

ATTRITION OF MOLECULAR SIEVE PARTICLES

UOP Method 438-81

SCOPE

This method is for determining the tendency of molecular sieve particles to abrade.

OUTLINE OF METHOD

A representative sample is placed on either a U.S.A. Series No. 50 or 60 sieve along with ten United States one-cent pieces, or copper disks of equivalent size and weight. The sieve is covered, placed in a sieve shaker and shaken for 30 minutes. The percent of material passing through the sieve is calculated. A second sample is placed on the No. 50 or 60 sieve without the disks, shaken for 30 minutes, and the percent of material passing through the sieve calculated. The weight percent attrition is calculated by subtracting the percent of material passing through the sieve when no disks are added from the percent passing through the sieve when the disks are added.

APPARATUS

Balance, triple-beam, 0.01 g sensitivity, available from Sargent-Welch Scientific Co., or equivalent

Brush, 2-inch wide, paint brush with natural or nylon bristles cut to 1-inch length, or equivalent

Copper disks, U.S. one-cent pieces, or copper disks of equivalent size and weight, (3.1 g, one-millimeter thick, 19-mm diameter), 10 required

Riffler, Sepor "Micro-Splitter" designed for sample volumes of one-liter or less, available from Sepor Laboratory Supply, or equivalent

Sieve, 8-inch diameter, U.S.A. Series Nos. 50 and 60, with cover and two bottom pans (ASTM E-11 Specification), available from W.S. Tyler, Inc., or equivalent

Sieve-shaker, W.S. Tyler "Ro-Tap", with timer, available from W.S. Tyler, Inc., or equivalent

PROCEDURE

The sieve mesh size chosen depends on the nominal mesh size of the molecular sieves to be tested. A 20-40 mesh molecular sieve requires the use of a No. 50 sieve, whereas a 30-50 mesh molecular sieve requires a No. 60 sieve.

IT IS THE USER'S RESPONSIBILITY TO ESTABLISH APPROPRIATE PRECAUTIONARY PRACTICES AND TO DETERMINE THE APPLICABILITY OF REGULATORY LIMITATIONS PRIOR TO USE. EFFECTIVE HEALTH AND SAFETY PRACTICES ARE TO BE FOLLOWED WHEN UTILIZING THIS PROCEDURE. FAILURE TO UTILIZE THIS PROCEDURE IN THE MANNER PRESCRIBED HEREIN CAN BE HAZARDOUS. MATERIAL SAFETY DATA SHEETS (MSDS) OR EXPERIMENTAL MATERIAL SAFETY DATA SHEETS (EMSDS) FOR ALL OF THE MATERIALS USED IN THIS PROCEDURE SHOULD BE REVIEWED FOR SELECTION OF THE APPROPRIATE PERSONAL PROTECTION EQUIPMENT (PPE).

A. Nest the U.S.A. No. 50 or 60 sieve on the bottom pan. Place approximately 50 mL of a carefully riffled sample on the top of the sieve, along with 10 copper disks. Cover and place in the sieve shaker. Adjust the shaker to properly hold the set. Shake for 30 minutes and remove the sieve from the shaker. Remove the disks and carefully dump the material retained on the sieve into a separate bottom pan by inverting the sieve over the pan. Brush the underside of the sieve to remove material lodged in the mesh. Weigh the material to the nearest 0.1 g and record as the weight of material retained on the sieve. Obtain the weight of the material in the bottom pan.

B. Place approximately 50 mL of another portion of carefully riffled sample on the nested U.S.A. No. 50 or 60 sieve. Do not add copper disks. Cover and place in the sieve shaker. Shake for 30 minutes and remove the sieve from the shaker. Carefully dump the material retained on the sieve into a separate bottom pan by inverting the sieve over the pan. Brush the underside of the sieve to remove material lodged in the mesh. Weigh the material to the nearest 0.1 g and record as the weight of material retained on the sieve. Obtain the weight of the material in the bottom pan.

CALCULATIONS

Calculate the weight-percent, C, of the original sample *through* the U.S.A. No. 50 or 60 sieve (*PROCEDURE B*) as follows:

$$C, \text{ wt-\%} = \frac{X \ 100}{Y}$$

where:

C = material through U.S.A. No. 50 or 60 sieve with no attrition, wt-%

X = material through the U.S.A. No. 50 or 60 sieve, g

Y = total material recovered, g

Calculate the weight-percent attrition as follows:

$$\text{Attrition, wt - \%} = \frac{A \ 100}{B} - C$$

where:

A = material through U.S.A. No. 50 or 60 sieve after attrition, g

B = total material recovered after attrition, g

C = previously defined

PRECISION

Based on the mean range from six duplicate samples, the estimated standard deviation (esd) for attrition at the 0.7 wt-% level was calculated to be 0.069.

Duplicate results should not differ by more than an allowable difference of 0.25 (95% probability).

TIME FOR ANALYSIS

The elapsed time for one analysis is 1.30 hours. The labor requirement is 0.58 hour.

SUGGESTED SUPPLIERS

Sargent-Welch Scientific Company, 7300 N. Linder Ave., Skokie, IL 60076

Sepor Laboratory Supply, P.O. Box 1252, 718 N. Fries, Wilmington, CA 90744

W.S. Tyler, Inc., 8200 Tyler Boulevard, Mentor, OH 44060