The evaluation for the geological formations at Korean East Sea as the subsurface CO_2 sequestration reservoir

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The geological sequestration of anthropogenic CO_2 as a CO_2 mitigation tool was first proposed in the 1970s, but some pilot scale studies were performed until the 1990s. By considering the leakage safety and human damage, the CO_2 injection into the ocean basin is more effective than into the inland basin and the research focused on the geological CO_2 storage into both onshore and offshore such as continental shelf and some adjacent deep-ocean sedimentary basins. From the early 2000s, a number of field scale CO_2 injection projects into the deep ocean basins such as saline aquifer and oil/gas reservoir began in Europe, USA, Japan, and Canada. Because South Korea is ranked 6th among the OECD countries for CO_2 emissions, with a total of 6 billion tons of greenhouse gases emitted annually, the Korean government has been at great pains to apply the suitable CO_2 mitigation plan to Korea. Among the various geological sequestration methods, the aquifer sequestration plan is considered to be most suitable for Korea because domestic onshore oil and gas fields or halite layers are rarely present. From the previous deep drilling researches, several onshore and offshore sedimentary basins in Korea have potential as CO_2 sequestration sites. Among them, the Pohang and the Janggi basin located at the Korean East Sea are currently being evaluated as the most optimal CO_2 storage site in Korea. These basins were composed of the conglomerate and rudaceous sandstone layers, which were repeated in more than 50 m depth. The supercritical CO_2 ($scCO_2$) storage capacity of these aquifers was measured based on the residual $scCO_2$ ratio to water in pore spaces after the $scCO_2$ injection into the aquifer and it ranged at 10 ~ 30 %. Assuming that the radius of the CO_2 storage site is 500 m and 50 m in the average thickness of the reservoir aquifer, the $scCO_2$ storage capacity of each aquifer was estimated at about more than 400,000 ton, considering as one of the roomy CO_2 injection sites in Korea in viewpoint of storage capacity. The pilot scale $scCO_2$ injection test has been performed in the Yeongil Bay onshore site at the Korean East Sea and 5 tons of $scCO_2$ was successfully injected per day through an injection well into the Pohang basin (1000 m in depth). The Korean government has a plan to inject more than 1,000,000 tons of CO_2 into the Korean East Sea basins until 2021.