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SIZING OF SUB-SIEVE MICA BY ELUTRIATION

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by

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GENERAL INTRODUCTION

The mica industry of North Carolina markets a variety of mica products to satisfy the demands of its customers. These products possess unique characteristics such as brightness, sheen, and low bulk density not found in other industrial minerals. Techniques for enhancing these properties have been developed throughout the years, and methods for improving procedures or developing new products are continuously being sought.

Following the writer's presentation, "Mica Concentration by Rising Current Elutriation and Screening," [1] at a meeting of the Wet Ground Mica Association, the need for additional products in the sub-sieve range was discussed. It was felt that a variation of the procedure as presented might be effective for separating sub-sieve mica into products having restricted size ranges; however, there was some doubt as to the commercial application of the procedure.

The primary objective of this project was to ascertain the feasibility of the process. After preliminary investigation on a batch scale, a continuous unit was assembled and proved satisfactory for producing two products decidedly different in texture and bulk density.

SAMPLE

The test material consisted of a fine ground mica product produced with a fluid energy mill and obtained from a North Carolina industry.

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[1] Lewis, Robert M., "Mica Concentration by Rising Current Elutriation and Screening." Presented at the Wet Ground Mica Association Meeting, Grove Park Inn, Asheville, North Carolina, May 11, 1971.

BATCH TEST

Introduction

The initial phase of the project was directed towards batch separation to develop data on particle behavior and determine velocities required for desired particle size separation.

Procedure

For this test, 200 grams of mica was placed in the bottom of the plexiglass column and a Denver vertical pump used to maintain an upward flow of water through the elutriation column. A Flowrator valve was used to regulate the volume or velocity of water which transported the finer sized mica up the column and into the overflow. The overflow material was retained in 600 ml beakers, filled in succession, to check the operation of the elutriation unit. A valve located at the bottom of the column was opened at the conclusion of the test, and the coarse settled mica recovered. The products were dried and evaluated. A sketch of the apparatus is shown in Figure 1.

Results

Using a water velocity of 0.10 ft/min, 80.7% of the mica (fine size), with a 79.0% color reflectance reading and a 14.1 lb/cu ft bulk density, was recovered in the overflow. The settled material, constituting 19.3% of the mica, had a 72.0% color reflectance reading and a 16.4 lb/cu ft bulk density.

CONTINUOUS-FLOW TEST

Introduction

The data derived from the batch test was useful for designing a continuous-flow elutriation apparatus. This unit was assembled so that

a mica slurry could be beneficiated in a separating device without interruptions for retrieving products. The unit was not intended as the ultimate in design but was for the purpose of demonstrating technique.

Procedure

For this test, 200 grams of mica was mixed with 2 gallons of water. The slurry was poured into a Denver vertical pump which was used to keep the mica dispersed and impel the material through the classification unit. The apparatus consisted of an enclosed plexiglass hopper with sloped bottom tangential to direction of flow. During operation, this hopper was completely filled with mica slurry. The hopper was used to steady the flow of slurry and create hindered settling before being subjected to elutriation. An elutriation column was located on top of the hopper at the downstream end. A valve on this column was used to control the upward flow of mica slurry to the overflow. A valve located on the bottom of the hopper at the downstream end was used to control the discharge of settled material. A sketch of this apparatus is shown in Figure 2.

Results

Using a water velocity of 0.10 ft/min, 42.0% of the mica (fine size), with a bulk density of 13.0 lb/cu ft, was recovered in the overflow. This material had good sheen and slip (term used to describe slippery feeling when rubbed between fingers). The underflow constituted 58.0% of the mica, had a bulk density of 16.2 lb/cu ft, a dull earthy appearance, and was lacking in slip.

CONCLUSIONS AND DISCUSSION

Elutriation and hindered settling techniques can be used for batch or continuous processes to separate sub-sieve mica concentrate into

products possessing diverse physical characteristics.

A scale-up of this technique would indicate an elutriation column with approximately 75 sq ft of water-surface area for each ton per hour of feed.

Electron microscopic photography of fine-ground mica products obtained from several mica producers reveal spherical shaped particles and minute flakes of material adhering to mica. It is possible that some of this material is an alteration product such as clay and could be removed after the final grinding phase. If this is so, a beneficiation stage, such as elutriation, following final grind would be advantageous for removing the spherical particles and thereby improving the sheen and slip characteristics. There is a possibility of removing the fine size flakes in an additional elutriation stage with a reduced flow rate.

