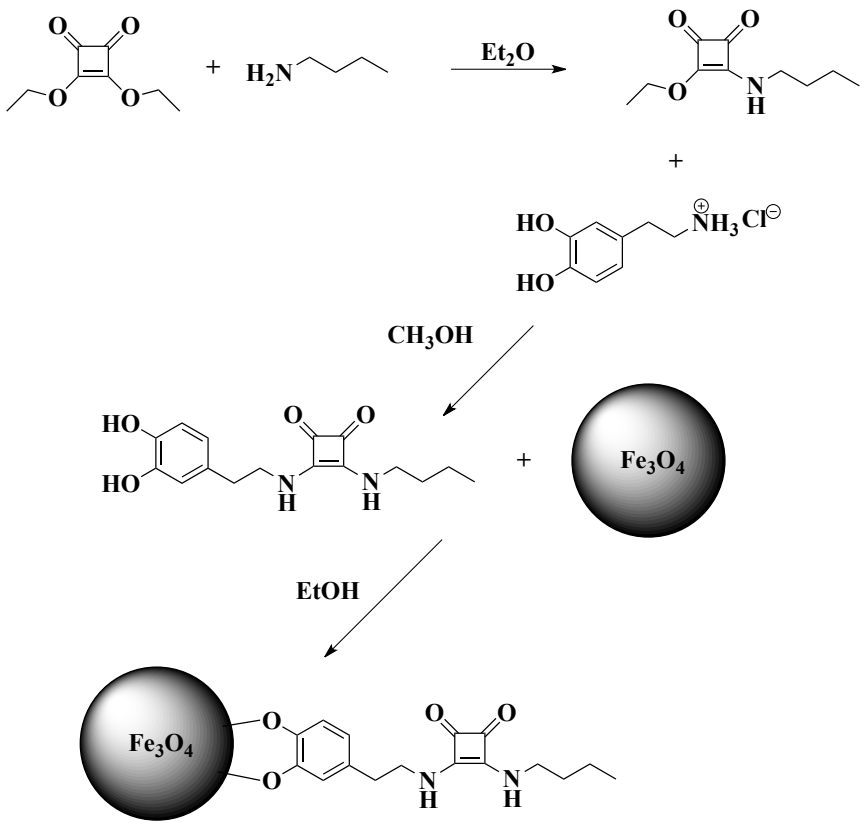

Figure 1. Preparation of Squaramide Iron-Nanoparticles (NPSq)

Our results, see Figure 2, show that hybrid squaramide magnetic iron nanoparticles (NPSq) remove from a water solution of a heavy toxic metals ions, the 99% of Pb^{2+}, 92% of Hg^{2+}, 87% of Cr^{3+} and 85% of Cd^{2+}. However, the Fe_3O_4 nanoparticles (NP), without functionalization, only remove 28% of Pb^{2+}, 31% of a Hg^{2+}, 6% of a Cr^{3+} and less than 1% of Cd^{2+}.

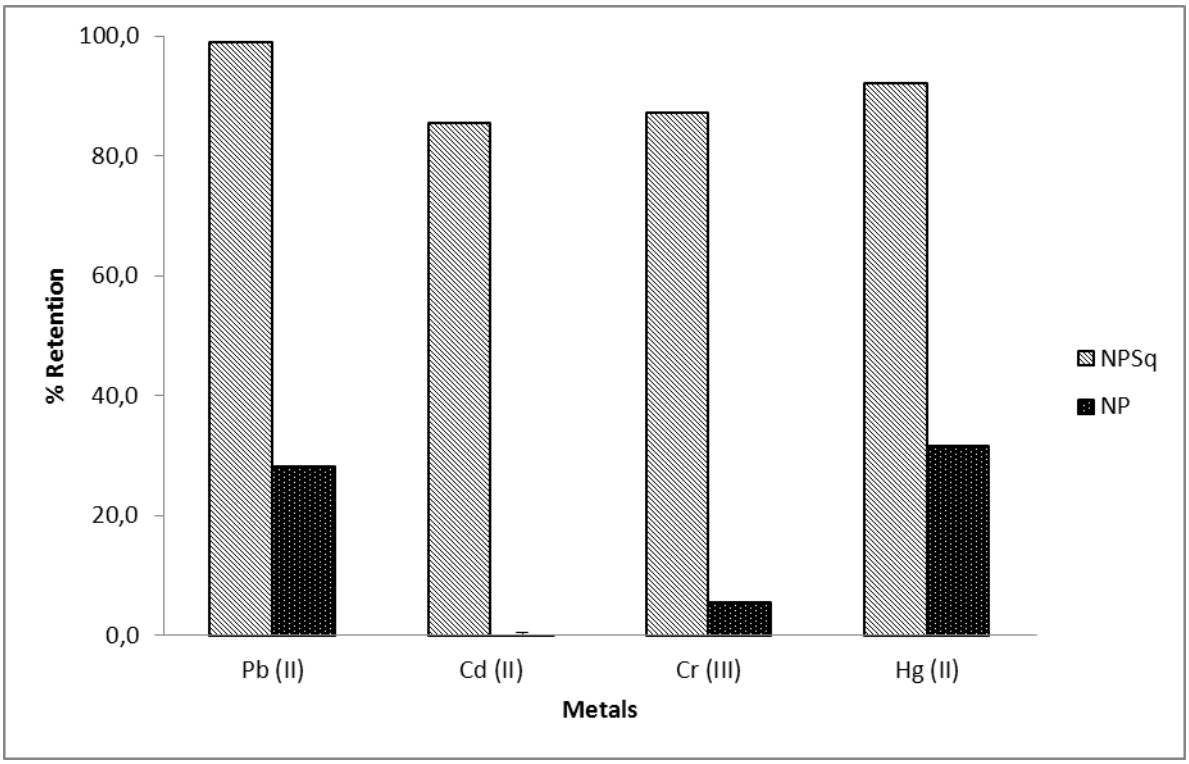

Figure 2: Metals ions retention by Squaramide Iron-Nanoparticles (NPSq) and iron-nanoparticles (NP).

References

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