Proposal and problem statement

ASSIGN BUSTER

The paper " How Anion-Exchange Water Softer Works and What Is the Industrial Benefit of Separating Co from Ni?" is a wonderful example of an assignment on formal science and physical science. 1. Briefly explain what clay and a zeolite represent and provide 2 key journal references for each. (3 pts) Clay refers to materials with a particle size of about less than 2 micrometers and belongs to the family of minerals which has the same chemical compositions and crystal structural properties (Velde, 1995). Clays may represent most mixtures of finer-grained minerals and clay-sized crystals of other minerals such as quartz, carbonate, and metal oxides. Clays are usually found in most part or near the earth’s surface. Clay minerals are known for its great affinity for water, have the increased ability to soak up ions or the electrically charged atoms and molecules derived from a solution and liberate the ions afterward when conditions change. Clays can be a major vehicle for transporting as well as dispersing contaminants from one region to another.

Zeolite, on the other hand, represents one of a family of materials which is known as molecular sieves. It is usually used in industry to catalyze very significant reactions, to store, break up gases, and to remove contaminants. This product also called the sodium aluminum silicate, is a chemical found in minerals which have been lately used as a builder in detergent powders as well as tablets, intended for water softening for the consumers’ washing process. Doyle, Byrick, Filipovic, and Cashin (2002) verified that silica zeolite was effective at completely removing 1% isoflurane from exhaled, humidified gas containing CO2 under simulated operating room conditions for 6. 5 hr. These data support Janchen’s conclusions from a clinical study, in which 62–86% of delivered desflurane was absorbed by a silica zeolite. According to

experts, it does not create a risk to the environment based on their assessments through the application of the margin of exposure or equivalent measures.

2. Briefly explain how anion-exchange water softer works. (3 pts)

Lyn and Lavinder (2000) say anion exchange system can be used as an additive treatment mechanism to the current readily available lime softening water treatment plant. The anion exchange process is applied by using raw water as well as lime-filtered lime-softened water. The anion exchange resin effectively removes color and show evidenced by the ability to trim down the HAA formation potential. It makes settled watercolor to decrease from approximately 25 to 30 color units reaching less than 1 color unit. In addition, the raw watercolor also has been decreased from about 70 color units until less than 5 color units. Similarly, haloacetic acid formation potential can be decreased in the raw water about an average of 173 mg/L reaching to less than 20 mg/L, also the total organic carbon (TOC) decreases from 11 mg/L to 1. 1 mg/L.

3. What is the industrial benefit of separating Co from Ni? (4 pts)

The United States and several countries of Europe have increased support in designing materials able to general vast quantity of nickel with least or absent with radioactive materials. Cited by El-Azzami, et. al (2007) an estimated amount of several contaminated nickels could be quantified in about 44, 794 tons. Efforts have been focused into various processes for the recovery of Ni in a more economical and efficient means for the refinement and decontamination of metals against nuclear facilities. Thus, industries will

benefit by attaining a green, friendly environment, production of cost-effective as well as less to nonhazardous products, help recovery economy and promoting the health of their consumers, and significant improvement in nickel purity. Ni can selectively be stripped by an organic oxide from an acidic solution of Ni & Cu.

4. Explain how EDTA would coordinate to Co (II). How would this complex be characterized? (2 pts)

Co is an indispensable nutrient for numerous organisms (it is cyanocobalamin or vitamin B12 metal cofactor); conversely, at higher levels, it can also be toxic (Barceloux, 1999; 201-206). Also, in nature cobalt occur in two stable oxidation conditions: Co(II), the soluble one, and Co(III), relatively insoluble or as organic complexes. Note that when EDTA is poured to an aqueous solution of cobalt (II) ion, the stability of the chelate complex is formed. These Chelate reactions are entropy-driven: meaning, the entropy change is positive.

5. Propose a geometry for an EDTA complex of Ni (II). Explain why you choose such geometry and provide some spectroscopic techniques to characterize this complex. (3 pts)

Perhaps it would good to investigate the effects of time or aging on the association of Ni or its stability to other metals like aluminum, talc, silica, and other the mixture which can possibly create reactions or changes in the material itself of to other entity which were exposed to it. The metal’s aging in relation to its stability can be studied taking account the number of years; about 1-5 years of material usage. The study can be treated using

radiometer pH-stat titrator, dissolution techniques or spectrophotometry.

6. Explain what the role of HCI is when you wash the resin. (l pt)
An organic resin consists of “ high-molecular-weight polyelectrolytes” that can replace their ions for ions of related charge starting the surrounding medium. Resins can be generally classified as weak or strong acid cation exchangers; strong or weak base anion exchangers. The strong acid resins have their chemical behavior which is parallel to a strong acid. HCl facilitates in the regeneration process in resin. It tends to increase the efficiency of resin in terms of resin capacity for the elimination of that ion out of the solution.

7. Concisely explain how the Ni(II) and Co(II) are separated using the resin and various concentrations of HCl. Take into consideration the following questions: Why does cobalt stick to the resin and not Ni(II)? Why does Co(II) come off the resin at lower HCI concentrations? What is the role of the sulfonic acid groups attached to the polymer and resin? (4 pts).
Different techniques have been studied for the removal of metal ions such as Ni(II) and Co(II) solvent extraction, precipitation, and ion exchange. The resins have been extensively applied as ion exchangers for diverse metal ions in dissimilar environmental and manufacturing areas. These resins show advanced selectivity. The classic regeneration process necessitates about 100 gallons of water in every cu ft of resin. The ion-exchange method is optimized to the quantity of water processed for the period of the service cycle. Calculations follow (da Silva & Gottlieb, 2008). Majority of plating procedures, water is used to wash the surface of the various parts after each

process bath. The overflow water is added to remove heavy metals. Metals basically ionized in water and it can be removed by the application with ion exchange resins. The resins can switch hydrogen ions (H+) for the ions which are positively charged. The resin is selective since depending on a given ion which is measured accordingly by the selectivity coefficient K, which in its simplest form for the reaction.

Chelating resin has selectively sorb Co (II) as of strongly acidic media creating an ideal acidic plating bath, in some solutions containing very elevated chloride concentrations such as HCl, cobalt can be captured, through the removal of cobalt from organic solvents is reasonably widespread using powerful acid cation resins. Moreover, weakly acidic cation exchange resins are time and again quite selective for multivalent ions like Co (II).