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Potential use of coconut husk-based magnetic sorbent for defoaming application

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ABSTRACT

Absorption process is the most common method that is being applied to sweeten sour gas in the oil and gas industry. However, this process does have several consequences which will trigger the foam formation of foam that will reduce the mass transfer efficiency and absorption capacity as well as amine solutions carryover to the downstream processes. The removal of undesired contaminants in activated methyldiethanolamine (MDEA) was conducted by utilizing magnetic activated carbon (MAC). In this work, MAC was synthesized from coconut husk through chemical activation and co-precipitation methods. The performance of this material as an adsorbent was evaluated based on the foaming behaviour of activated MDEA solvent after being contacted with MAC at different duration and varying amounts. Nitrogen gas was introduced into the solvent through a gas diffuser to create foam. Based on the results, the foam volume generated by activated MDEA solvent was identified to decrease with the increase in both MAC contact time and amount. The highest removal efficiency by MAC was identified to be at 1 h contact time between MAC and activated MDEA solvent where the foam breaking time was reduced to 10–30 min. Meanwhile, the addition of 50 % MAC into the solvent was able to further decrease the foam breaking time to 5–10 min. The characteristics of the prepared MAC were evaluated through various instrumental analyses. This study shows that the MAC synthesized from coconut husk has a good potential as an adsorbent in removing the contaminants in activated MDEA solvent to reduce foam formation.

1. Introduction

The natural gas sources which being extracted vertically from Earth's surface are usually contaminated with several components like carbon dioxide (CO_2) and hydrogen sulfide (H_2S). The presence of these components causes the natural gas stream to become a sour gas. Thus, the removal process of these components is crucial to reduce the negative impacts on the environment. According to [1], the alkanolamine-based absorption process is the most common process that is utilized in the natural gas refining process to remove the acid gas content. This is due to the ability of the alkanolamines that have a high absorption capacity on these gases. Example of alkanolamines which typically used to stimulate the acid gas removal process is methyldiethanolamine (MDEA), monoethanolamine (MEA) and diethanolamine (DEA) [2]. This absorption process is conducted by scrubbing the natural gas with the liquid solvent to selectively remove the acid gases from the process stream through the physical or chemical bond. At present, activated MDEA solvent is preferable to other amines solvents as it has high resistivity towards thermal and oxidative degradation under the common amine treating unit operating conditions [3].

Some drawbacks are encountered through the utilization of alkanolamine solution to remove acid gas content which then gives rise to the occurrences of operational problems in a production plant. One of the issues which usually occurred is a foaming problem. The formation of foam in amine treating units is generally influenced by the presence of undesired contaminants like condensed hydrocarbons, organic acid anions, metal ions, water contaminants and amine degradation products [4]. Due to this, the absorption capacity of the amine solution is reduced and the mass transfer area, as well as productivity, also decreases [5]. Thus, some suitable approaches are carried out by the oil and gas

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