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Microbial methane oxidation assessment and characterisation in bench-scale landfill bioreactors

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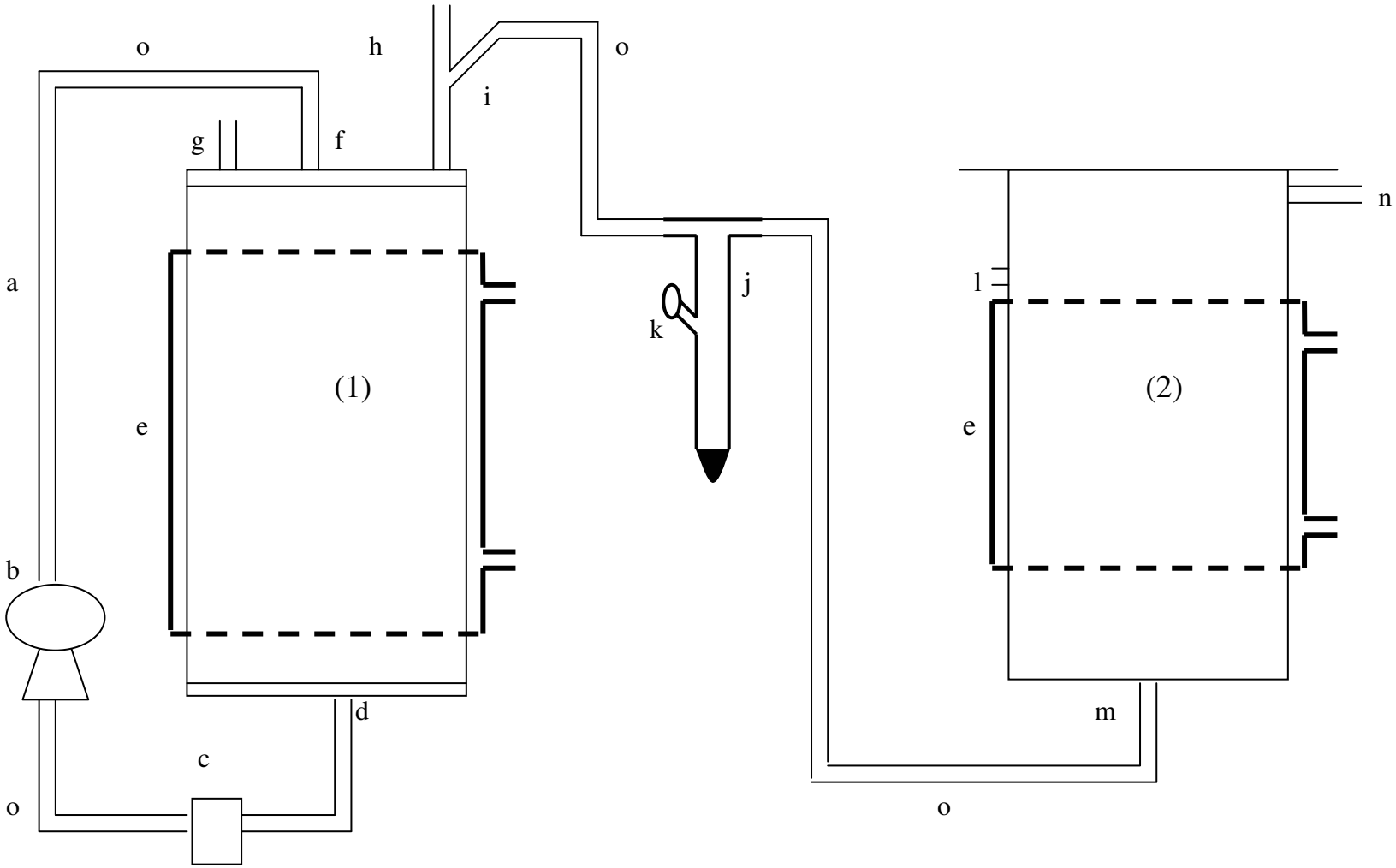


FIGURE 2.1.1. Schematic diagram of the setup of the landfill bioreactor. (1) Anaerobic phase, (2) Aerobic phase. a) leachate recycling pipe, b) peristaltic pump, c) leachate sampling and dilution port, d) leachate outlet, e) water jacket, f) leachate inlet, g) manometer outlet, h) additional gas measurement outlet, i) methane outlet, j) gas trap, k) gas sampling port, l) air inlet, m) methane inlet port, n) gas volume measurement outlet, o) Tygon piping.

