PREPARED BED BIOREMEDIATION OF CONTAMINATED SOILS

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WHAT IS SOIL TREATMENT IN A PREPARED BED?

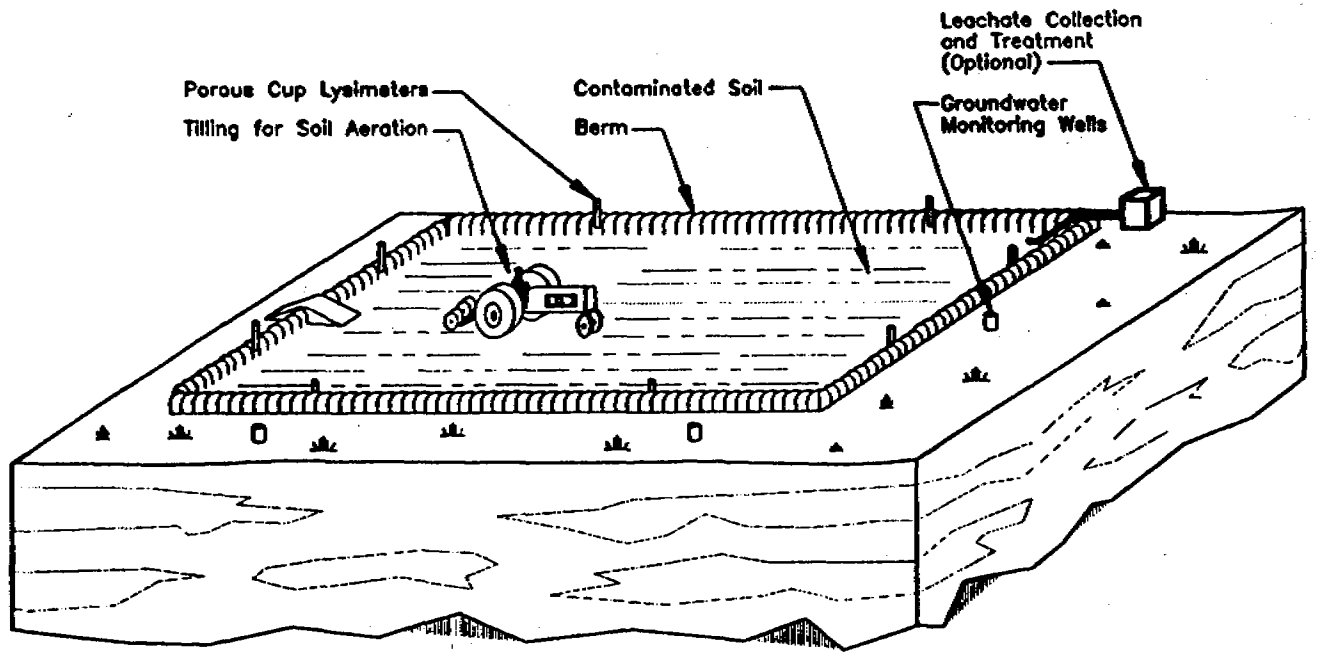
Land Treatment (Also Known as Landfarming and Land Application) Technology is the Basis for Prepared Bed Soil Remediation

Land Treatment: An above ground remediation technology for soils that reduces concentrations of organic waste constituents through biodegradation.

Technology involves spreading excavated contaminated soils in a thin layer on the ground surface and stimulating aerobic microbial activity within the soils through aeration and/or the addition of nutrients and moisture.

A prepared bed land treatment unit (LTU) is designed with a liner to prevent leaching of waste constituents.

