

## **Manipulating the Physical Properties of Vegetable Oil to Produce a Concentrated Substrate for Halorespiration**

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Emulsified vegetable oil has been used as a carbon source for enhanced halorespiration on a commercial basis for a number of years. With most carbon substrates, concerns have arisen about various properties of the amendment. Some formulations of vegetable oil substrates are slowly degraded, and they remain in the aquifer years beyond what is required while others can not be readily distributed in the aquifer matrix. In many cases, vegetable oil alone is not utilized fast enough to support the strongly reducing conditions required for complete dehalogenation of solvents. In the past, these inherent properties were ignored or just accepted as part of the cost of the project. However, overcoming these limitations could lead to increased performance in the field.

The original concept of using vegetable oil as an organic substrate is based partly on the idea that the oil will be slowly degraded, thereby promoting halorespiration over an extended period of time. One of the issues associated with oil is its slow dissolution which may limit complete degradation. Also, in some cases the oil will separate from the groundwater and then adhere to soil particles thereby limiting dispersion to the area immediately around the application point. In other cases, the oil will separate from the water and simply “float” to the groundwater interface thereby limiting vertical distribution of the substrate. This is complicated further if the contaminants become encapsulated by the oil. Contaminants essentially become emulsified within the oil, forming a complex contaminant/oil/water emulsion that can adhere to soil particles essentially isolating the contaminant for an extended period of time. These issues are partly overcome by mixing vegetable oil with emulsifying agents. What is needed now is a slow-release substrate with the characteristics of oil that also sets up strongly reducing conditions to rapidly degrade the contaminants.

JRW Bioremediation, L.L.C. has developed a low-cost vegetable oil substrate that can be easily emulsified on site. This material has the slow-release characteristics of emulsified vegetable oil systems, but will stimulate much stronger reducing conditions in the groundwater. The moderate longevity of the emulsion promotes halorespiration while avoiding excessive encapsulation or phase separation.