Efficiency of Different Organic Surfactants on Nitrate Adsorption in Water

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Organoclays are modified clays in which the natural inorganic interlayer cations are replaced by organic cations. The net amount of organic cations adsorbed to the clay can exceed the cation exchange capacity of the clay, thus providing binding sites for exchangeable anions. Therefore, organic surfactants are efficient in the treatment of contaminated water. Here a review has been carried out to understand the efficiency of various organic surfactants, viz. hexadecyl trimethylammonium, hexadecyl pyridinium and benzethonium on nitrate reduction in drinking water. This study revealed that hexadecyl pyridinium are more efficient to remove nitrate in drinking water than other organic surfactants.

Keywords: Organic surfactant, Modified clay, Nitrate adsorption, Cation exchange capacity.

INTRODUCTION

Silicate layers stacked on one another are the main structure of clay minerals1. High cation exchange capacity (CEC), swelling capacity, high specific surface area and consequentially strong adsorption capacity are the most important characteristics of clay minerals which are widely used in different applications1-4. One of the major applications of clay minerals in water resources is contaminants adsorption in aqueous solution. Clay minerals have tendency to adsorb organic molecules, change to organoclay and create new materials1,5. Adsorbents of organic pollutants in soil, water and air, paints, cosmetics, refractory varnish, etc. are some applications of organoclay6-8. Organoclay are modified clays in which the natural inorganic interlayer cations are replaced by organic cations. The net amount of organic cations adsorbed to the clay can exceed the cation exchange capacity of the clay and provide binding sites for exchangeable anions8. High anion exchange capacity has made the organoclay being researched as adsorbents for anionic contaminats in environmental applications9,10. A number of research reported the modified clay minerals or organoclays are the most significant pollutants adsorption9,11,14,17.

Due to easy availability and comparatively less cost the clay minerals and their modified forms have received wide attention in recent years as adsorbents of pollutant from aqueous medium. A short review has been carried out in this article on different organic surfactants to assess their efficiency in removal of nitrate in aqueous media. For this purpose, performance of various organics modifier such as hexadecyl pyridinium (HDPy), hexadecyl trimethylammonium (HDTMA) and benzethonium (BE) in particular, are reviewed. It is expected that the study will give a clear view on recent development of organic surfactants and their efficiency in removal of nitrate in water.

Modified clay as absorbents: Various clay minerals viz. sodium-montmorillonite, bentonite, kaolinite, halloysite and zinc-smectite are reviewed in this article as nitrate absorbant. Montmorillonite, bentonite and smectite belong to montmorillonite group. It has a 2:1 layer structure as shown in Fig. 1a, composed of units made up of two silica tetrahedral sheets with a central alumina octahedral sheet. The tetrahedral and octahedral sheets combine in such a way that the tips of the tetrahedral of each silica sheet and one of the hydroxyl layers of the octahedral sheet form a common layer. These are the clay minerals with substantial isomorphic substitution. The exchangeable cations in layers of montmorillonite balance the negative charges generated by the isomorphic substitution18. Kaolinite is a 1:1 layer mineral (Fig. 1b) which a product of advanced weathering processes. One layer of the mineral