Assessment of CO2-EOR and its geo-storage potential in oil reservoirs of Precaspian basin, Kazakhstan

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Precaspian basin is the most petroliferous basin in Kazakhstan with more than 100 years of history of the oil and gas industry. The economy of the country has been depending on the revenues coming from the sale of Precaspian oil. Nevertheless, the average oil recovery rate in the country remains low around 30-35% and its government planned to increase the recovery rate to 55-60%. The high oil recovery rate could be achieved by enhanced oil recovery (EOR) methods by injecting diverse inert gases and liquids. The global challenge of excessive CO₂ emissions makes an EOR with CO₂ injection (CO₂-EOR) a good candidate because the anthropogenic CO₂ emission could be a good source of the injection gas. Depleted oil reservoirs are the first targets for the implementation of carbon storage. The basin contains 178 oil and gas fields distributed in pre-salt and post-salt sections divided by the huge Kungurian salt bed that deformed into domes throughout the basin. A set of suitable reservoir parameters (Original Oil In Place (OOIP), depth, API, pressure, porosity, permeability, initial oil saturation) for CO₂-EOR have been identified by earlier works of researchers based on previous experience of the petroleum industry and used to screen the oil reservoirs of the Precaspian basin. Thirty-four reservoirs of the basin were identified to be suitable for CO₂-EOR or CO₂ storage. The effective CO₂ storage capacity of the reservoirs has been estimated using the Carbon Sequestration Leadership Forum (CSLF) method. The previous estimation of the storage capacity of 178 reservoirs was 179.2 Mt of CO₂ however, after the CO₂-EOR screening, the capacity decreased to 24.4 Mt. The mapping of CO₂ sources and investigation of CO₂ amount released from each CO₂ source in the Precaspian basin will contribute to the CO₂ source-CO₂ sink matching to decide the most feasible CCS options. In addition, the analysis of fault intensity and seismicity in suitable reservoir-seal pairs could have important implications for the safety of CO₂ storage.