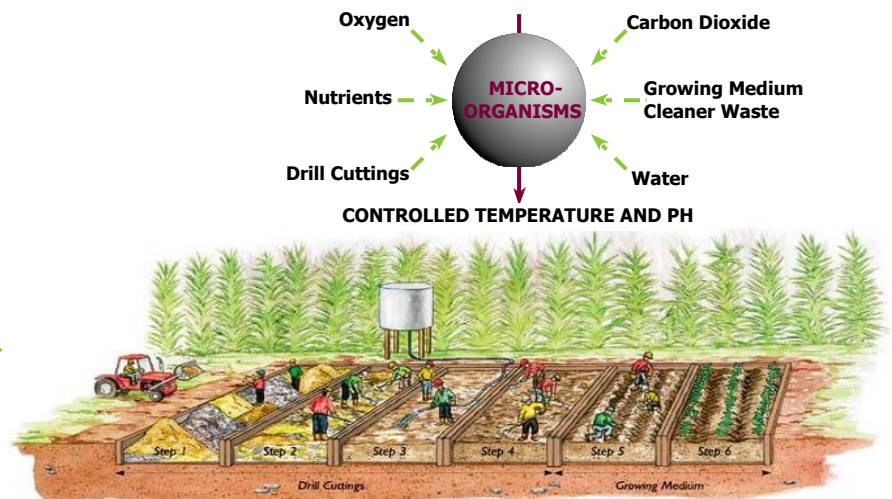


SCM-DRILL CUTTINGS BIOREMEDIATION



- Step 1:** The drill cuttings are fed into the process cells along with sand and sawdust
- Step 2:** The drill cuttings, sand and sawdust are tilled until thoroughly mixed
- Step 3:** A microbe and nutrient solution is sprayed over the cuttings
- Step 4:** During the process the mixture is sprayed and tilled regularly, until measured OOC's are less than 1%
- Step 5:** Once the oil content of the mixture has fallen to acceptable levels seeds are planted into what is now referred to as a growing medium
- Step 6:** Once the plants have grown, toxicity levels are tested to prove that the bioremediated drill cuttings are fit for disposal

Traditional methods for the disposal of Oil-Based Mud (OBM) drill cuttings have included pit burial or leaving the untreated cuttings scattered in-situ. Increasingly stringent regulations and increased environmental awareness have required new and improved disposal techniques. Midgard, with over twenty one years Drilling Waste Management experience, has developed a system to remediate drill cuttings biologically. This process is known as Drill Cuttings Bioremediation.

CONCEPT

Some micro-organisms have the ability to digest organic compounds using specialist protein molecules, known as enzymes. Enzymes are what are referred to as biological catalysts. Some micro-organisms produce enzymes capable of accelerating the biodegradation process of organic pollutants into harmless carbon dioxide, water and clean solids. This natural process can be exploited and used in the oil industry to treat drill cuttings waste.

APPLICATION

Midgard has developed a system to biologically treat drill cuttings produced by the drilling process, including those that were previously disposed of by land farming and scattering in-situ.

Firstly, a containment area consisting of a clay-based and banded cell is built. This is surrounded by a drainage system to prevent any contaminants getting into the environment. The location of this area is also carefully selected to allow ease of access for the process workers.

Drill cuttings are placed into the cells of the banded areas, along with measured quantities of sawdust, sand, nutrients and naturally occurring microbes. The mixture can be tilled by either manpower or machine depending on the size of the project and location. Properly organized regular mixing and passage of time allows the pollutants in the drill cuttings to be digested and consumed by the microbes. This process will cause the percentage of oil in the drill cuttings to drop to a level

TREATMENT AND DISPOSAL

which has been agreed with the operator as being environmentally acceptable. In many cases the end product, containing harmless nutrients, can be used as a growing medium.

Midgard can design a Bioremediation system to suit the drilling waste product that requires treatment. The balance of micro-organisms and chemicals required is very much dependant on the composition of the drill cuttings or other waste material. Pilot Testing prior to start-up is necessary to determine the best treatment regime. This is a fairly complex task, and requires some experienced input. Once determined, the treatment process is simple to set up and manage.

FEATURES & BENEFITS

- The Bioremediation process is fairly flexible. It can be used for all manner of drill cuttings and other waste; OBM, WBM, previously treated material and newly extracted drill cuttings
- There are several combinations of bacteria that can be used in order to obtain the results desired by a client. Deciding which biological systems are best suited for the results required, requires skill and expertise. However, once the system is in place the project is relatively simple and safe to manage
- This is a treatment process that uses naturally occurring micro-organisms (yeast, fungi or bacteria) to break down the organic substances into harmless carbon dioxide and water. Once the contaminants are degraded, the micro-organism population will reduce naturally as they have used all their food source
- Environmental Impact – All products from the process can be disposed of without the need for further treatment or special care at an oil content of < 1% w / w

- Cost – Bioremediation is a relatively inexpensive method of remediating previously disposed material. As the drill cuttings can be treated in-situ, transportation costs are lower compared to other methods
- Safety – Very few machines are needed to assist with the Bioremediation process, thus operating hazards are reduced
- Useful Products – The end product is earth with some organic additives. This can be used as a soil additives or a growing medium
- Low Maintenance – As a low tech process, that requires few machines, there are few delays due to equipment down-time

SPECIFICATIONS

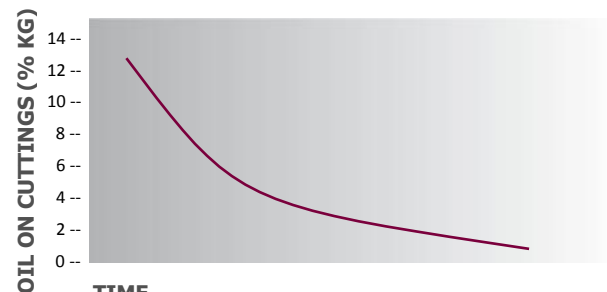
Basic requirements for a successful project:

Ambient temperature requirement – Bioremediation Process Plants are best located in tropical regions due to their suitable ambient conditions

Land area requirement – 7.5 sq M / MT

Land specification – Above seasonal water table

OIL REDUCTION DUE TO MICRO-ORGANISM ACTIVITY



TIME

Time period is dependent on formation drilled, local soil and type of oil-based drilling fluid