

Cost Performance of Simple Substrates used for Halorespiration

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The general acceptance of halorespiration as a viable remedial option for chlorinated solvents has resulted in the use of a myriad of carbon substrates ranging from highly purified forms of metabolic acids to common natural biopolymers. Since the process originally was significantly less expensive than existing mechanical alternatives, little attention was paid to the costs or efficiencies of these substrates. As the technology has become better understood, the cost and efficiency of the substrate has played a greater part in the remedial selection process. Today, the underlying question has shifted from whether reductive dechlorination is effective to which material has the best efficiency and ease of application to provide the best project value.

Substrates can be grouped into several categories based on their general chemical makeup, organic acids and their derivatives, carbohydrates, and other organics. Substrates can also be grouped by their in situ longevity, “slow release” versus “fast release” substrates. This longevity is generally related to the physical state of the substrate, liquid or solid/semi-solid. All of these types of substrates can stimulate reductive dechlorination, but due to their physical and chemical properties, their effectiveness varies from site to site and is impacted by the amount of substrate utilized for processes other than dechlorination.

In this study, substrate efficiency was defined as the ratio of contaminant dechlorinated compared to the amount of electron donor consumed. JRW, in conjunction with the University of Illinois, Urbana campus, conducted a series of studies to determine the efficiency of various widely available carbon substrates. In order to better evaluate the selected substrates, the substances were compared on a cost per pound of contaminant degraded basis. These results were combined with hypothetical application strategies to identify typical overall project costs. Results of these studies are discussed.