Public Abstract
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Title:Nitrate and nitrite growth inhibition of Desulfovibrio strains

Sulfate-reducing bacteria, common non-pathogenic soil bacteria, have the ability to limit the movement of toxic heavy metals from one environmental site to another by keeping those metals from dissolving in water. Limiting the movement of heavy metals into drinking water supplies is especially desirable in former nuclear weapons complexes, which are contaminated with heavy metals. Although these bacteria can have positive effects in heavy metal immobilization, they also have negative impacts on the petroleum industry. For example, these bacteria cause oil "souring" and corrosion of metal pipes because of their production of hydrogen sulfide, the gas that smells like rotten eggs. Therefore, it is desirable to study these bacteria in order to increase their positive effects and decrease their negative effects. Growth of the sulfate-reducing bacteria can be inhibited by the chemicals nitrate and nitrite. Nitrate and nitrite are also present in heavy-metal contaminated environments and limit the growth of sulfate-reducing bacteria and their positive effects. In addition, nitrate and nitrite are often added to oil production processes to limit the souring of oil and corrosion of the pipelines. Therefore, in order to manipulate the activities of sulfate-reducing bacteria, it is necessary to be able to predict the responses of these bacteria to inhibitory chemicals like nitrate and nitrite. In this research, responses of the model sulfate-reducing bacteria, Desulfovibrio vulgaris Hildenborough and Desulfovibrio alaskensis G20, to nitrate and nitrite were studied. We found that mutations that inactivate the functions of a small number of genes cause nitrate resistance in these bacteria. These mutations may assist the growth of the bacteria in environmental settings where nitrate is present. Although it was long believed that nitrate inhibition occurred through nitrite production, our work confirmed that nitrate inhibition of these bacteria can be independent of nitrite production. Additionally, the much more potent inhibitor, nitrite, but not nitrate, can be used beneficially by the bacteria to assist their growth. Therefore, nitrate and nitrite should be considered as separate inhibitors in the environment, rather than as a single inhibitor. Furthermore, the beneficial effects of nitrite on sulfate-reducing bacteria should be considered when a model is made to describe how these bacteria interact with nitrate or nitrite in the environment. These results can help researchers to study more effectively how to increase the beneficial effects of sulfate-reducing bacteria and to decrease their negative effects.