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# Oil contaminant degradation by natural indigenous microorganisms under aerobic condition

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Petroleum hydrocarbons are one of the major contaminants in the groundwater and the soil. Mineral oil such as gasoline, kerosene, light oil, and heavy oil have been concerned as contaminant in Japan recently. Various kinds of remediation technologies, such as a chemical washing, chemical degradation, dig and dump, soil vapor extraction, thermal treatment, bioremediation and phytoremediation, are applied to the oil contaminated sites. Each of these techniques has its merits and demerits. Soil cleanup goal is attained with a combination of some of those remediation technologies. We should set a clean up plan for oil contaminated soil and groundwater to eliminate the risk to human health by the contaminant.

Monitored Natural Attenuation (MNA) as a remedial approach has been applied to the contaminated sites in the U.S., the UK, the Netherlands and so on. We monitor the natural self-cleansing action carefully to achieve the sites specific remedial objectives when applying MNA. The "Natural Attenuation" includes a wide variety of processes, such as biodegradation, dispersion, dilution, sorption, volatilization. Especially if bioremediation is focused on, oil contaminant would be eliminated from the environment without destroying the nature. MNA should have more advantages such as cost-effective and high-security approach, than disadvantages such as time-consuming. The number of natural attenuation studies and field trials is getting increase. The degradation mechanisms of oil contaminant by intrinsic microorganism have been investigated widely. However, there are few papers that focus on the degradation ability by indigenous microorganisms without extracting them from the soil. In this study, we investigated the bioremediation ability of oil contaminant by natural indigenous microorganisms under aerobic condition in a batch system.

We used ten components hydrocarbons included in regular gasoline to simulate the oil contaminant. The ten components are n-hexane, n-heptane, n-octane, iso-octane, n-nonane, methylcyclohexane, toluene, ethylebenzene, p-xylene, and o-xylene. Toyoura sand and topsoil which was collected from the ground inside our laboratory were used to examine the difference of oil degradation ability by different soil microbiota. Each 10 g soil was filled into glass vials and they were capped. We prepared sterilized and nonsterilized sample for each soil. The vials were then set into a 30 degrees C incubator over one night for temperature homogenization. 3 microlitter of ten components mixed solution was injected within each glass vial using a micro-syringe from the top rubber stopper laminated by teflon. The vials were shaken for 5 minutes by hand and set into the incubator again. The undegradable concentrations of ten components were analyzed by a headspace method with GC-FID. The concentrations were observed at the previously-determined time.

As a result, there was no clear degradation of ten components when the experiments used Toyoura sand and sterilized topsoil. There was a grate difference of degradation rate and concentration in each component when the experiment used the nonsterilized topsolil. There is

strong evidence that hydrocarbon degraded microorganisms are existing in the Japanese soil. The degradation rate of each component was high in the early time of the experiment. After that the residual concentration inside a vial closed to an almost constant value. The degradation rate and undegradable concentration of normal alkanes were high, while those of iso-octane that has branched chain were low. The degradation rate and undegradable concentration of normal alkanes with large carbon number were high, while those of n-hexane were not high. It is estimated that there should be easily degraded and recalcitrant components in hydrocarbons, and the chemical structure would affect the degradation rate and degraded concentration of hydrocarbons from this result.

Keywords: oil contaminant, biremediation, indigenous microorganisms, aerobic condition, laboratory experiment