

APPARENT BULK DENSITY OF SOLID PHOSPHORIC ACID CATALYST

UOP Method 762-76

SCOPE

This method is for the determination of the apparent bulk density of solid phosphoric acid catalyst having a particle size range of 3/16 - to 5/16-inch in diameter and 3/16- to 1/2- inch in length.

OUTLINE OF METHOD

A cylindrical container of known volume is filled with catalyst under specified conditions. The catalyst weight is determined. The catalyst weight is divided by the volume and the resulting quotient is reported as the apparent bulk density of the catalyst.

DEFINITION

Apparent bulk density (ABD) is defined as weight per unit volume. In this method the units used are grams per milliliter (g/ml). Apparent bulk density is an empirical value, dependent upon and variable because of certain dimensional elements of the apparatus used for conducting the test.

APPARATUS

Balance, triple beam; capacity, 2610 g; sensitivity, 0.05 g; scale divisions, 0.1 g

Cylindrical container. Construct a container from plastic tubing 88.5 mm (3.5 inches) ID with approximately a 6 mm wall thickness. Plug one end with a plastic disk and cut the tubing to give an inside height of 152.5 mm (6 inches). Calibrate the container in milliliters and report the volume to the nearest 0.1 ml.

Container cover. Construct a cover with ID to equal the container OD plus 1 mm with an inside height of 41.3 mm (1-5/8 inches). (A snug fitting cover with the same approximate height is acceptable.)

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).

PROCEDURE

Fill the tared cylindrical container in increments of 1/4 of the total volume with a representative sample of catalyst. After each incremental catalyst addition, tap the container lightly on an inverted No. 12 rubber stopper 25 times to settle the catalyst. Discard clustered pieces and pieces of abnormal size.

After adding the last 1/4 increment of catalyst and after subsequent adjustments of the catalyst level, place the cover over the cylinder and hold in place securely while tapping on the rubber stopper. After the cylinder has been filled and tapped, adjust the level and tap an additional 25 times. Again adjust the level and tap 25 times. Finally, at this point the catalyst bed should be level with the cylinder top. But to compensate for the visible voidage, inherent with the large catalyst diameter, adjust the level to provide for only a few pieces above the cylinder top by not more than one-half the catalyst diameter.

Weigh the contents of the cylinder to the nearest 0.1 g and determine the weight of the catalyst.

Combine all the catalyst sample and repeat the preceding routine twice more.

CALCULATIONS

Average the three weights of the catalyst to the nearest 0.1 g. Calculate the ABD as follows:

$$ABD = \frac{W}{V}$$

where:

W = average weight of catalyst, g

V = volume of cylindrical container, ml

Report the ABD to the third decimal place.

PRECISION

Duplicate ABD measurements, each of which is calculated from an average of 3 weighings, should not differ by more than 0.01 ABD units for either 3/16- or 1/4-inch diameter catalyst.

The estimated standard deviation calculated from the mean range of 5 pairs of ABD results was 0.002 for both 3/16- and 1/4-inch diameter catalyst.

TIME FOR TEST

The average elapsed time for this test is about 0.5 hours. The estimated man-hours per unit is 0.5.