Volume 12

Washington University
Undergraduate Research Digest

Spring 2017

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Geological CO_2 sequestration (GCS), the underground injection of supercritical carbon dioxide ($scCO_2$) more than a mile underneath the surface of the earth, is an up and coming environmental technology that would drastically reduce carbon dioxide emissions. This research was completed with the purpose of better understanding the conditions of rock formations that are used for various underground technologies such as GCS. Biotite, a mica mineral found mostly in the cap-rock layers of underground rock formations ideal for GCS, is used to understand better the mobility and transport of $scCO_2$ through studying the wettability of the basal and edge surfaces and the stability of biotite particles under different conditions. Different basal and edge surfaces were prepared and contact angles were measured to determine the wettability trends of different biotite surfaces with changes in salinity and pH. Furthermore, the stability of biotite was studied by UV/vis spectroscopy using biotite suspensions in solutions of different salinities, pH values, and concentrations of DTPMP (Diethylenetriamine penta(methylene phosphonic acid)), a scale inhibitor. It was found that basal surfaces showed lower contact angles at higher salinities and fairly constant contact angles with varying pH conditions. Edge surfaces showed a trend of increasing contact angles as salinity increased, although the angles were higher than that for basal surfaces, and no discernable trend could be found for varying pH. The stability tests showed that solutions of high salinities destabilize the suspension so that aggregated particles could clog small pores in the geologic formations. Also DTPMP has a stabilizing effect on biotite suspensions and suppresses the effects of pH on stability. While these results provide some promising conclusions, it is evident that the conditions need to be tested for reproducibility and further understanding of the system.