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Experimental investigations to study the effects of halite (NaCl) precipitation on sandstone permeability and injectivity during CO_2 storage into saline aquifers

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Salt precipitation associated with the injection of dry CO_2 into saline aquifers has caused reduced injectivity in CO_2 storage sites such as Ketzin and Snøhvit, which are located in Germany and Norway respectively. The produced salt provides additional surface area for evaporation, and therefore enhances the overall rate of precipitation. For carbon dioxide (CO_2) underground storage, saline aquifers are considered as good candidates due to their abundance as well their favourably large storage capacities. This paper focuses on salt precipitation, which can occur due to the variation of the salinity of the aquifer and its effects on the aquifer porosity, permeability and CO_2 injectivity. The objectives of this study are to: (1) investigate the effect of the salt precipitation phenomenon on aquifer gas permeability during CO_2 injection into sandstone rocks, (2) visualize the locations of salt precipitation within the pores of the sandstones rocks by using CT scan (X-ray) technology (3) evaluate the changes in gas permeability (4) evaluate the injectivity behavior. The experimental work investigated the changes in the core permeabilities as a result of high brine (NaCl) concentrations. Six different sandstone core samples were saturated with different NaCl concentrations. The core samples employed in this work are: Castlegate, Bentheimer, Idaho gray, Buff Berea, Gray Berea and Parker. The aforementioned types of dry samples were selected as aquifer representative sedimentary rocks, which can be utilized as storage sites. Core porosity and gas permeability measurements were carried out. All samples were investigated to determine and evaluate the effect of salt concentration in the NaCl saturated core samples on permeability and infectivity. All the samples were saturated with (NaCl) of different salinities, with the worst scenario of 26.4 wt%. In summary, it can be concluded that the dilution of the storage aquifer by periodical pumping of well-treated sea water can delay the promotion of salt precipitation phenomenon in the near well bore, and this will improve the aquifer permeability and injectivity and will eliminate the pressure build-up problems, particularly CO_2 leakage and migration.

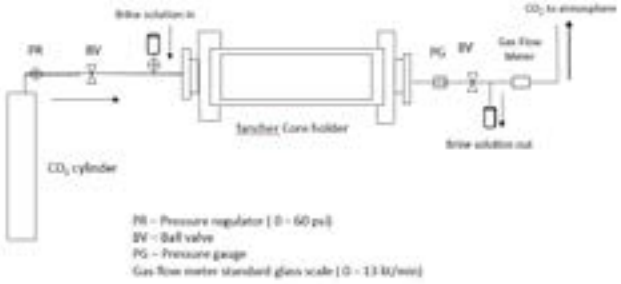

Figure : Simplified core flow test

Biography

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