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Data-driven based machine learning for predicting hydrogen solubility in brine systems to implicate underground hydrogen storage

H. Vo Thanh, B. Min
Ehwa Womans University, Climate Change/Center for Climate/Environmental Change Prediction Research, Seoul, Republic of Korea (South Korea)

To bridge the gap between sustainable economic development and the reduction of worldwide greenhouse gas emissions, the utilization of renewable sources of energy is essential. Unfortunately, there are several hurdles that need to be jumped before renewable energy sources can be made readily accessible to the general public. By reinforcing renewable energy sources and easing the shift to a carbon-neutral sector, underground hydrogen storage, also known as UHS, may be able to assist in the resolution of these problems. One of the most important functions that it plays in UHS is the solubility of hydrogen (H_2) in brine. For the purpose of estimating the H2 solubility in brine, this study made use of the molality of the brine, as well as temperature and pressure, as input characteristics. As a consequence of this, the authors of this study suggest a collection of trustworthy estimate models constructed using strong machine learning algorithms and utilizing 255 different experimental examples. In order to accomplish the objectives of this article, four sophisticated machine learning strategies are being used. These strategies are referred to as adaptive gradient boosting (AGB), extra tree (ET), extreme gradient boosting (XGB), and random forest (RF). In terms of the accuracy of its predictions, the XGB model surpasses the ET model, the AGB model, and the RF model. In this scenario, the values of overall R2 and average absolute relative deviation that were generated by XGB were found to be 0.993 and 0.021, respectively. Also, William Plot carried performed research in the relevant area of XGB, and the results showed that an insignificant portion of the samples had outliers. In conclusion, the findings of this research may be used in UHS projects in order to get a deeper comprehension of the H_2 solubility of brine