ANAEROBIC HYDROCARBON BIODEGRADATION AND THE BIOCORROSION OF CARBON STEEL IN MARINE ENVIRONMENTS: THE IMPACT OF DIFFERENT ULTRA LOW SULFUR DIESELS

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Hydrocarbon releases to the environment are often associated with biocorrosion of the carbon steel energy infrastructure. Recent evidence has shown that biocorrosive anaerobic microorganisms proliferate on metal surfaces at the expense of petroleum components. We conducted a study to determine if different ultra low sulfur diesels (ULSDs) influence the microbial biodegradation of the fuel and biocorrosion of carbon steel in anoxic marine incubations. Seawater and sediment from the Gulf of Mexico were incubated with 1018 carbon steel and four different ULSDs. A replicate set of incubations was amended with a positive control inoculum of *Desulfoglaeba alkanexedens* strain ALDC, a model sulfate-reducing bacterium known to metabolize C_6-C_{12} *n*-alkanes. Ion chromatographic analysis revealed that early stage sulfate loss in the incubations was consistent with the amount of low molecular weight (C_8-C_{12}) *n*-alkane utilization by the positive control inoculum. However, total sulfate loss (9mM) at the conclusion of the experiment was similar for all ULSDs and consistent with the theoretically expected amount needed for the complete mineralization of all *n*-alkanes in the fuels. A comparison of initial and final hydrocarbon loss by GC-MS confirmed this contention. The rate of sulfate reduction in incubations without *D. alkanexedens* was much slower. Corrosion, as evidenced by coupon weight loss, was linearly correlated (r^2 = 0.77) with the total amount of sulfate loss in the incubations. Thus, while ULSDs are compositionally varied, such differences become less important with increased incubation times. The anaerobic biodegradation of ULSDs under sulfate reducing conditions can clearly exacerbate carbon steel biocorrosion.

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