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Enhancement of CO_2 storage efficiency in the finite formation with permeable drain filter

Taehee Kim

Korea Institute of Geoscience and Mineral Resources, Daejeon, Korea, Republic Of (katzura@kigam.re.kr)

In general, a relatively small and finite sedimentary formation has some critical disadvantages to CO_2 geological storage. The rapid increase in the pore pressure caused by CO_2 injection can be the one of serious disadvantages, without any kind of the pressure management. Even if the pressure management is applied, some problems still remain even in the case with the pressure management. The duration, till injected CO_2 at the injection well arrive to the extraction or drain well, can be shortened when the brine extraction and/or drain would be applied as the method for the pressure management in storage reservoir. In this case, the operation duration of the storage site is shortened and the storage cost will be increased. In this study, to overcome these disadvantages, a permeable filter was applied in the brine drain well. The sensitivity studies on the permeability of the filter and the distance of the drain well from the injection well were performed. For this purpose, we assumed a storage formation with 3.0 km X 1.5 km and 30 m in thickness. The injection well was set at a distance of 500 m from one side of the boundary, and the distance between injection and drain wells was set to be 1.5/2.0/2.5 km. The permeability of the applied filter was set to $1.0\times$10-8 (without permeable filter), 10-9, 10-10, and 10-11 m2. The maximum pressure increase due to the injection tended to increase as the distance between injection and drain wells increased. The range of overpressure pressure was 5.18 $\sim$ 7.91MPa at 1.5km, 5.7 $\sim$ 8.3MPa at 2.0km and 7.9 $\sim$ 10.5MPa at 2.5km. However, the injection duration without the CO_2 drain showed the inverse relationship with the overpressure. In the cases with 1.5km drain distance it takes 4,389 $\sim$ 5,099 days that CO_2 arrive at the drain well, 6,442 $\sim$ 7,450 days for 2.0km cases, and 9,229 $\sim$ 10,250 days for 2.5km cases. In each case, the storage efficiency in the storage formation increased to 10% of 1.5km and 22% at 2.5km. Simple sensitivity studies on the slope of storage formation are also being performed.