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**Research****Green Industrial Processes—Perspective****Carbon Sequestration through CO<sub>2</sub> Foam-Enhanced Oil Recovery: A Green Chemistry Perspective**

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**ABSTRACT**

Enhanced oil recovery (EOR) via carbon dioxide (CO<sub>2</sub>) flooding has received a considerable amount of attention as an economically feasible method for carbon sequestration, with many recent studies focusing on developing enhanced CO<sub>2</sub> foaming additives. However, the potential long-term environmental effects of these additives in the event of leakage are poorly understood and, given the amount of additives injected in a typical CO<sub>2</sub> EOR operation, could be far-reaching. This paper presents a summary of recent developments in surfactant and surfactant/nanoparticle-based CO<sub>2</sub> foaming systems, with an emphasis on the possible environmental impacts of CO<sub>2</sub> foam leakage. Most of the surfactants studied are unlikely to degrade under reservoir conditions, and their release can cause major negative impacts on wildlife. With recent advances in the use of additives (e.g., nonionic surfactants, nanoparticles, and other chemicals) the use of harsh anionic surfactants may no longer be warranted. This paper discusses recent advances in producing foaming systems, and highlights possible strategies to develop environmentally friendly CO<sub>2</sub> EOR methods.

**1. Introduction**

Carbon dioxide (CO<sub>2</sub>) flooding is one of the most widely used enhanced oil recovery (EOR) methods. In the United States, CO<sub>2</sub> EOR has recovered over 1.5 billion barrels of oil, and estimates of the amount of oil that is recoverable by CO<sub>2</sub> EOR range from 47 to 137 billion barrels [1–3]. Even though CO<sub>2</sub> flooding is an attractive

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