Typical Landfarming Operation



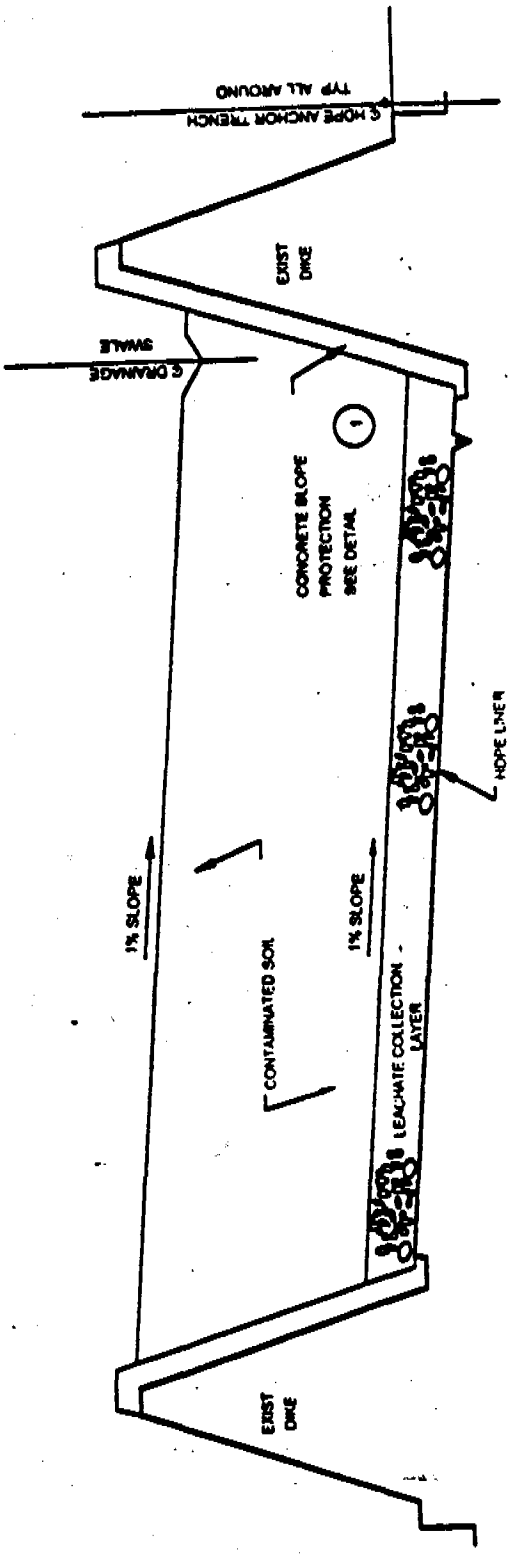


FIGURE D-4
TREATMENT CELL SECTION
A

- **Landfarming technology developed in petroleum refining industry to treat waste streams in soil**

- **Landfarms were established at all major oil refineries**

- **Land "farming" process similar to that used for good agricultural cropping practices (the "crop" in landfarming is the microbes)**

  - **cultivate for aeration**
  - **cultivate to mix soils and nutrients**
  - **fertilize**
  - **maintain water availability**
  - **control pH**

- **Landfarming technology adapted to remediating contaminated soils**
  - **more monitoring required**
  - **regulations concerning construction of treatment cells more rigorous**
  - **costs increased as result of construction standards and monitoring costs**

FLUX of O_2 into soil by diffusion

① $$J_{DM} = -D_G^S \frac{dC}{dx}$$

D_G^S (cm^2/s) = diffusion coefficient (soil gas diffusivity)

C = gas conc.