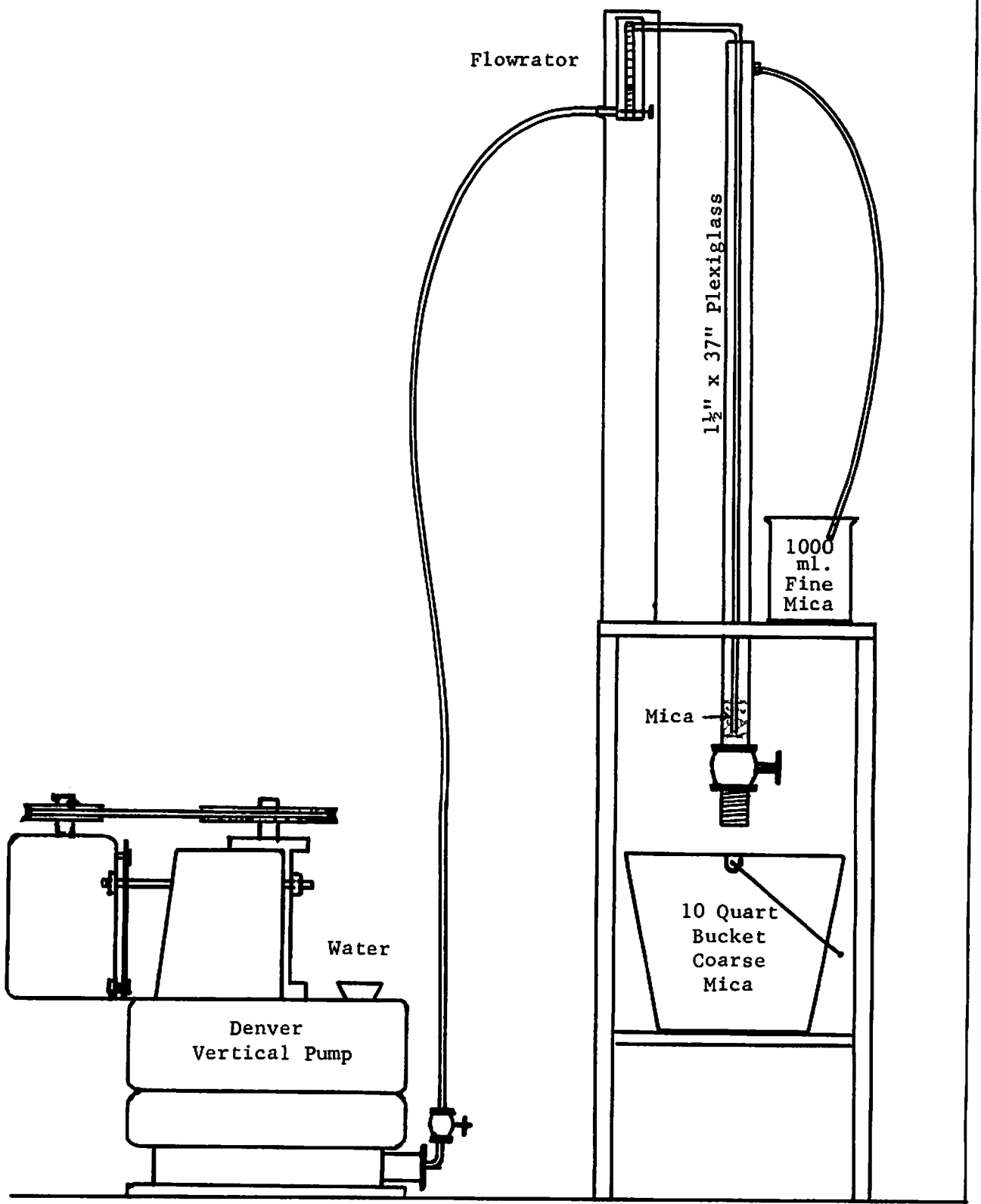
Flowrator
1½" x 37" Plexiglass
1000 ml. Fine Mica
Mica
10 Quart Bucket Coarse Mica
Water
Denver Vertical Pump
ELUTRIATION APPARATUS
BATCH TEST
Scale: 1/8"=1" 12/20/71