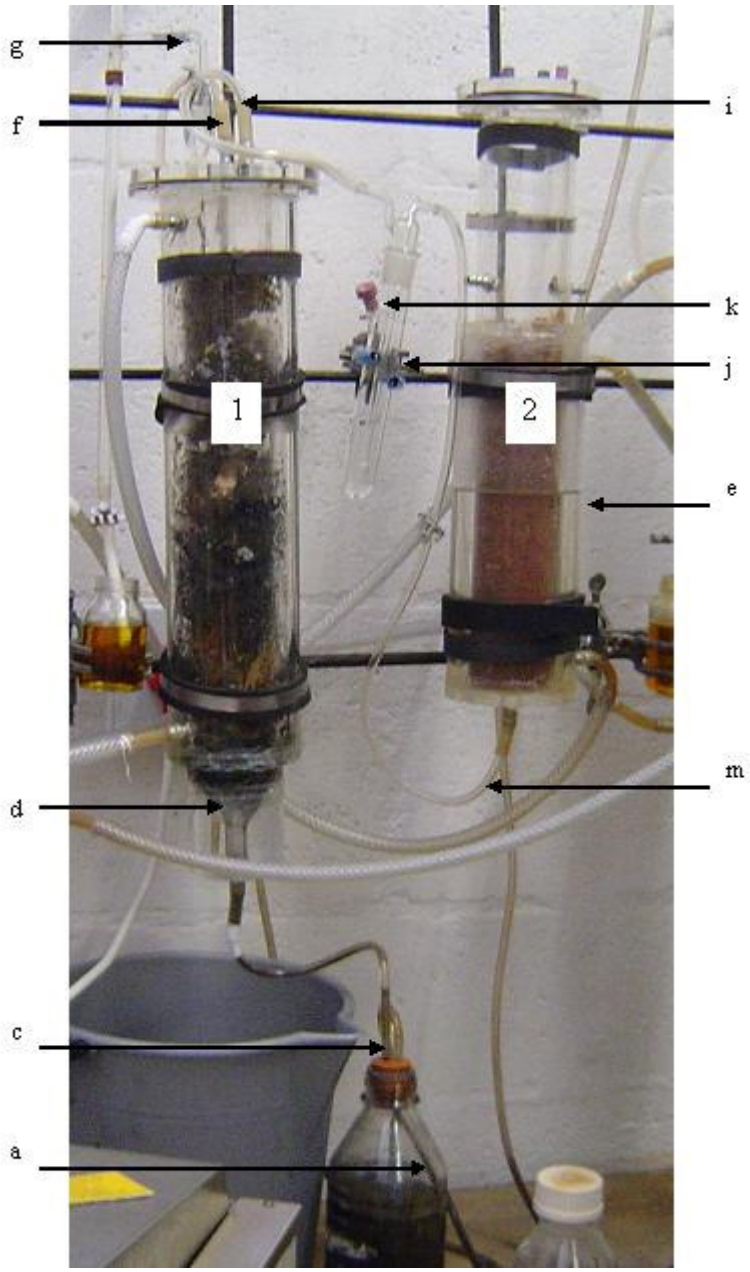


Figure 2.1.2. Anaerobic (1) and Aerobic (2) phases representing the MSW waste and landfill cover soil components, respectively.

Table 2.1.1. Composition of refuse used as the MSW fraction in this study

COMPONENT	% BY WET WEIGHT	SUB-COMPONENT
Paper	13.30	Cardboard
		Newspapers/
		Directories
		Magazines
		Office paper
Textiles	5.09	Brushed nylon
		towelling
		other
Plastics	7.64	Shopping bags
		Bottles (Ace)
		Bottles (Coca-Cola)
		Perspex
Metals	6.36	Aluminium cans
		Lathe shavings
		Off-cuts
Putrescibles	24.05	Meat, bones, bread
		Grass, fruit / veg.
		Mixed garden waste
		Rice, noodles, oats
Other	11.91	Polystyrene, wax, leather
		Batteries, tyres, soap
Glass	6.62	
Ash	25.04	

