Bioremediaton of Diesel Range Organics in Soil with ZymoBac® VICRO

SUMMARY

Hydrocarbon contamination derived from petroleum production and processing is a challenging environmental concern for today's petrochemical industries. Current methods for degradation of petroleum have proved to be expensive and take a considerably long amount of time to digest the contaminants. The goal of this research was to determine the effect of microbial products, specifically ZymoBac® VICRO, on degradation of gasoline range organics (C6-C10) and diesel range organics (C10-C28). Plot studies on 650 cubic yards of land contaminated by petrochemical operations were performed to demonstrate the effectiveness of ZymoBac® VICRO vs. traditional remediation methodologies. Samples were taken at 0 and 21 days and sent to a third-party lab for analysis. Results showed that ZymoBac® VICRO was effective in reducing the gasoline range organics (C6-C10). Additionally, ZymoBac® VICRO reduced diesel range organics (C10-C28) by 65% while the traditional remediation methods reduced diesel range organics by 13%. Thus, both methods showed the ability to decrease contaminants but the use of ZymoBac® VICRO showed a significantly higher reduction.

BACKGROUND

The degradation of gasoline range organics (C6-C10) is often remediated by applying common bioremediation engineering procedures that boost the activity of natural soil microflora. However, in these procedures' diesel range organics (C10-C28) are poorly digested and considerable amounts of time and operating cost are required to remediate these long chain hydrocarbons. Long service cycles lead to lost opportunities. If efficient procedures are not followed or optimized, remediation of soil can require up to 18-36 months. However, these processes are less expensive then excavating the soil and paying for incineration. To accelerate bioremediation processes, the state of the microbial growth in the soil must be considered. For instance, an organism that doubles in cell concentration in 0.5 hours in liquid takes 50-100 hours to double in soil. Thus, remediation efficiencies can be improved by not only accelerating the activity of the natural flora that can degrade the recalcitrant organics, but also by adding a high concentration of petroleum degrading microbes to the soil. This approach requires less time for the microbes to increase in concentration, therefore degrading the same amount of contamination in much less time. Considerable competitive advantage will go to the firms and processes that can breakdown these diesel range organics in a more rapid fashion due to their effect on reducing the long-term operating costs of remediating soil.

MATERIALS AND METHODS

To demonstrate these remediation methodologies MDG worked with an engineering firm to perform plot studies on 650 cubic yards of land contaminated by petrochemical operations. 90% of the contamination included mid-range diesel range organics (C12-C17). Approximately 640 cubic yards land was treated as the control and standard soil bioremediation techniques were applied. The procedures included moisture adjustments, fertilizer application, and soil was turned regularly for a period of 3 weeks (detail were proprietary to the engineering firm). A soil plot of approximately 10 cubic yards was designated as the treatment plot and these same remediation techniques were applied however, a one-time addition of ZymoBac® VICRO was blended into the soil. Core samples were taken at 0-21 days and sent to a third-party lab analyzing for both gasoline range organics (Petro GRO) and diesel range organics (Petro DRO).

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RESULTS

The primary benefit of nitrogen reduction was the ability to irrigate more water on the farmland currently available. Treatment prevented the client from needing to rent additional land to irrigate the water from their lagoon. This along with having 75% less sludge to dredge, saved significant dollars in equipment and land rental fees. As an additional benefit, odor generated in the lagoon was significantly reduced.

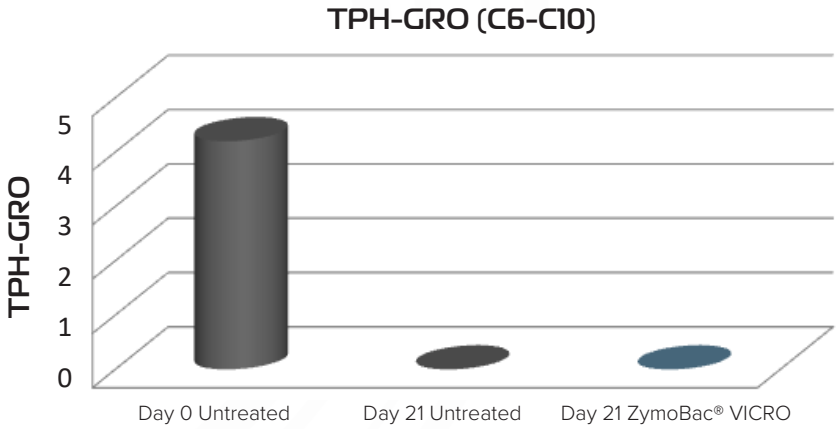

Figure 1. Untreated and treated results of gasoline range organics.

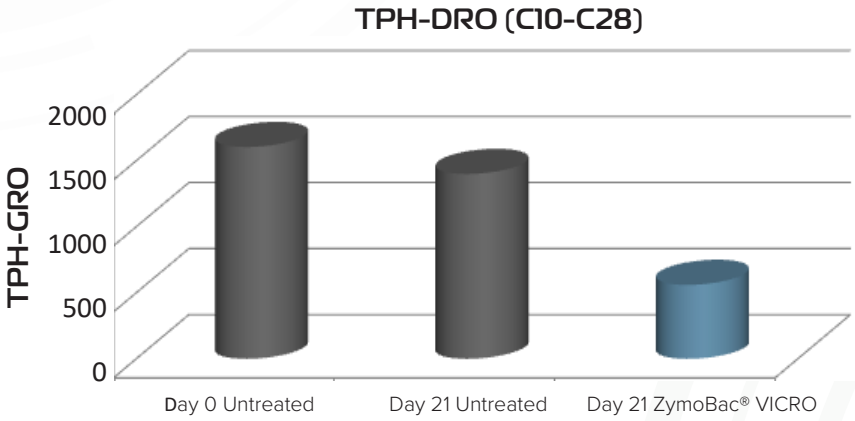

Figure 2. Untreated and treated results of diesel range organics.