



Review

Paradigm shift towards the sustainability in upstream oil industry for enhanced recovery - A state-of-art review

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ABSTRACT

Sustainability refers to achieving our goals without compromising the capacity of coming generations to accomplish their aims. Sustainability is a multifaceted approach considering ecological, social, and economic factors. Adopting sustainable practices, whether large or small, can have a significant long-term impact. Therefore, a detailed study of sustainability in the upstream Oil and Gas (O & G) industry is presented. In this review, a contemporary explanation of the enhanced oil recovery methods and their evolution over the years in terms of chemicals and mechanisms has been discussed. The application of nano-sized particles for better recovery has been introduced in hydrocarbon recovery. The nanoparticles, the involvement of polymeric surfactants, Pickering emulsions, and ionic liquids show effectiveness in oil recovery. This review encounters the applicability of various chemical enhanced recovery methods. Moreover, the synergistic impacts of the above-mentioned chemicals with standard methods, their efficiency, and their evolution in the petroleum industry have also been investigated thoroughly. The era of enhanced recovery begins with the involvement of surfactants, followed by alkali, polymers, combinations of both, and microemulsions. Then, nanotechnology came into the picture followed by Pickering emulsions. The journey is still continuing in search of sustainable recovery methods for a better tomorrow. Recently, ionic liquids have also been involved in oil recovery methods. Current research works show the potentiality of ionic liquids in the hydrocarbon industry as a green solvent. Overall, this review gives a clear-cut insight regarding the chemicals involved in recovery as well as the paradigm shift happening in the hydrocarbon industry for sustainability. CO₂ injection with geological storage has also been discussed and this method could help to achieve a target of net-zero emission. A substantial discussion regarding the applications of chemical enhanced oil recovery and CO₂ injection procedures for sustainable production of energy is presented to show the paradigm shift in enhanced oil recovery methods. This paper reviews the previous works done by the researchers on various enhanced oil recovery (EOR) methods and tries to meticulously add the new developments that caused the switch from conventional materials to bio-based materials as well as the carbon capture, utilization, and storage (CCUS) strategies. The major objective of this study is to provide insight into various advancements in the upstream O & G Industry for EOR and also helps in understanding the significance of bio-based additives, microbial enhanced oil recovery (MEOR), and the CCUS for achieving more environmentally friendly and cost-effective operations. The state-of-art review will provide a complete and detailed comprehensive analysis of EOR methods as well as the shift toward sustainability. This paper is beneficial as it delivers insights into the mechanism of various new synthetics in the EOR application. Also, it offers commendations and guiding principles for future advances in sustainable methods.

1. Introduction

Petroleum resources are still considered as a paramount benefactor for energy supply. To meet the escalating demand for energy, it is necessary to enhance the retrieval of oil from the under-exploited

reservoirs. And petroleum comes under the conventional energy resource. Therefore, it is impossible to reuse once these energy sources are over and exploited. There comes the importance of sustainability in energy production. Sustainability is nothing but the idea of developing and using the products as per the need and demand without compromising the needs of future generations. As the environment is an

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