1. Introduction

Albemarle is one of the major companies which provide top-performance catalysts to petrochemical industries. In the manufacturing process, alumina is used in different flavors as support for catalysts. Catalyst based on alumina carrier has been produced in huge amount in HPC plant by using precipitation method. In chemical industries such as Albemarle, the common process of the catalyst production begins with the synthesis of particles in liquid and finish with thermal drying. The first step is mixing aluminum sulfate, sodium aluminate, sodium silicate or water glass, and water in a CSTR to get the alumina slurry. This process is called precipitation process. Afterwards, the slurry will be washed and filtrated to get clean alumina cakes. Furthermore, the cake is shaped, calcined to 800^{o}C to form gamma-alumina (γ-Al_2O_3) and then γ-Al_2O_3 is impregnated with the sol to make the final product catalyst.

In the precipitation process, the alumina is contaminated with sodium (Na^+) and sulfates (SO_4^{2-}) ions which are familiar as salts. Unfortunately, it has a negative influence in catalytic system and has to be removed. Salts removal can be done by washing the slurry or cakes by displacing the mother liquor containing salts by the wash water containing less concentration of these salts [1]. Thus, the concentration of the salts will be reduced by the addition of the wash water. The current process which is applied in Albemarle to wash the alumina cakes is using two drum filters with microfilament filter cloth. The process occurs in three steps; slurry is washed by wash water using a drum filter, the obtained cake is mixed with clean water and nitric acid in a reactor, and the slurry is washed for the second times using a drum filter. Unfortunately, the disadvantage of this process is necessary to provide wash water in huge amount.

In this project, a new salt washing method will be presented with the main purpose of reduce the wash water amount. This project begins with the study on theoretical background of catalyst production, salt washing, and cake washing process. Afterwards, a new salts adsorption model is established based on the theoretical background. The experiments are performed in three different temperatures to get the experimental data. Moreover, using the salts adsorption model, we fit the experimental data and determine the parameters using experimental and calculated data. In the end, a continuous stirred tank washing is used to show the applicability of the model based on the parameters.

2. Objective

2.1 General

- Optimize the washing process by reducing the wash water use in the washing process.

2.2 Specific

- Determine experimentally the adsorption amounts of Na^+ and SO_4^{2-} on alumina, as function of pH, temperature, ions concentration.
- Correlate the experiment data and develop an adsorption model for Na^+ and SO_4^{2-} ions on boehmite.
- Develop a CSTW model for washing process using the parameters from measured data.

3. Research question

- Which adsorption model that is used to determine the Na^+ and SO_4^{2-} amount adsorbed on the boehmite?
- What are the parameters of adsorption model?