

عنوان مقاله:

A Numerical Investigation into the Effect of Controllable Parameters on the Natural Gas Storage in a Weak Reservoir-type Aquifer

محل انتشار:

فصلنامه علوم و فناوری نفت و گاز، دوره 8، شماره 1 (سال: 1398)

تعداد صفحات اصل مقاله: 21

نویسندگان:

.Arezou Jafari - Assistant Professor, Faculty of Chemical Engineering, Tarbiat Modares University, Tehran, Iran

.Peyman Sadirli - MS Graduate Student, Faculty of Chemical Engineering, Tarbiat Modares University, Tehran, Iran

.Reza Gharibshahi - PhD Candidate, Faculty of Chemical Engineering, Tarbiat Modares University, Tehran, Iran

Esmaeel Kazemi Tooseh - MS Graduate Student, Faculty of Chemical Engineering, Tarbiat Modares University, Tehran, Iran

خلاصه مقاله:

Natural gas storage process in aquifer, due to fluid flow behavior of gas and water in the porous medium and because of their contact with each other under reservoir conditions, faces several challenges. Therefore, there should be a clear understanding of the injected gas behavior before and after the injection into the reservoir. This research simulates the natural gas storage in aquifer by using Eclipse 300 software. For this purpose, a core sample was considered as the porous medium for gas injection, and a composition of natural gas was injected into the core in different conditions. Moreover, by using Plackett-Burman method, all of the factors affected in this process were screened, and finally four main significant parameters, including the flow rate of injected gas, permeability, pressure, and irreducible water saturation were selected for designing a design of experiments (DOE) plan. Response surface method (RSM) is one of the best methods of experimental design used for optimizing the process and finding the best combination of parameters to have a high stored gas volume and a high recovered gas volume. The simulation includes 28 runs with four considered parameters, and the output is the recovered gas, which in turn is vital for the process accomplishment. Sensitivity analysis and grid independency test were checked. To this end, three grids with different number of cells in x-direction were generated, and by analyzing the results of gas saturation in the porous medium for each model, a grid with 11250 cells (50 elements in x-direction and 15 elements in y- and z-directions) was then chosen as the main grid. Uncertainty analysis and the validation of numerical simulations were carried out, and good agreement was observed between the numerical results and experimental data. In addition, the numerical results showed that the flow rate of the injected gas had a significant impact on the process in comparison with other parameters. Furthermore, increasing permeability and decreasing pressure and irreducible water saturation raise the amount of trapped gas in aquifers. Therefore, for having the maximum stored gas volume and a high recovered gas volume, the best combination of parameters is a high gas injection flow rate (0.9 cc/min), high permeability (1.54 md), a low pressure (2254 psi), and irreducible water saturation. (0.46). Finally, in a natural gas storage operation in an aquifer, both rock properties and operational parameters play important roles, and they should be optimized in order to have the highest amount of stored gas.

<https://civilica.com/doc/896173>

