



PermeOx Plus® vs ORC Advanced® – An Analytical Study

Successful bioremediation of petroleum contamination through aerobic microbial respiration depends on a number of factors including the presence of appropriate microbes, nutrients, electron donors and terminal electron acceptors. In the aerobic metabolism of petroleum contaminants, oxygen acts as a terminal electron acceptor and petroleum contaminants act as electron donors, which are then oxidized. Often, the limiting factor in aerobic bioremediation of petroleum contaminants is the lack of oxygen. PermeOx Plus is a timed-release form of calcium peroxide that releases sufficient oxygen over an extended time period to enhance the biodegradation of petroleum hydrocarbons and other biodegradable contaminants in soil and groundwater.

A side-by-side analysis of oxygen release was performed comparing FMC's PermeOx Plus and Regensis' ORC Advanced over a period of one year examining several key parameters:

- 1) Initial Calcium Peroxide (CaO_2) Concentration
- 2) Initial Active Oxygen (AO - %)
- 3) Calcium Peroxide (CaO_2) Loss
- 4) Active Oxygen (AO - %) Loss

Results:

Analytical Parameter Tested	PermeOx Plus	ORC Advanced
Initial CaO_2 Concentration (Day 1)	76.80%	68.70%
Initial Active Oxygen Concentration (Day 1)	17.05%	15.25%
CaO_2 Concentration (5 Months)	38.50%	0.30%
CaO_2 Loss/Day (Hydrolytic Loss)	0.261%	0.465%
Active Oxygen Concentration (5 Months)	8.55%	0.06%

Active Oxygen (AO - %) is a measure of the oxidizing power of a substance or compound. FMC's PermeOx Plus has 11.8% more Active Oxygen than ORC Advanced and displays a slower oxygen release profile in order to support sustained aerobic bioremediation.



A comparison of AO and pH of PermeOx Plus and ORC Advanced is shown below in Figure 1 and Figure 2. The final pH has stabilized near the 12.0+/- level, which is dictated by the hydroxyl anion concentration.

Fig. 1: Hydrolysis of PermeOx Plus in DI Water at 25°C

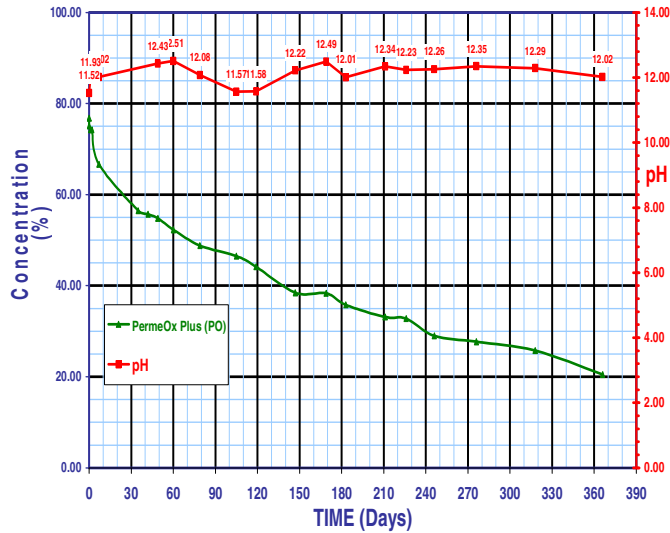
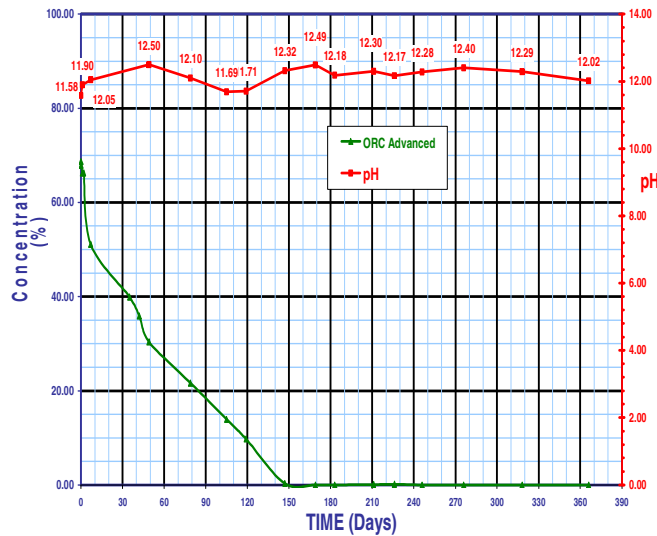


Fig. 2: Hydrolysis of ORC Advanced in DI Water at 25°C



PermeOx Plus had roughly 20.5% CaO_2 available at the end of one year; however ORC Advanced had lost almost all its CaO_2 in only 5 months. The high assay and controlled oxygen release profile of PermeOx Plus make it the preferred solution for enhanced aerobic bioremediation at your site.