x = soil depth

② Fick's Second Law

$$\phi \frac{dc}{dt} = D_G^S \frac{\partial^2 C}{\partial x^2} + R$$

ϕ = air-filled porosity

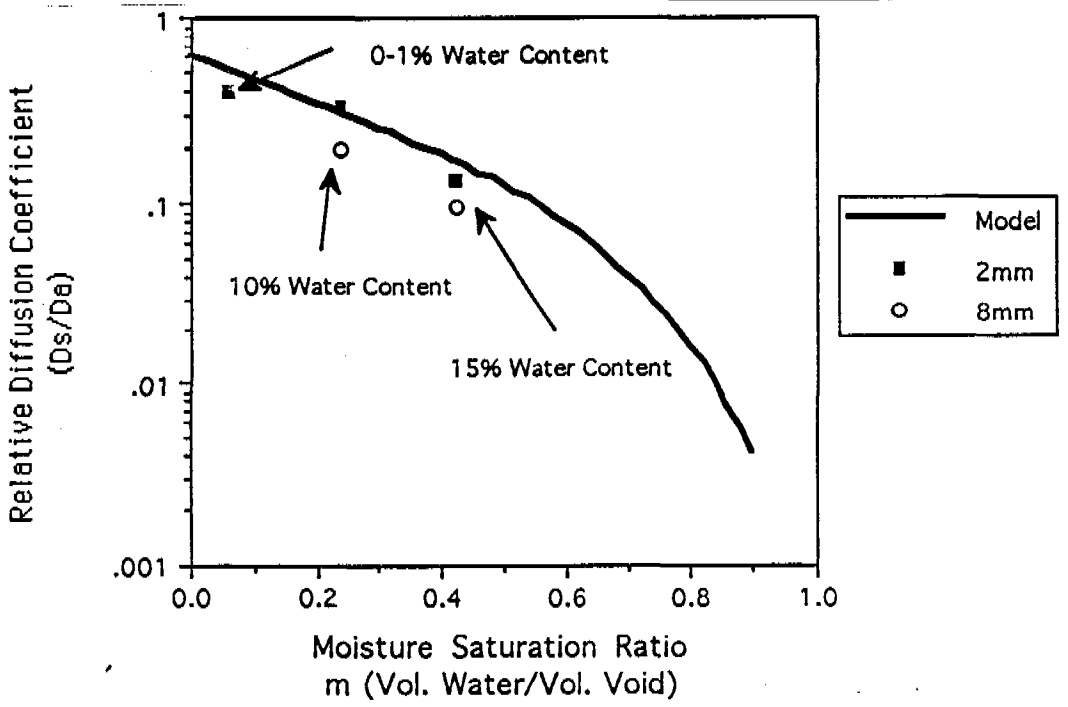
R = gas consumption rate

when $R=0$, measure dc/dt and dc/dx

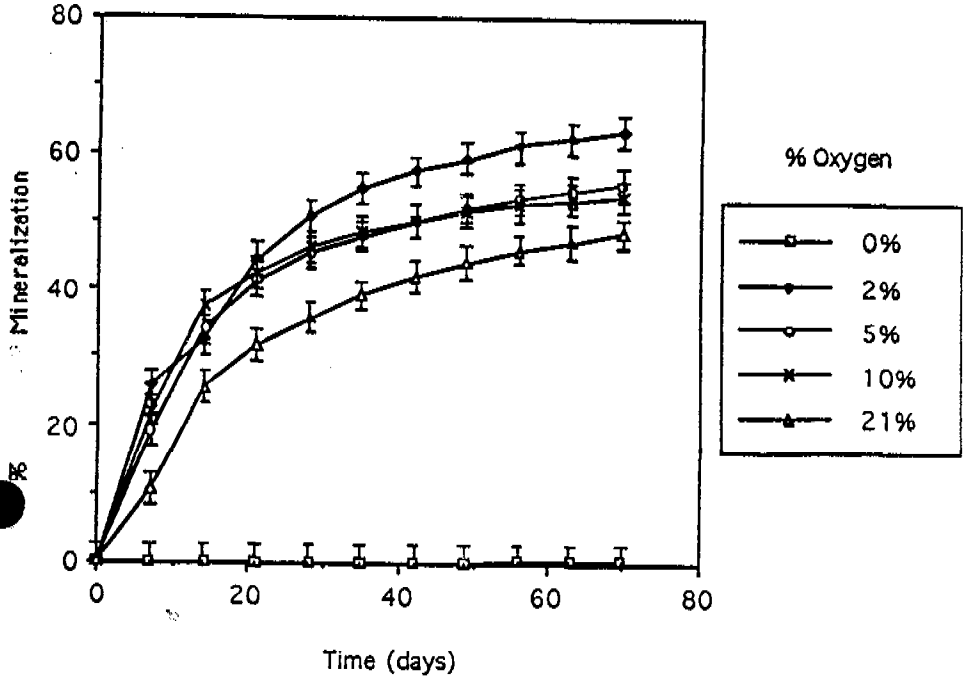
③ $$\frac{2 D_G^S (C_o - C_a)}{R} = L^2$$

Values for bulk density, porosity, and air filled porosity

Parameter	0% Moisture	10% Moisture	15% Moisture
Bulk Density (gm/cm3)	1.25	1.22	1.45
Total Porosity	0.53	0.54	0.45
Air-Filled Porosity	0.53	0.41	0.23



Pore Distribution Model of Oxygen Diffusion in Contaminated Soil. Where Ds is the oxygen diffusivity coefficient D_G^S in the soil gas, and Da is the oxygen diffusivity coefficient in air.



