The Observation of Popcorn

Purpose

1. By operating and observing the process of popping kernels, students can familiarize yourself with two types of equipment commonly used in laboratories: heating plate and balance.
2. Through repeated measurements, students can learn the processingand analysis of experimental data, as well as the evaluation of the credibility and reproducibility of the experimental results.

Principle

How many popcorns are there? If we were to take two popcorns and use the balance to weigh them separately, it is likely that we will get different results. So how do we answer this question? Even if you make two weighings on the same popcorn, you may get different results. However, if the results of the two weighings are exactly the same, is this same result representingthe “correct” weight of the popcorn?

Just like the weight of a popcorn, the properties of almost all substances vary from one sample to another. Only some of the differences are quite significant, and people's senses can be distinguished, such as the weight ofapopcorn. Some of the differences are less obvious and must be known through instrumental measurements, such as the weight of a New Taiwan dollar coin. In this year's course, we will measure the weight, volume, concentration, freezing point, evaporation heat, pH, and the equilibrium constants, heat of reaction, etc. of a certain chemical reaction. The results of these measurements are also the same as the weight of a popcorn, and the data from repeated experiments will show differences.

In order to obtain objective and reliable results, we must repeat at least two measurements of any physical quantity. After theobtained data are processed, the measured results can beexpressed asaverage valueswithindexes that can show the degree of difference, such as average deviation or standard deviation. Taking corn as an example, if we have a pack of corn, we use the balance to say that its total weight is 12.33 grams and the total number of particles is 100. The average weight of each corn is 0.1233 grams. If the weight of each corn is further weighed and the standard deviation of the weight is calculated to be 0.0201 g, it can be predicted from statistics that the weight of about 68% of the corn kernels will be averaged (Not sure of the meaning). Within a range of plus or minus one standard deviation, that is, between

0.1434 g and 0.1032 g, about 95% of the corn kernel weight will be within plus or minus two standard deviations.

Procedure

* In order to avoid the transfer of moisture and grease from the fingers to the corn kernels, please do not use fingers to pick corn kernels.

1. Take20 pieces of corn into the beaker with tweezers. (5 of them were doing bursting exercises, 5 were individually burst tested, and the remaining 10 were burst together.)
2. To practice popping the weighed corn kernels: Place each corn kernel in a 250-mL Erlenmeyer flask with tweezers. Gently place cork stoppers (not rubber stoppers) on the sides of the bottle, and then gradually heatthe cones. The bottle is placed on a hot plate. Gently shake the bottle until the corn kernels burst (about 1-2 minutes). Immediately after the corn kernel burst, remove the conical flask from hot plate and continue to shake it to prevent the popcorn from sticking to the conical flask until the bottle cools so it will not scorch the popcorn. Repeat the exercise until you can successfully popthe corn kernel without burning it.
3. Bursting 5 corn kernels that have been individually weighed: one at a time, and returning each popped popcorn to the original marking paper
4. Put 10 grains of corn kernels that have been weighed into an Erlenmeyer flask and gently padded the cork stoppers to burst them all together with the previous procedure. Observe any changes in this processin detail, which will help explain some of the quality changes in this experiment. Becareful whenapproaching the inside of the glass wall above the conical flask and honestly record the observed results.

Safety

1. Wear eye protection
2. Never eat popcorn that was poppedin this experiment. In the laboratory, your hands, desktops, and laboratory equipment can be contaminated with toxic substances.

Data

# popcorn		1	2	3	4	5	Group of 10	Average	σ
Mass before popping m_o(g)								$\overline{m}_o$	
Mass after popping m_f(g)									
Mass lose Δm(g)(=m_o-m_f)									
Percent mass lose，$\%\Delta m$ (=($\Delta m/ m_o$)×100%)								$\overline{\%\Delta m}$	
For mass before popping	d_1 (= m_o- $\overline{m}_o$)							$\sum d_1^2$	
	d_1^2							σ (m_o)	
For percent mass lose	d_2 ($\%\Delta m$- $\overline{\%\Delta m}$)							$\sum d_2^2$	
	d_2^2							σ ($\%\Delta$ mlose)	