Figure 1

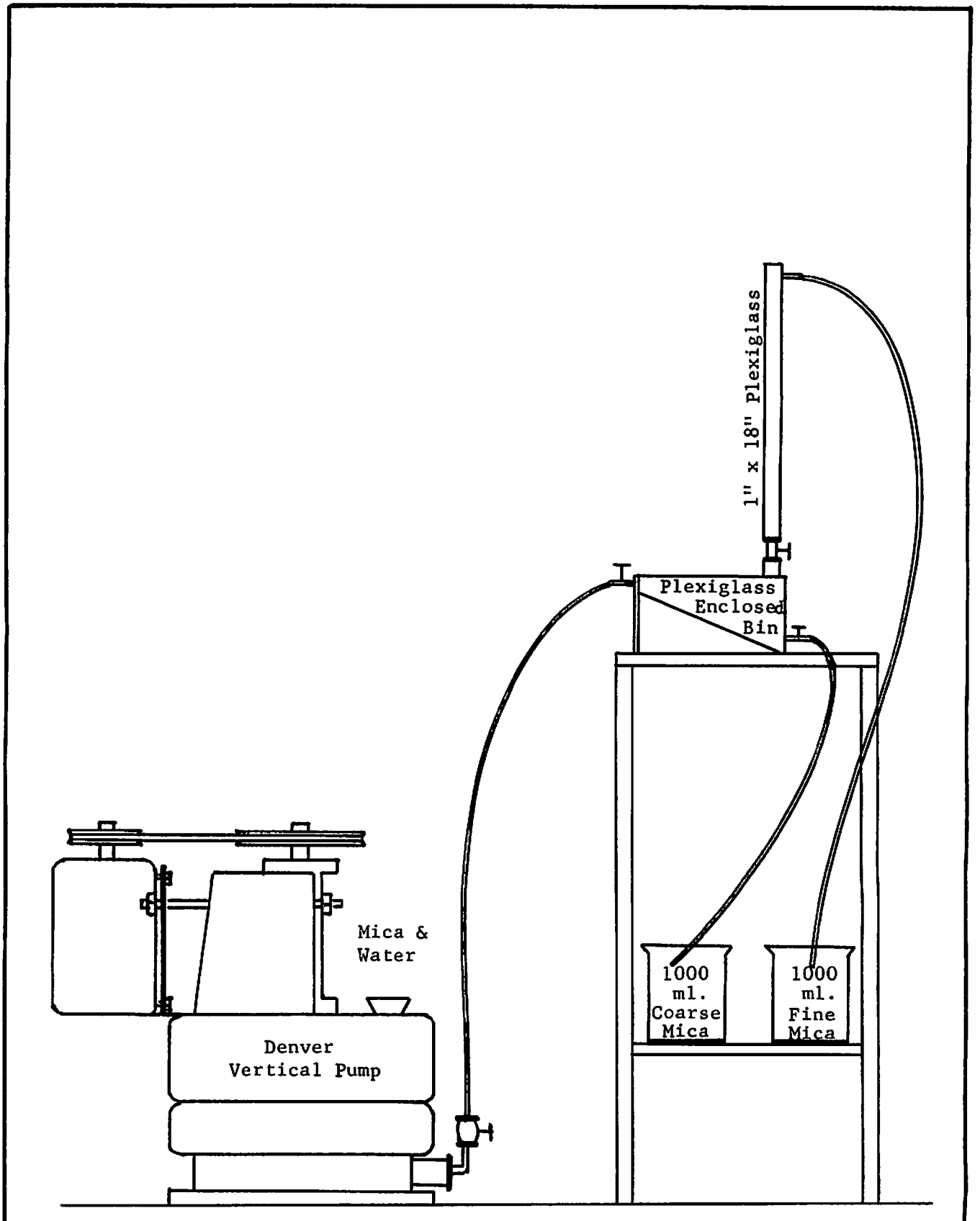
1" x 18" Plexiglass
Plexiglass Enclosed Bin
Mica & Water
Denver Vertical Pump
1000 ml. Coarse Mica
1000 ml. Fine Mica
ELUTRIATION APPARATUS
CONTINUOUS FLOW TEST
Scale: 1/8"=1" 12/20/71

Figure 2