Impact of the Air Injection Well Position on the Performance of Preventing Seawater Intrusion

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ABSTRACT

Trapped air can effectively decrease the hydraulic conductivity without minifying the aquifer water storage capacity. Via injecting compressed air into a confined coastal aquifer, low-conductivity zones could be produced, and thus lead to saltwater retreat. Therefore, air injection has been used as a relatively simple and effective way of combatting seawater intrusion into freshwater aquifer systems in areas with limited freshwater resources. In the present study, we explored the impact of the air injection well position on the efficiency of preventing seawater intrusion by varying the well position horizontally and vertically. Our study was based on a simplified hypothetical confined coastal (a modified Henry problem) and the numerical simulation of air-water two-phase flow and solute transport using TOUGH2/EOS7. Our simulation results demonstrate that the air injection well position has a significant influence on the efficiency of the air injection method on controlling seawater intrusion. Given the same vertical position of the air injection well and air injection pressure, using a more seaward well leads to a better efficiency of the air injection method in terms of the reduced salt mass in the coastal aquifer. In addition, a shallower injection well outperforms a deeper injection well, given the same injected air pressure and horizontal position. Consequently, the air injection well is suggested to be located close to the coastline and at a shallow position. The results obtained could provide an important guidance for implementing the air injection method to control seawater intrusion.