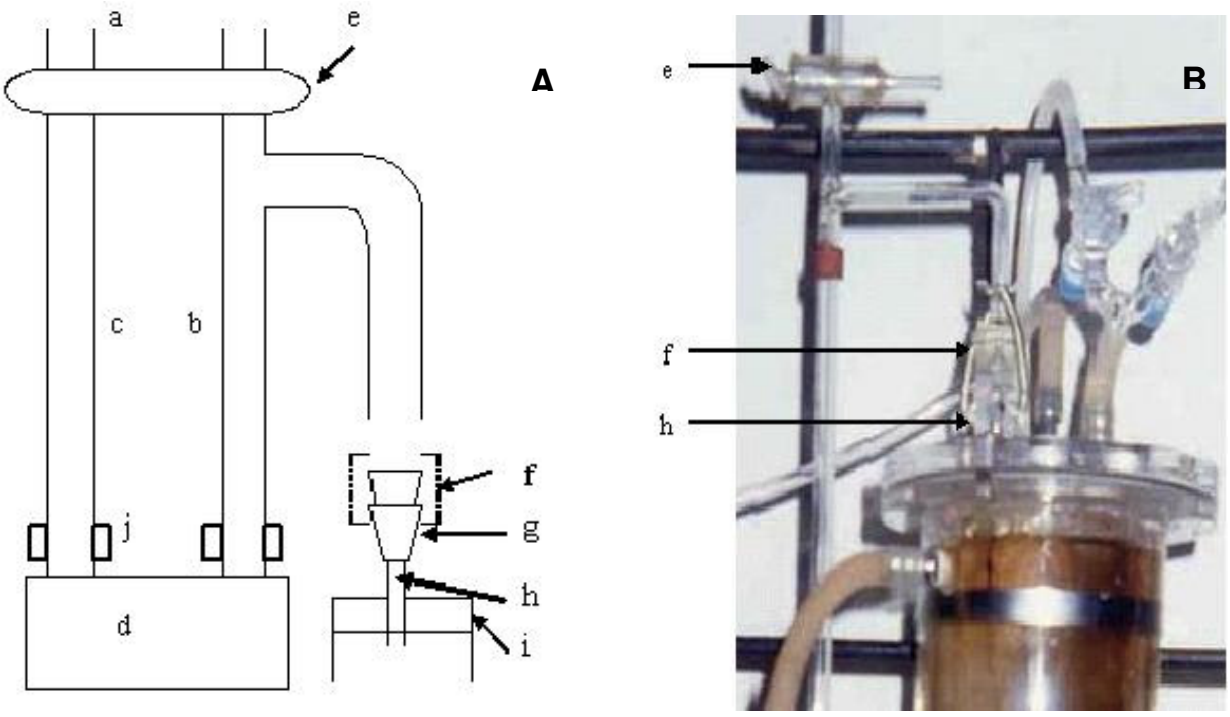


Figure 2.1.3. Schematic diagram illustrating the pressure manometer (A) and corresponding photograph (B): a) Linseed oil inlet capillary b) Second capillary tube, c) manometer arm with linseed oil, d) Clamped Tygon piping to hold the oil reservoir, e) 3 – way tap, f) spring with clamps, g) ground glass, h) ground glass tube location in solid Perspex cap, i) solid Perspex cap (anaerobic reactor), j) clamps for manometer support.

Table 2.1.2. Morphological characteristics of the anaerobic reactor leachate

Morphological characteristic	**Week 0 (Run start)**	**Week 1**	**Week 2**	**Week 21 (Run end)**
Leachate colour	opaque	Murky brown	Clear yellow	Clear yellow
Waste height	40 cm	38 cm	37 cm	31 cm
Additional – slime formation	None	Black slime on upper inner walls	Black slime is more pronounced	Black slime has completely dried on inner walls
Anaerobic indicator strip	Pink (aerobic)	White (anaerobic)	White (anaerobic)	White (anaerobic)

