Feasibility study on CO\textsubscript{2} EWR and storage for deep saline layers in China

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Abstract

The technology on CO\textsubscript{2} EWR and storage is one of the new CCUS technologies, which is coupling brine extraction and CO\textsubscript{2} storage. CO\textsubscript{2} can be injected and trapped in deep saline layer with the depth above 800 m and the salinity of brine above 10000 mg/L. Meanwhile, huge water resource with rare elemental mineral can be produced. It characterizes as the integration of CO\textsubscript{2} EWR, storage and utilization. Some case studies on CO\textsubscript{2} EWR and storage are located in depleted oil or gas fields, such as Ketzin near Persian of Germany, Zama in Alberta of Canada, Gorgon in Barrow of Australia, Teapot Dome in Wyoming of USA. The feasibility studies on CO\textsubscript{2} EWR and storage for the target deep saline in the northeastern China were conducted. The mechanisms on CO\textsubscript{2} EWR and storage were determined. Furthermore, the storage coefficient was confirmed through experiments and numerical simulation. And then, the potential evaluation method for CO\textsubscript{2} EWR and storage was formed, which was applied to calculate the potential of CO\textsubscript{2} EWR and storage for the target deep saline layer. The results show that the mechanisms of CO\textsubscript{2} EWR and storage mainly contain solubility, compressibility and displacement effects. The CO\textsubscript{2} solubility in brine is mainly related with temperature, pressure and salinity. The comprehensive compressibility factor is composed of the integrated compressibility of brine, CO\textsubscript{2} and rock. The displacement effect is described in the recovery factor of brine, which is the product of the displacement efficiency and the sweep efficiency. The numerical simulation in a geological model shows that the recovery factor is 9.65\%. Basing on the experimental and the numerical results, the potential evaluation method of CO\textsubscript{2} EWR and storage was developed. The effective storage capacity of the target deep saline layer is 474 million tonnes. Besides, the brine production is about 102 million cubic meter. In general, the technology of CO\textsubscript{2} EWR and storage has a big potential in other deep saline layers in China. It is technical feasibility in deep saline. And the technology has some advantages of reducing pressure, improving injectivity, increasing storage capacity, improving safety through brine extraction. Obviously, this technology is a strategic CCUS technology, especially for water shortage area. CO\textsubscript{2} EWR and storage technology can make CO\textsubscript{2} storage in deep saline large-scale application possible. Obviously, CO\textsubscript{2} EWR would promote CCS industry in China.