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# $CO_2$ storage in unconventional oil and gas reservoirs to enhance productivity

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Unconventional oil and gas resources play a key role in the global energy supply. While the world is aiming to zero carbon emissions, how this produced petroleum becomes carbon neutral is an important research topic. One of the methods to reduce the carbon footprint is to use these unconventional reservoirs for $CO_2$ storage with the economic benefit of improving productivity. This work discusses the interaction of $CO_2$ with organic rich unconventional reservoir rocks, including shales and coals. With $CO_2$ adsorption as one of the main storage mechanisms, part of the $CO_2$ also dissolves in the reservoir fluids, including oil and water, and the rest stores as free gas in the pore spaces of the unconventional reservoir rocks. The partitioning of the amount of $CO_2$ stored via each mechanism depends on the pressure and temperature as well as the pore surface characteristics of the unconventional reservoir rocks. How $CO_2$ enhances the oil and gas productivity from these reservoirs is also discussed. $CO_2$ displacement of the adsorbed oil and gas as $CO_2$ is more preferentially adsorbed in organic matter is one of the most important mechanisms to enhance productivity. Other mechanisms include the viscosity reduction with $CO_2$ dissolution in the oil. However, as $CO_2$ adsorption may lead to swelling of the organic matter, this may change the pore spaces in the reservoir leading permeability reduction, then the reduction of oil and gas production rate. Therefore, the impact of $CO_2$ storage to enhance productivity should be studied for each specific reservoir as it depends on the combined effects of above discussed mechanisms.