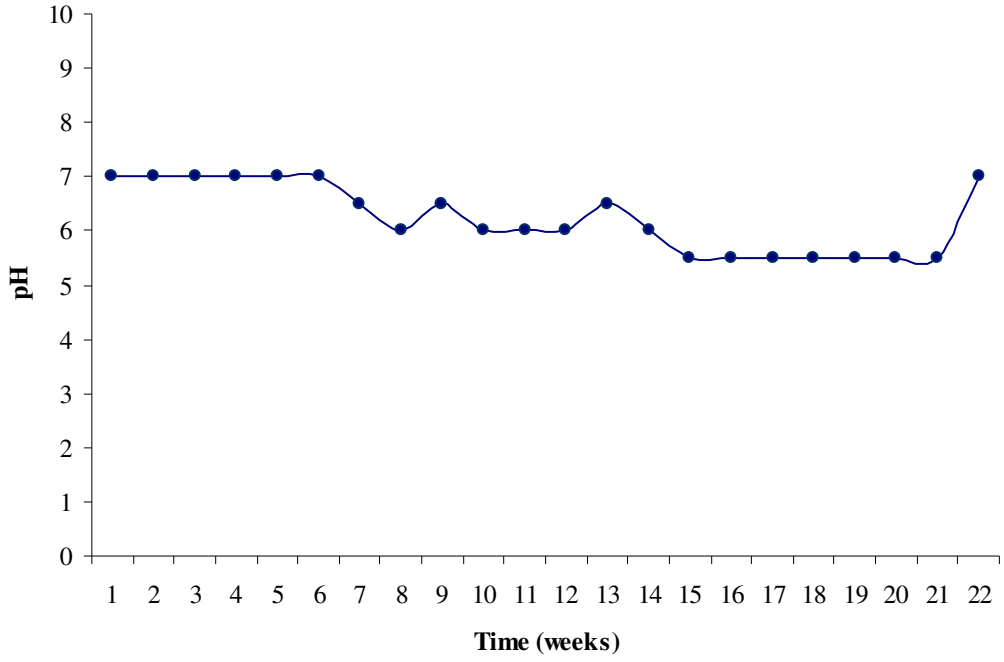


Figure 2.1.4. pH profile of leachate from the anaerobic reactor showing pH changes over a 21 week period.

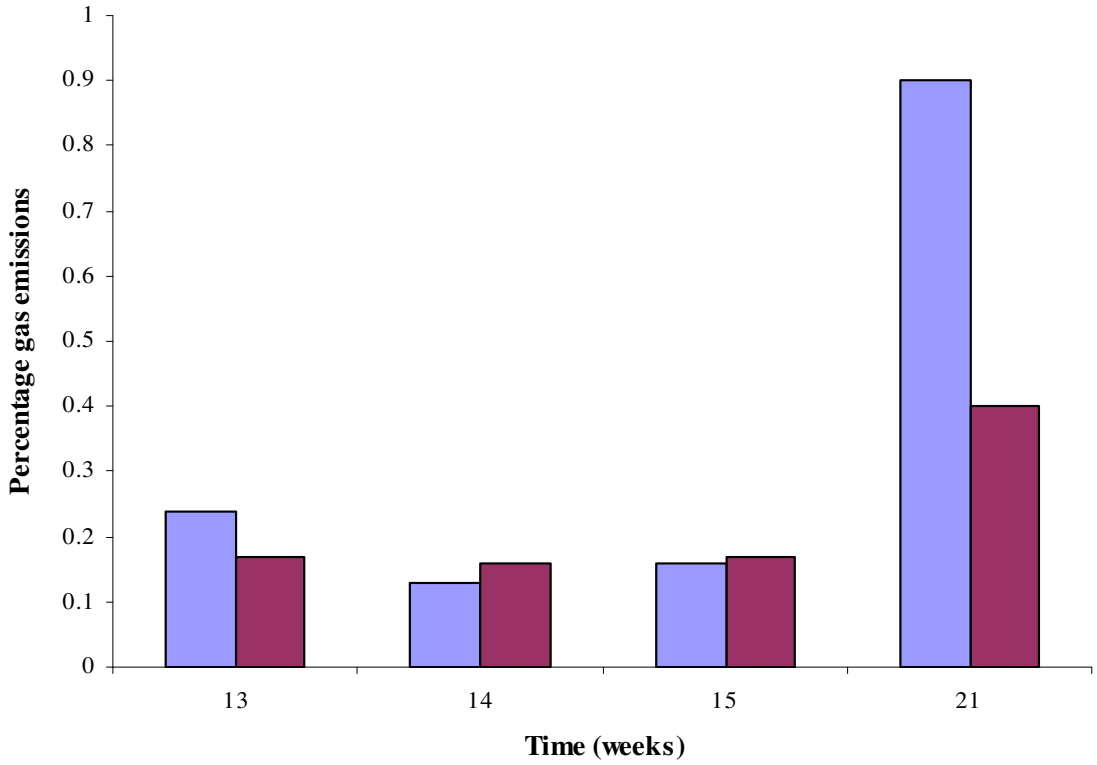


Figure 2.1.5. Gas emission profile of the anaerobic reactor showing methane (CH_4) and carbon dioxide (CO_2) levels over a 21 week period.