BCH 445- Biochemistry of Nutrition [Practical]

Preparation of Laboratory Food Samples

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BCH 445- Biochemistry of Nutrition [Practical]

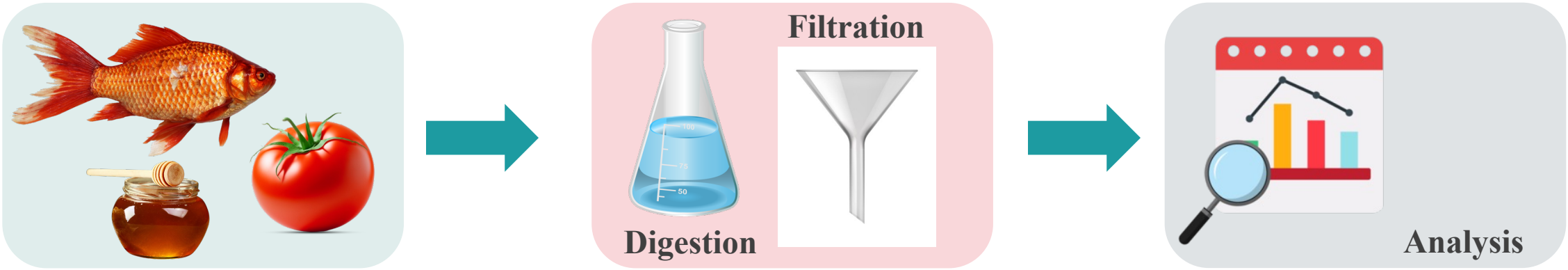
Tasks	Marks
Conducting the experiment	2 marks
Homework	3 marks
Report	6 marks
Quiz	5 marks
Final	Practical 10 Theoretical 4
Total marks	30 marks

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.
- Advances in **sample preparation** aim to **minimize** laboratory solvent use and hazardous waste production, save employee time, and reduce the cost per sample, while improving the efficiency of the analytic isolation.
- The food material is usually heterogeneous.
- It is usually necessary to make samples homogeneous before they are analyzed.



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)**

- For this reason it is usually necessary to make samples homogeneous before they are analyzed, otherwise it would be difficult to select a representative **laboratory sample** from the sample
- 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:

1. Soil or sand that adheres to fresh fruit or vegetables can be removed by washing or wiping the surface of the produce
2. Removing the skin of a fruit
3. Meat is removed as completely as possible from bone
4. 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 and blenders).
  2. **Enzymatic methods** (e.g., proteases, cellulases and lipases).
  3. **Chemical methods** (e.g., strong acids, strong bases and detergents).

- The type used depends on the properties of the food being analyzed (e.g., **solid, semi-solid and 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**.

- Techniques that may used to prepare liquid samples prior to the analysis step include **sample dilution, evaporation, micro-dialysis 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.**

Ways that can prevent sample changes

Enzymatic Inactivation

-Freezing

-Drying

-Heat treatment

-Chemical preservatives

(or combinations).

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.

-In refrigerated temperatures.

-Antioxidants may be added to retard oxidation.

Microbial Growth and Contamination

-Freezing

-Drying

-Heat treatment

-Chemical preservatives

(or combinations).

Physical Changes

Physical changes can be minimized by controlling

1- The temperature of the sample.

2- The forces that it experiences.

3- Sample identification:

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

• The information used to identify a sample includes:

- Sample **description**
- **Time** when sample was taken
- **Location** where sample was taken from
- **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 errors:

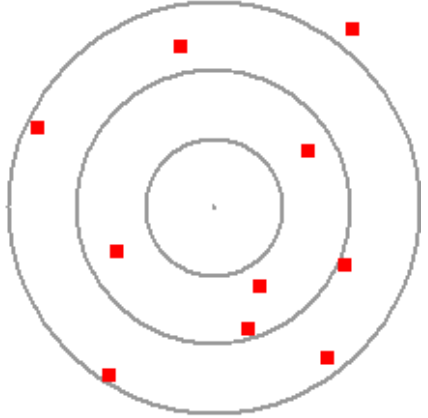
1. Personal Errors (Blunders).
2. Random Errors.
3. Systematic Errors.

1. Personal Errors (*Blunders*)

- These occur when the analytical test is **not carried out correctly**

→ The wrong chemical reagent or equipment might have been used; some of the sample may have been spilt; a volume or mass may have been recorded incorrectly; etc.

- It is partly for this reason that analytical measurements should be repeated a number of times using freshly prepared laboratory samples.
- Blunders are usually easy to identify and can be eliminated by carrying out the analytical method again more carefully.

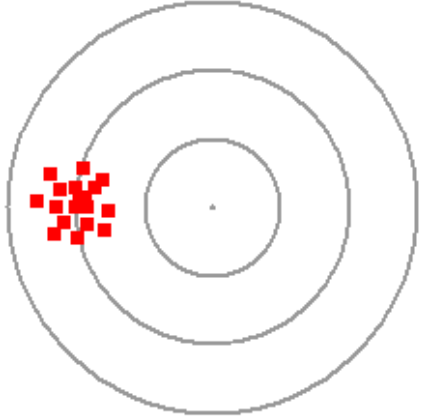


Random Error

2. Random Errors

- 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.

3. Systematic Errors



Systematic Error

- 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.

➢ To make accurate or and precise measurements it is important when designing and setting up an analytical procedure to identify the various sources of error and to minimize their effects.

➢ Often, one particular step will be the largest source of error, and the best improvement in accuracy or precision can be achieved by minimizing the error in this step.

Examples

1- Personal errors (Blunders):

When you spill chemicals when transferring between containers.

2- Random errors:

Time taken to complete reaction = 20.0s

	1	2	3	4	5
Time taken to complete reaction	20.1	20.0	19.8	19.9	20.2
Errors	+0.1	0.0	-0.2	-0.1	+0.2

3- Systematic errors:

Different samples weights

	1	2	3	4	5
Actual weight	14.5	19.5	25.5	27.8	19.7
Different samples weights	15	20	26	28.3	20.2
Errors	0.5	0.5	0.5	0.5	0.5