How can the bulk density of a dry semi-solid material be determined?

The bulk density of many dry semi-solid materials (e.g. pellet, granule, flake, powder, etc...) can vary from delivery to delivery even if the same grade or specification of material is purchased. Additionally dry bulk materials will settle and compact durring storage affectively changing density.

When studying a mateiral to determine bulk density it is recommended to make two measurements. First, an initial 'as poured' density measurement - pour the material directly into the sampling container and weigh. Next, shake or vibrate the sample container while topping-off the material. Weight the sample to determine the 'vibrated' or settled density.

It is typical to use the average of these two density measurements when calculating inventory weight.

Methodology. The easiest method to determine the density of a material, in pounds per cubic foot, is to weight exactly 1.0 ft^3 of material. However, sample containers of precisely 1.0 ft^3 volume are difficult to find and are not really necessary. By determining the volume of a smaller more manageable container a correction factor can be applied and the pounds per ft^3 vaule determined.

Sampling container. Any dimensionally stable material (not cardboard!) will do. The container may be of any shape or size but it is best to make it larger as opposed to smaller. A 32oz, or so, plastic jar does nicely. The calculations below will explore a method by where the weight of clean water can be used to determine the volume of a container.

Weight the sample of material. Use of an accurate scale is important. Postal scales are convenient. Be sure to subtract the weight of the sampling container from the overall measured weight as we are interested in only the weight of the material.

Useful Conversion Factors
1.0 oz(avd) = 28.349 grams
1cc of water weighs 1gram (clean water, distilled water prefered)
1.0cc = 3.583×10^{-5} ft^3
1.0 lbs = 16 oz(avd)

1) Calculate volume of sampling container
   A) completely fill the sampling container with water and weigh
      note: do not include the weight of the container
   B) convert water weight from oz (avd.) to grams
   C) convert grams into cubic centimeters
   D) convert cc to ft^3

A	B	C	D	
X oz	$\frac{28.349g}{1\ oz}$	$\frac{1\ cc}{1\ g}$	$\frac{3.531 \times 10^{-5}\ ft^3}{1\ cc}$	= Y ft^3

2) Determine the number of sample containers necessary to achieve our target of 1.0 ft^3

$$\left| \frac{1}{Y\ ft^3} \right| = K$$

K is the constant or multiplier which is to be applied to the weight of the material sample to realise a volume of 1.0 lbs / ft^3

3) Calculate the material's bulk density
   A) determine weight of sample. Note: as with Step 1 do not include the weight of the sampling contaner.
   B) apply **K** constant
   C) convert oz / ft^3 to lbs/ft^3

A	B	C	
X oz	**K**	$\frac{1\ lbs}{16\ oz}$	= XX.X $\frac{lbs}{ft^3}$

FAQ042709