Title

OCTOBER MONTHLY PROGRESS REPORT - SPENT SHALE AS A CONTROL TECHNOLOGY FOR OIL SHALE RETORT WATER

Author

Fox, Phyllis.

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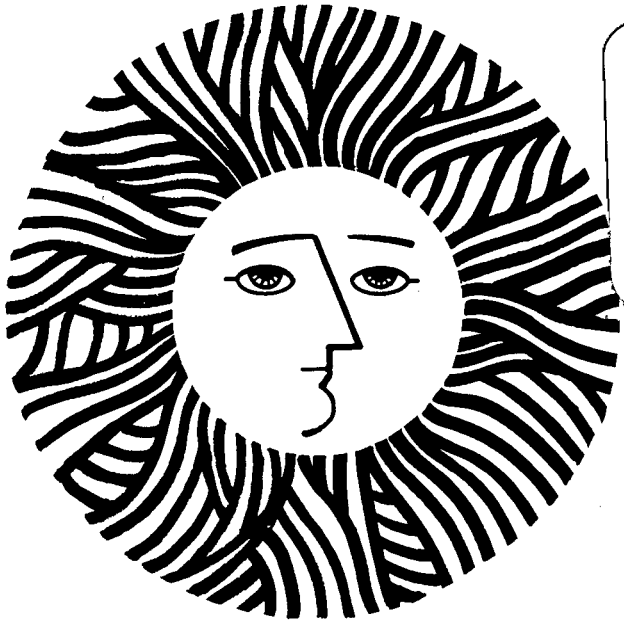
Lawrence Berkeley Laboratory
UNIVERSITY OF CALIFORNIA

ENERGY & ENVIRONMENT DIVISION



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LAWRENCE BERKELEY LABORATORY
Room: 128 Bldg.: 70 Ext.: 6698

November 14, 1979

TO: Charles Grua

FROM: Phyllis Fox

RE: October Monthly Progress Report
Spent Shale as a Control Technology for Oil Shale
Retort Water
LBID-138

The purpose of this program is to explore the use of spent shale for the treatment of oil shale retort waters. Previously, batch and continuous-flow column experiments were conducted which demonstrated that spent shale reduces the organic carbon, inorganic carbon, conductivity, color and odor and elevates the pH of retort waters. This result suggested that spent shale may be suitable for use in a treatment system that includes oil and grease removal, air stripping and a biological treatment step. The pH elevation would convert NH_4 to NH_3 which could then be readily removed by air stripping. Removal of inorganic carbon and ammonia would lower the buffering capacity of the water, reducing the acid required to control the water's final pH, and organic carbon removal would decrease the BOD load on any subsequent biological treatment process. Based on this result, work has been initiated to incorporate spent shale columns in a complete treatment system that includes oil and grease removal, ammonia stripping and biological treatment.

Task 2. Batch Studies

During October, equilibrium batch adsorption studies using TOSCO II spent shale and 150-ton and Omega-9 retort water were initiated. The purpose of these experiments is to determine the time required for these shale-water combinations to reach equilibrium so that isotherms can be generated and used to design columns. These experiments were conducted under a N_2 atmosphere to determine if atmospheric CO_2 affects results. Thirty g of TOSCO II spent shale were contacted with each water for 0, 0.25, 1, 2, 3 and 8 days and the supernatant was analyzed for conductivity, pH, inorganic carbon and organic carbon. Data reduction and analysis is in progress.

Experiments were conducted to determine the effect of the parafilm tape used to seal flasks in the batch adsorption studies. This work indicated that organic carbon is leached from the parafilm tape and may increase the organic carbon of the supernatant. This means that effluent organic carbon concentrations may be lower than previously reported and that the percent reduction in organic carbon may be larger. Tygon tape seals have been substituted for the parafilm seals.

Task 3. Physical Properties and Pretreatment

Oil and grease removal is being investigated as a pretreatment step for spent shale adsorption columns. A large number of polymers were previously tested, and it was found that high dosages, about 200 mg/l, were required to affect any reduction in oil and grease content of retort waters. This result led to the investigation of the composition of oil and grease in retort waters. These studies have indicated that the oil and grease measured in retort waters by the standard analytical method includes about

25 mg/l of mineral oil and variable and much higher amounts of dissolved carboxylic acids. The only fraction that is significant from a treatment standpoint is the mineral oil fraction which should be removed and/or recovered. Work is in progress to develop an analytical method to rapidly and accurately measure mineral oil and grease in retort waters so that the performance of treatment processes may be assessed.

Task 5. System Studies

Design and construction of continuous-flow activated sludge units and trickling filters is under way. Acclimation of a batch activated sludge reactor is continuing. A retort water and domestic sewage mixture supplemented by nutrients is being added to the reactor daily. The quantity of domestic sewage is being reduced by 10% V/V increments. Preliminary results indicate that the pH is elevated in the aeration basin due to removal of CO_2 and that pH control is necessary to achieve satisfactory organic reductions.

TECHNICAL INFORMATION DEPARTMENT
LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA 94720