Title

MONTHLY PROGRESS REPORT FOR MARCH. OIL SHALE WASTE TREATMENT: FUNDAMENTAL APPROACHES

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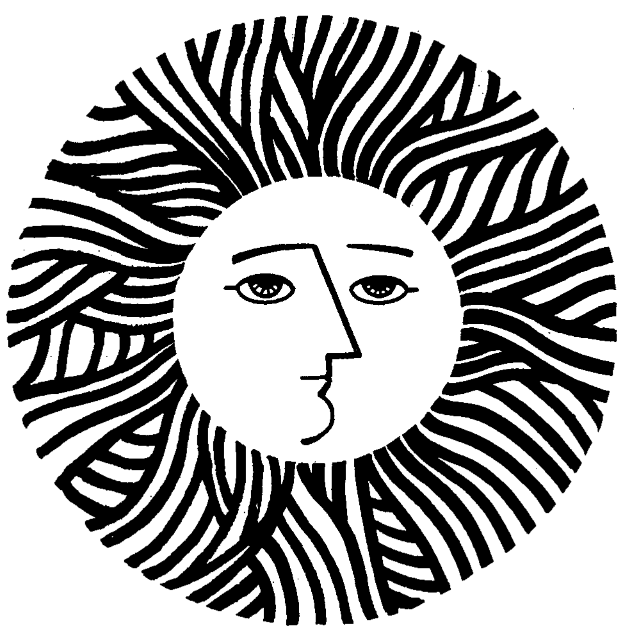

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TASK 1. ANALYTICAL METHODOLOGY

Ozone Determination

To verify the quantity of ozone production and to quantitate the amount of ozone that is being consumed or decomposed during retort water pretreatment experiments, the ozone determination method from Standard Methods, 15th edition, was followed. Samples of gas from either the ozone generator or from the reaction vessel were bubbled through a 20-g/L solution of potassium iodide. The ozone reacts quantitatively with the iodide to produce iodine which is then titrated with 0.005 N sodium thiosulfate; the mass of ozone in the gas phase can be calculated from the volume of titrant required. The ozone production rate from an Aqueonics 1T Ozone Generator (Aqueonics Division, ARCO Environmental, Inc., Dublin, CA) was found to be within specifications; we found, however, that a 30-minute warm-up period was required for consistent ozone production when the feed gas was oxygen.

TASK 2. BIOLOGICAL TREATMENT OF PROCESS WATERS

Enrichment Studies

The enrichment studies from February were continued. On the basis of cell counts, the four most promising cultures were selected and monitored for removal of DOC from Oxy-6 spent retort water. Two of these cultures, one derived from an inoculum of activated sludge and the other from soil exposed to retort water, showed negligible DOC removal (less than 20 mg/L). The remaining two cultures, both derived from a domestic compost inoculum, removed 90 and 100 mg/L of DOC. These removals are somewhat lower than those achieved in the previous enrichment study (January 1982 monthly report). The remaining 37 cultures were pooled and are being maintained for future work.

TASK 3. PHYSICOCHEMICAL TREATMENT OF PROCESS WATERS

Steam Stripper

Plumbing of the 6-kW, 240-V circulation heater (steam drier) was completed early this month. The present steam generation unit is now being tested. Startup and operational procedures are being developed and documented.

The excessive condensation we had observed in the bottoms collector was eliminated during a 30-minute test run. Three factors contributed to this improved performance. (1) Additional insulation of the steam generator raised its maximum operating temperature to 120 °C (an increase of 5 °C); insulation was also added to the reactor column, bottoms collector, and steam lines. (2) The steam drier temperature was increased to 190 °C. (3) The cooling system of the overheads condenser was operated with gradual additions of cool make-up water (2.4 L per minute when solenoid activated; controller set for 105 °C).

A ratio of overheads to bottoms volumes of approximately 13:1 resulted from these modifications. The operating temperatures of the various units were fairly stable; the bottoms temperature varied between 106.2 and 107.2 °C, and the overheads temperature between 103.6 and 104.0 °C. Even without use of the cooling system, a stable temperature differential of approximately 2 °C between the overheads and bottoms was maintained, an indication that the system was operating as designed; system pressure was between 1.5 and 2 psig. Evacuation of air from the system by imposing a vacuum or by physical displacement with water followed by draining proved unnecessary to achieve this level of operation. Rapid cooling of the system on shutdown, however, resulted in a residual system pressure of approximately one inch of mercury. This indicated the presence of residual air in the system which may have to be removed for optimal performance of the steam stripper. We will continue to modify operational parameters to achieve optimum performance of the steam stripper before experimental samples are run.