Preparation of Laboratory Food Samples

Aims:

1. Food pre-treatment for analysis.
2. Preventing Changes in Sample.
3. Sample Identification.
4. Sources of Experimental Error.

Sample preparation:

- Sample preparation is one of the key steps for the development of any new analytical methodology.

➔As a result research on new sample preparation procedures is one of the most active areas in analytical chemistry.

- Advances in sample preparation aim to minimize laboratory solvent use and hazardous waste production, save employee labor and time, and reduce the cost per sample, while improving the efficiency of the analyte isolation.

- The food material is usually heterogeneous.

- **Sample heterogeneity may either be caused by:**

1. variations in the properties of different units within the sample (inter-unit variation) and/or
2. variations within the individual units in the sample (intra-unit variation).

- It is usually necessary to make samples **homogeneous** before they are analysed.

- The variability in composition of a single food sample can be minimized with proper sampling and sample pretreatment techniques.

1-Food pretreatment :

- It is often necessary to wash, remove, or drain irrelevant extraneous matter.
- **Examples:**
  I. Soil or sand that adheres to fresh fruit or vegetables can be removed by washing or wiping the surface of the produce .
  II. Removing the skin of a fruit .
  III. Meat is removed as completely as possible from bone.
  IV. Eggs are broken to isolate the liquid interior.

1-Food pretreatment cont' :

- A suitable method is then required to make the material less heterogeneous.
- **Homogenization** can be achieved using:
  1. Mechanical devices (e.g., grinders, mixers, slicers, blenders).
  2. Enzymatic methods (e.g., proteases, cellulases, lipases).
  3. Chemical methods (e.g., strong acids, strong bases, detergents).
- The type used depends on the properties of the food being analyzed (e.g., solid, semi-solid, liquid).

1-Food pretreatment cont' :

- The analyses of liquid food samples have an advantage over those associated with solid samples in that they usually require **one less pretreatment step**, due to their liquid form.
- Straightforward techniques that may used to prepare liquid samples prior to the analysis step include sample dilution, evaporation, microdialysis, or liquid-liquid extraction.
- Once the sample has been made homogeneous, a small more manageable portion is selected for analysis. ➔This is usually referred to as a **laboratory sample.**

2-Preventing Changes in Sample:

- Once we have selected our sample we have to ensure that it does not undergo any significant changes in its properties from the moment of sampling to the time when the actual analysis is carried out.
- e.g., enzymatic, chemical, microbial or physical changes.

- There are a number of ways these changes can be prevented.

Enzymatic Inactivation

-Freezing.
-Drying.
-Heat treatment.
-Chemical preservatives
-(or a combination).

with the method used depending on the type of food being analyzed and the purpose of the analysis.

Lipid Protection

-Store samples that have high unsaturated lipid contents under nitrogen or some other inert gas.
-In dark rooms covered bottles
-and in refrigerated temperatures.
-Antioxidants may be added to retard oxidation.

Microbial Growth and Contamination

-Freezing.
-Drying.
-Heat treatment.
-Chemical preservatives.
-(or a combination)

Physical Changes

-Physical changes can be minimized by controlling the temperature of the sample, and the forces that it experiences.

3-Sample Identification:

- Laboratory samples should always be labeled carefully so that if any problem develops its origin can easily be identified.

- **The information used to identify a sample includes:**
  a) Sample description.
  b) Time sample was taken.
  c) Location sample was taken from.
  d) Person who took the sample.

- The analyst should always keep a detailed notebook clearly documenting the sample selection and preparation procedures performed and recording the results of any analytical procedures carried out on each sample.

- Each sample should be marked with a code on its label that can be correlated to the notebook.
  ➔Thus if any problem arises, it can easily be identified.

4- Sources of Experimental Error:

A. Personal Errors (Blunders).

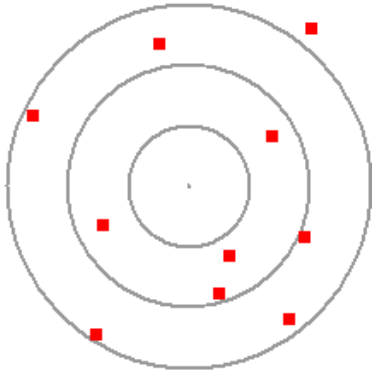
B. Random Errors.

C. Systematic Errors.

A- Personal Errors (Blunders):

- These occur when the analytical test is **not carried out correctly.**
- The wrong chemical reagent or equipment might have been used.
- Blunders are usually easy to identify and can be eliminated by carrying out the analytical method again more carefully.

B- Random Errors:

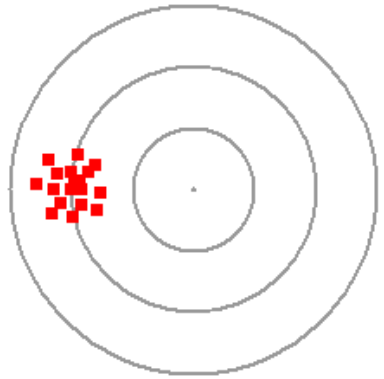


Random Error

- These produce data that vary in a non-reproducible fashion from one measurement to the next e.g., instrumental noise and environmental conditions.
- This type of error determines the standard deviation of a measurement.
- There may be a number of different sources of random error and these are accumulative.

C- Systematic Errors:

- A systematic error produces results that consistently deviate from the true answer in some systematic way.
- e.g., measurements may always be 10% too high.
- This type of error would occur if the volume of a pipette was different from the stipulated value.
- Systematic errors are difficult to detect and cannot be analyzed statistically.



Systematic Error

References:

- Sampling and Sample Preparation for Field and Laboratory: Fundamentals and New Directions in Sample Preparation, Volume 37Janusz Pawliszyn, 2002.

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