Numerical simulation of CO2 sequestration in Malay Basin, South China Sea

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Reduction of CO_2 (carbon dioxide) emission is required as a measure against global warming at the present day. Our research group assumes that CO_2 underground sequestration is to be a feasible big supporter to this issue in the future. We have evaluated potentials of CO_2 sequestration in some Southeastern Asian fields by numerical simulation on basin modeling for a couple of years. In this study, the target field is Malay Basin in the South China Sea. In the Malay Basin, CO_2 content in producing gas is very high so that it is going to be an ideal CO_2 sequestration system to inject the collected CO_2 into the underground of high seal capacity at the same site, reducing a large amount of transportation cost and applying EOR (Enhanced Oil Recovery) if needed.

In this study, development of the Malay Basin was restored by numerical simulation and physical properties of the present geology were estimated in detail. CO_2 injection was examined in the modeled reservoir horizons and evaluated its stability. For those simulations, PetroMod, the basin modeling software produced by IES Integrated Exploration Systems, was used.

First, various geologic and geophysical information, e.g. geologic structure, lithology, formation age, thermal conductivity, heat flow, were applied for the present basin model, and geological history of the basin was restored by forward modeling. For verification of accuracy, the simulation results were calibrated with respect to burial and thermal histories using actual porosity and vitrinite reflectance profiles from borehole. Next, the optimized basin model was used for the examination of CO_2 injection. Here, the maximum CO_2 capacity was evaluated on each reservoir horizon (sandstone), applying the method where the reservoirs were set to create huge amount of CO_2 rapidly at present time. Suitable CO_2 for underground sequestration is on supercritical phase so that the target reservoirs are more than about 740 m in depth where pore pressure is over 7.3 MPa.

Consequently, it was found that supercritical CO_2 sequestration was possible in reservoirs at any target depth. These CO_2 capacities indicate more than 20 m in column height and they are the higher at the greater depth. In comparison with oil and gas accumulations in the same reservoirs, capacity for CO_2 is typically higher than that for natural gas in each reservoir horizon. This shows the same tendency as the result from a previously performed simulation in other gas field. This study does not refer effect of faults so that any leakage through faults or fractures is not allowed basically. However, our result concludes that if it is in a previously admitted gas accumulation in high sealing trap, supercritical CO_2 is expected to be stably stored within the range of the maximum gas column height.

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