Effectiveness of soap and shampoo in hard water

Literature Review

According to Soap and Detergent Association of Canada [SDAP] (n. d.), soap is an effective cleansing agent, but its effectiveness reduced when used in hard water which has contaminations like calcium, magnesium, iron and manganese. These mineral salts will react with soap to form insoluble salt known as scum or soap film. For detergent, it is effective to cleanse in hard water and soft water due to it has more surfactants (SPAD, n. d.). For shampoo, it is still work in hard water and soft water. It is less effectively as detergent, but its effectiveness is stronger than soap. The shampoo lessens the ability of shampoo to later in hard water. To increase the effectiveness of soap and shampoo in hard water , the lime softening , Zeolite Base Exchange softening process, distillation reverse-osmosis softening, and electrolysis are introduced (Mountain Empire Community College, n. d.).

For the lime softening, the addition of lime until pH 10 to 10. 5 in order to change magnesium and calcium change into calcium carbonate and magnesium hydroxide. (Mountain Empire Community College, n. d.). The addition of lime and carbon dioxide to produce water and calcium carbonate, which uses in next step. The lime reacts with calcium bicarbonate will form water and calcium carbonate that forms white precipitate out of the solution. Magnesium bicarbonate react with lime will form calcium carbonate, magnesium carbonate and water. The magnesium carbonate reacts with excess of lime to form calcium carbonate and magnesium hydroxide which can be precipitate out from water. The high concentration of calcium carbonate and lime which increase the pH of water will corrode the steel pipes. The recarbonation can lower the pH of water, but it can react with

calcium carbonate and drawback to calcium bicarbonate. The addition of acids like sulfuric acid and hydrochloric acid can be reduced the pH of water.

Zeolite Base Exchange softening process can be known as ion exchange softening. The raw water passes through a filter that contains resin granules to exchange the ions that cause hardness like magnesium and calcium to sodium. For this, it does not need flash mixer, flocculation basin and sedimentation basin for lime softening. The calcium, magnesium and other metals are replaced by sodium ions which cause problem for those who cannot consume too much salt. When the zeolite bed becomes saturated with calcium, magnesium and other metals, it can be regenerated by washing with brine solution which can cause disposal problem.

For the reverse-osmosis softening, the water is pulled into a semi permeable membrane (Mountain Empire Community College, n. d.). The calcium and magnesium and other metals cannot pass through it and capture at the side of semi permeable membrane (Mountain Empire Community College, n. d.). The morphology of membrane has lower wall thickness and a larger size of pore resulted in the higher yields (Li, 2011). The process efficiency increases due to the increasing both feed flow rate and temperature increases the permeate flux simultaneously (Li, 2011). The higher flow rates also achieved heat losses by conduction, which decreases the thermal efficiency (Li, 2011). This efficiency also reduces when the salt concentration in the feed was achieved (Li, 2011). The influence of magnesium, calcium, stain and other metals on the process efficiency was considered (Li, 2011).

Electrodialysis is the water passes between two plates with positive and negative electrical charge which the positive charge terminal attracts non-metal and negative terminal attracts metals.

Introduction

Soap, shampoo and detergent are important in life to cleanse our body and clothes by killed disease and dirts. Soap is made up of saturated fat from animals' oil or vegetable salt. Detergent is included from synthetic ingredients. Shampoo is made up of soap or detergent's compounds. The surfactants are important for cleaning compound and reduce the surface tension of water or solid to increase the wetting ability of water when it used in low concentration (Allan & Campbell, n. d.). There are 4 types of surfactant which are anionic, cationic, amphoteric, and nonionic (Wolf et al., n. d.). The anionic hydrophilic are carboxylates, sulphates, sulphonates and phosphates which are negative charge that need alkaline or basic materials to neutralize them (Wolf et al., n. d.). The cationic surfactants are some form of amine product which is positive charge and need acid to neutralise it (Wolf et al., n. d.). The amphoterics surfactants have negative and positive charges which can react with acid and alkaline (Wolf et al., n. d.). Nonionics have no charged components, but it connected to water at ether oxygen of a polyethylene glycol link (Wolf et al., n. d.). The hydrophilic at end of surfactant is strongly attracted or dissolved in water because it forms hydrogen bond and electrostatic force with water (Wolf et al., n. d.). The force of attraction between hydrophobic and water is slight and dissolved in organic substances because it forms dispersion force which it do not have freely moving ions (Wolf et al., n. d.). In order to balance for the lost of

entropy, the water molecules force the hydrophobic molecule to cluster together and occupy minimum of space (Bhairi, 2007). The repulsion and attraction between hydrophobic, hydrophilic and water caused hydrophilic moving toward the water and hydrophobic is squeezed away from water (Wolf et al., n. d.). This phenomenon is known as hydrophobic effect and hydrophobic tails are called hydrophobic interactions (Bhairi, 2007). In this experiment, we will determine the effectiveness of shampoo, soap and detergent in different of medium.

References

Allan & Campbell. (n. d.). Surfactants: *Surface active agents* . Retrieved fromhttp://www. chemistry. co. nz/surfactants. htm

Wolf, R., Davidovici, B., Israel, R., Parish, L. C., Philadelphia (n. d.). *Soaps, detergents and shampoos* . Retrieved fromhttp://www. google. com/url? sa= t&rct= j&q=&esrc= s&source= web&cd= 9&cad= rja&ved= 0CHYQFjAI&url= http://www. iacdworld. org/101/soaps. pdf&ei= PYsJU9CGCOWQigevkIHoAw&usg= AFQjCNGouNpt5nGf8eMaIYatn21bMwPRtA&sig2= S4PJOSnIqxaeL9VoyTlnaw&bvm= bv. 61725948, d. aGc

Bhairi, S. (2007). *Detergent: A guide to the properties and uses of detergents in biology and biochemistry* . Retrieved fromhttp://www. google. com/url? sa= t&rct= j&q=&esrc= s&source= web&cd= 9&cad= rja&ved= 0CHYQFjAI&url= http://www. iacdworld. org/101/soaps. pdf&ei= PYsJU9CGCOWQigevkIHoAw&usg=

AFQjCNGouNpt5nGf8eMalYatn21bMwPRtA&sig2=
S4PJOSnIqxaeL9VoyTlnaw&bvm= bv. 61725948, d. aGc

Soap and Detergent Association of Canada [SPAD] (n. d.). *Soap and detergent* . Retrieved fromhttp://www. healthycleaning101. org/english/SDAC_soaps. html

Mountain Empire Community College (n. d.). *Softening* . Retrieved fromhttp://water. me. vccs. edu/courses/ENV115/lesson9. htm

Li, J. (2011). Computer-Aided Design, Modeling and Simulation of a New Solar Still Design. *Modeling & Simulation in Engineering* , *2011* (1-5). doi: 10. 1155/2011/903721