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SPECIAL RE-REVIEW

FINAL DETERMINATION

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BY J.P. Strain DATE 7-13-81

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DEVELOPMENT TEST 105-558-B

EVALUATION OF HIGH Na₂O NEUTRALIZATION IN ACTIVATED SILICA PREPARATION

OBJECTIVE

The purpose of this Development Test is to establish the practicability of continuous activated silica production at greater than 92 per cent Na₂O neutralization (with subsequent short aging times).

BASIS AND JUSTIFICATION

Present specifications for activated silica preparation require neutralization of less than 92 per cent of the initial alkalinity of a dilute solution of sodium

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silicate by mixing with dilute sulfuric acid. The concentration of the resulting activated silica solution is not to exceed 1.6 per cent SiO_2 by weight. This activated silica preparation is presently carried out as batch process with aging times on the order of one hour.

New equipment proposed by the Design Section for the preparation of activated silica utilizes neutralization of up to 96 per cent of the initial alkalinity of the sodium silicate. This high percentage of neutralization results in gel times shorter than fifteen minutes. With the proposed equipment, activated silica can be prepared on a continuous basis whenever desirable, and can be fed immediately to the process water or stored for subsequent use. Substantial savings in equipment cost, and probably in installation costs as well, can be realized from use of the proposed equipment. Further savings are possible from reduced maintenance costs. In addition, the proposed equipment should be simpler to operate than present systems, and should be easier to maintain in operating condition. Evaluation of activated silica prepared with up to 92 per cent neutralization has been carried out on a plant scale, with satisfactory results.⁽¹⁾ The performance characteristics of activated silica prepared with greater than 92 per cent neutralization are not expected to be appreciably different from 92 per cent neutralized silica, but a plant scale evaluation has not been made using silica with this percentage neutralization.

SCHEDULE

Desired Starting Date: Upon approval of this development test.

Estimated Completion Date: Approximately two months from the start of this test.

Area: 100-C

COSTS

Cost Code: XXX-5730-253.62 as per "Procedures".

Reactivity: None

Maintenance Unit: About 12 manhours. Required to perform piping modifications as per "Procedures".

Shutdown Time: None

Elevator Time: None

PROCEDURES

The present pipeline which feeds dilution water to the outlet chamber in the baffled aging tank will be modified to permit addition of dilution water to the inlet chamber in the same tank. A portable mixer will be attached to this tank to mix the solutions entering the inlet chamber, if initial operation under this test indicates the desirability of mixing at this point.

(1) Woods, W. C. A., "Final Report, The Use of Alum and Activated Silica for 100 Area Process Water Coagulation", HW-37698, (Report to be issued 7/15/55)

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Activated silica will be prepared and added to 100-C process water according to the following specifications:

1. Sodium silicate will be diluted with water to a concentration less than 2.0 per cent SiO_2 by weight prior to being mixed with sulfuric acid.
2. Sulfuric acid will be diluted with water to a concentration less than 5 per cent by volume before being mixed with sodium silicate.
3. Following the mixing of the sodium silicate and sulfuric acid solutions:
  - a. The concentration of SiO_2 by weight shall not exceed 1.8 per cent.
  - b. The per cent of the Na_2O neutralized shall be from 92 to 96 per cent.
4. The activated silica shall be aged for from 25 to 50 per cent of its gel time prior to dilution.
5. The activated silica shall be added continuously to the raw water inlets of the 183-C Building in the concentration required to maintain water quality, with a minimum concentration of 1 ppm during the period of this test. The costs incurred in adding silica during periods of this test when it would not otherwise be required will be borne by Pile Technology Process Assistance Code.

The high percentage of Na_2O neutralization will result in gel times for the activated silica of 30 minutes or less. Therefore, aging of the mixed acid and silicate solution must be accurately timed, and the aged solution must be moved rapidly to the dilution tank.

Caution: If the mixed acid-silicate solution is aged for too long a time before dilution, the solution will gel in the equipment, necessitating messy, time-consuming clean-up work. For this reason, whenever preparation of the activated silica is to be discontinued, even for short periods of time, or when faulty equipment operation interrupts the activated silica preparation, all of the equipment must be flushed immediately with water to remove the solution from the lining of tanks, valves, etc.

SPECIAL INSTRUCTIONS

Abnormal Hazards: None

Special Adjustments to Pile Equipment: None

Data Desired: Daily averages of aluminum sulfate and activated silica feed rates will be required for each side of the water plant. The average methyl orange alkalinity, per cent SiO_2 , and observed gel time during the preparation of each batch of activated silica will be supplied to Pile Materials Sub-Section (Pile Coolant Studies Unit) by the Power Sub-Section. Pile Penallit deviation data should be furnished to Pile Materials Sub-Section by Operations Sub-Section.

Special Equipment: Approximately three feet of additional piping will be connected into the water line used for dilution of aged silica in the 183-C Building. A portable mixer may be installed on the present silica aging tank.

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RESPONSIBILITY

Reactor Section: The 100-C Operations Unit will be responsible for all scheduling, slug charging and discharging, recording of process data, operational safety and production continuity of the pile.

100-C Power Unit will be responsible for all water treatment operations.

Pile Technology Section: R. B. Richman, Pile Coolant Studies Unit, will be responsible for technical advice and assistance concerning the test, evaluation of data and preparation of reports.

R. B. Richman
Pile Coolant Studies
Pile Technology Section
ENGINEERING DEPARTMENT

RB Richman:maj

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Date of Issue 7/14/55

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