Microbial-induced risks associated with CO\textsubscript{2} storage

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Abstract

Most subsurface environments host a variety of microorganisms regardless of their harsh conditions [1]. Many microorganisms can use CO\textsubscript{2} for catabolism and/or anabolism [2]. As such, microbial growth fuelled by CO\textsubscript{2} injection can have various side effects such as reduction of injectivity, decrease in storage capacity, and microbial-induced corrosion [3]. The microbial corrosion induced by microbial reduction of CO\textsubscript{2} depends on CO\textsubscript{2} metabolism, as well as, different mechanisms used by microbes to uptake electrons from Fe(0). Besides the corrosion induced by microbial reduction of CO\textsubscript{2}, CO\textsubscript{2} can also activate other corrosive metabolisms by dissolving the mineral matrix and imposing other electron acceptors that were not accessible otherwise. These minerals can either act as an electron acceptor for electrons donated from iron and therefore trigger corrosion directly, or they can cause corrosion indirectly by producing corrosive products such as H\textsubscript{2}S [4]. In this paper, we thoroughly review various metabolisms that can be activated by CO\textsubscript{2} injection. We then assess the induced risk associated with each metabolism in terms of corrosion and injectivity impairment for several hydrocarbon fields in the Danish North Sea. Further, we evaluate the impact of impurities (in the CO\textsubscript{2} injection stream) on both methanogenic and sulfate-reducing bacteria. Considering various parameters such as mineral type (e.g., carbonate or sandstone) and CO\textsubscript{2} injection scenarios, we discuss the optimum scenario and reservoir conditions for which microbial risks are minimal.

Keywords: Microbial induced corrosion; Solid phase electron uptake; Methanogenesis; Biologic sulfate reduction

References:

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