ABSTRACT

CO2 *INJECTION OPTIMIZATION* FOR MAXIMIZING *OIL RECOVERY* FOR *CONTINUOUS INJECTION* AND *WATER ALTERNATING GAS* USING *PARTICLE SWARM OPTIMIZATION*

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CO2 Injection become an important topic due to its potential to mitigate the impact of climate change and improve the efficiency of oil production. The success key of CO2 injection as an EOR technique largely depends on the injection design and its optimal parameters. This study evaluates the optimization of CO2 injection techniques for enhanced oil recovery (EOR) with continuous injection and Water Alternating Gas (WAG) using Particle Swarm Optimization (PSO). The objective of this study is to determine the optimal CO2 injection parameters that can maximize oil recovery.

In this study, a reservoir modeling approach using tNavigator software was used to evaluate miscible CO2 flooding since miscibility can be achieved. The reservoir model is based on a field with properties of the South Sumatra Basin, and the PSO algorithm was deployed to optimize the CO2 injection parameters, including the injection rate, and WAG ratio. The PSO algorithm was chosen due to its ability to optimize multiple variables and its ability to handle non-linear and non-convex problems. The performance of the optimized CO2 injection techniques was compared to various scenarios of natural depletion (basecase), continuous and WAG injection.

The simulation results showed that the optimized CO2 injection with WAG provided better oil recovery compared to continuous CO2 injection alone. The PSO optimization algorithm successfully identified the optimal injection parameters that maximize oil recovery and minimize gas injected. The results also showed that the injection rate have a significant impact on the oil recovery, and that an optimal WAG ratio can enhance oil recovery while reducing CO2 usage. The results demonstrate the importance of injection design parameters for efficient and effective CO2 injection EOR. The PSO optimization algorithm provides a robust tool for optimizing multiple injection parameters simultaneously and can be applied to maximize oil recovery and minimizing gas injected.

Keywords: CO2 *Injection,* PSO, Reservoir Simulation, CCUS