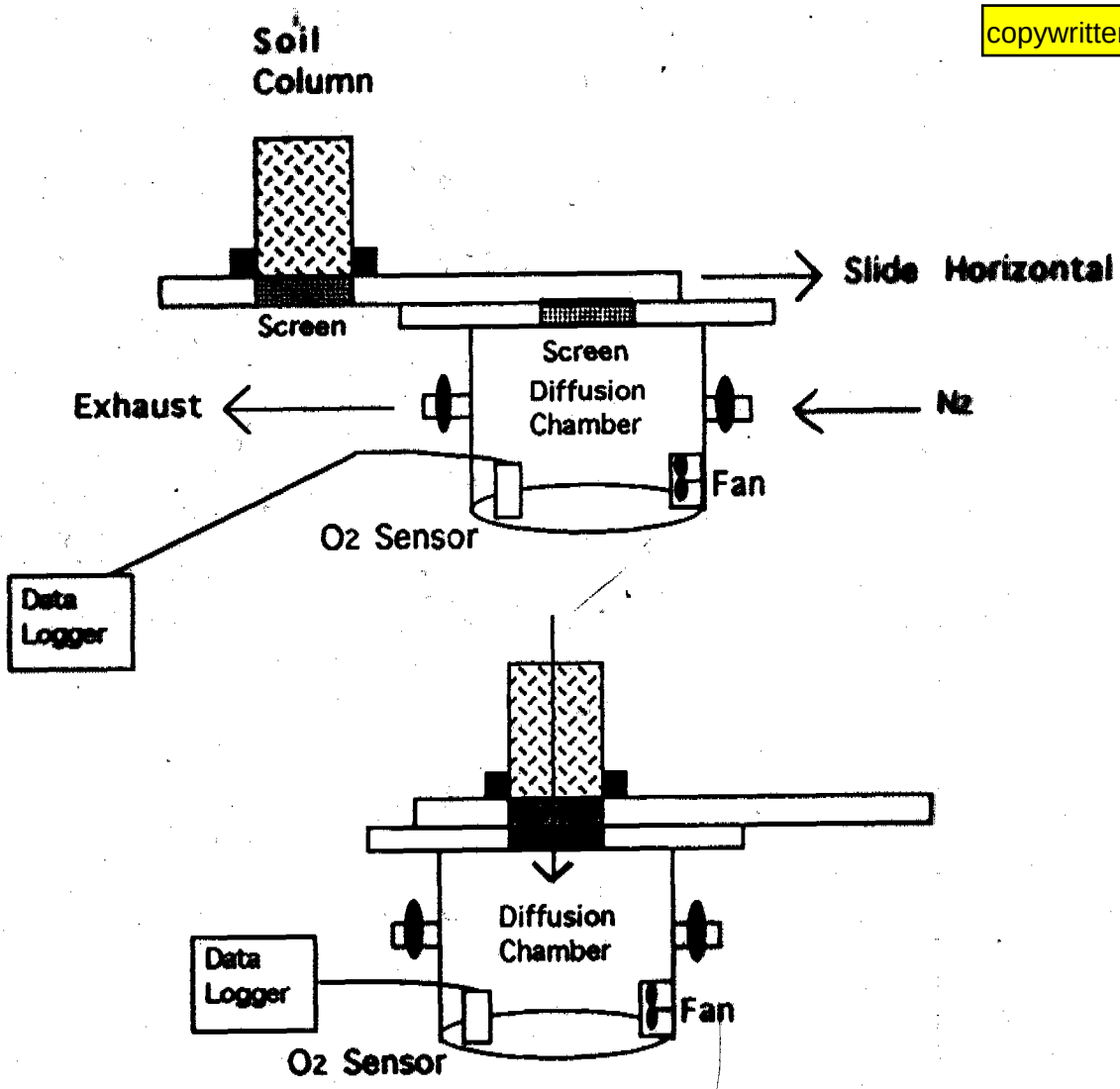


Fig. 29. Schematic of laboratory soil diffusion apparatus.