OMICS International
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J Pet Environ Engineering 2015, 6:5
http://dx.doi.org/10.4172/2157-7463.C1.014

International Conference and Expo on
Oil and Gas
November 16-18, 2015 Dubai, UAE

Absorption or stripping of CO_2 using polymeric PVDF hollow fiber membrane contacting process

Nayef Ghasem, Mohamed Al-Marzouqi and **Nihmiya Abdul Rahim**
UAE University, UAE

Natural gas is the clean energy that has been extensively used for several purposes primarily in transportation and generation of electricity. The major constituents of natural gas are CH_4 and CO_2. The absorption or stripping of carbon dioxide is an important task in the operation of gas-liquid membrane contacting processes. The removal of CO_2 from natural gas prior to use is essential. The presence of CO_2 reduces the heating value of the natural gas and causes pipe corrosion. The conventional absorption processes are packed columns. The packed towers are usually large in size, require high investment cost and suffer from several operational limitations include flooding, entrainment and foaming. Recently hollow fiber membrane contactor has attracted the attention of many researchers. Absorption of CO_2 takes place in a membrane contactor when the gas stream contacts with the liquid phase flowing on the opposite side of the membrane. Various absorbents on CO_2 absorption or stripping were investigated; potassium glycinate (PG), monoethanolamide (MEA), di-ethanolamine (DEA), and 2-amino-2-methyl-1-propanol (AMP) were applied as absorbent or stripping solutions. The membrane used for the experiments was hollow fiber Polyvinylidene fluoride (PVDF) membrane fabricated via thermally induced phase separation method. The performances of various amine solutions on the CO_2 absorption or stripping capability were investigated. CO_2 stripping experiments revealed that regardless of type of solvent the CO_2 stripping flux and efficiency rapidly increases with liquid temperature, pressure and initial CO_2 concentration.

nayef@uaeu.ac.ae

Cellulose nanoparticles for controlling rheology and fluid loss in bentonite water-based fluids

Qinglin Wu and **Mei-Chun Li**
Louisiana State University AgCenter, USA

Rheological and filtration characteristics of drilling fluids are considered as two critical aspects to ensure the success of a drilling operation. This research demonstrates the effectiveness of cellulose nanoparticles (CNPs), including microfibrillated cellulose (MFC) and cellulose nanocrystals (CNCs) in enhancing the rheological and filtration performances of bentonite (BT) water-based drilling fluids (WDFs). CNCs were isolated from MFC through sulfuric acid hydrolysis. In comparison with MFC, the resultant CNCs had much smaller dimensions, more negative surface charge, higher stability in aqueous solutions, lower viscosity and less evident shear thinning behavior. These differences resulted in the distinctive microstructures between MFC/BT and CNC/BT-WDFs. A typical “core-shell” structure was created in CNC/BT-WDFs due to the strong surface interactions among BT layers, CNCs and immobilized water molecules. However, a similar structure was not formed in MFC/BT-WDFs. As a result, CNC/BT-WDFs had superior rheological properties, higher temperature stability, less fluid loss volume and thinner filter cakes than BT and MFC/BT-WDFs. Moreover, the presence of polyanionic cellulose (PAC) further improved the rheological and filtration performances of CNC/BT-WDFs, suggesting a synergistic effect between PAC and CNCs.

QWu@agcenter.lsu.edu