BIOPHARMACEUTICS

PRESENTED BY:

LECTURER DR. Ebtihal Abdulkahdim

Lecturer. Nora Zawar

THE PRACTICAL COURSE WILL COVER THE FOLLOWING EXPERIMENTS....

- Exp .1 Construction Of Calibration Curve Of Salicylic Acid With The Application Of Statistics

- Exp .2 *In Vitro* Evaluation Of Antacid

- Exp .3 *In Vitro* Evaluation Of Bulk Forming Laxatives

- Exp .4 Hydrolysis Of Acetyl Salicylic Acid Solution In Sorensen Phosphate Buffer At pH 8

- Exp.5 pH And Solvent Effect On Drug Solubility

- Exp.6 *In Vitro* Dissolution Of Per-oral Tablet

Introduction For Biopharmaceutics And Pharmacokinetics

Biopharmaceutics is defined as the study of factors influencing the rate and amount of drug that reaches the systemic circulation and the use of this information to optimise the therapeutic efficacy of the drug products.

Pharmacokinetics

- Pharmacokinetics is derived from two words: *Pharmaco- meaning **drug** and -kinesis meaning **movement**.*

- In short, it is **'what the body does to the drug'**. It includes absorption (A), distribution (D), metabolism (M) and excretion (E) of a drug.
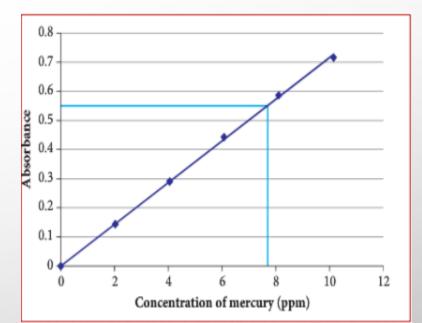
BY KINETIC WE LEARN ABOUT :

- **Rate Of Absorption**

- **Rate Of Elimination Of a Drug**

- **Calculate The Half Life Of a Drug In The Body**

So We Can Predict What Will Be The Duration Of Correct Dosage Regimen For Maintaining a Therapeutic Level

- During The Practical Course Certain Dosage Form Will Be Evaluated *In Vitro* (Means Outside The Body In The Lab)
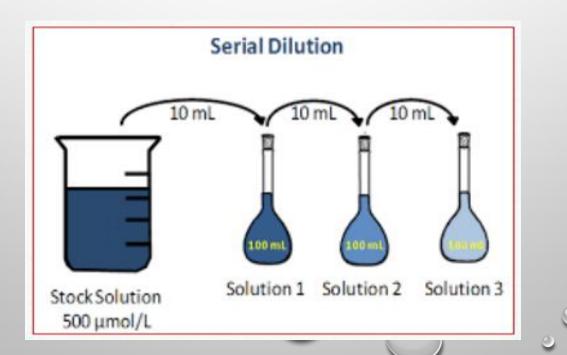
- *In Vivo* (Means Inside The Body)

Calibration curve:

- It is the curve prepared from a series of standard solutions
- It used as a reference curve to Obtain the concentration of unknown sample of the same drug
- X axis is the conc. of sample
- Y axis is the absorbance

Stock solution:

- **Solution of known and high conc. from which we prepare standard solution**
- Solution of known conc. Prepared from stock solution using dilution equation:
- **C1*V1=C2*V2**

Serial Dilution

10 mL   10 mL   10 mL

Stock Solution 500 µmol/L   Solution 1   Solution 2   Solution 3
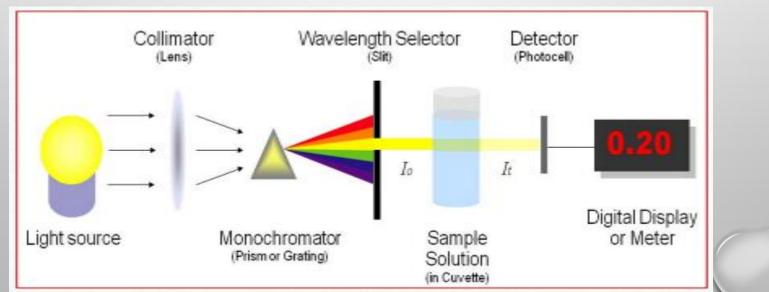
Blank solution:

Its the solution which contain all the constituents of the sample except the active ingredient which is required to be measured

SPECTROPHOTOMETRY

It is a method to measure how much a chemical substance absorbs light

• The basic principle is that each compound absorbs or transmits light over a certain range of wavelength.

• In our work usually the analysis concerned with the absorbed amount of light

SPECTROPHOTOMETRY

Depending on the range of wavelength of light source, it can be classified into two different types:

1.UV-visible spectrophotometer:

• uses light over the ultraviolet range (200- 400 nm) and

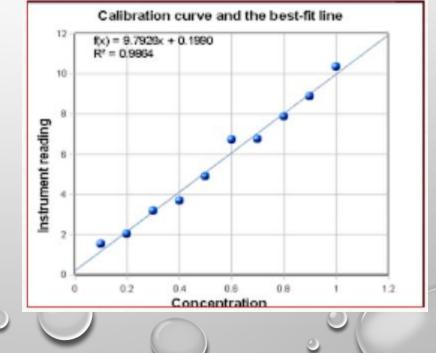Visible range (400 - 700 nm) of electromagnetic radiation spectrum.

2.IR spectrophotometer:

uses light over the infrared range (700 - 15000 nm) of electromagnetic radiation spectrum

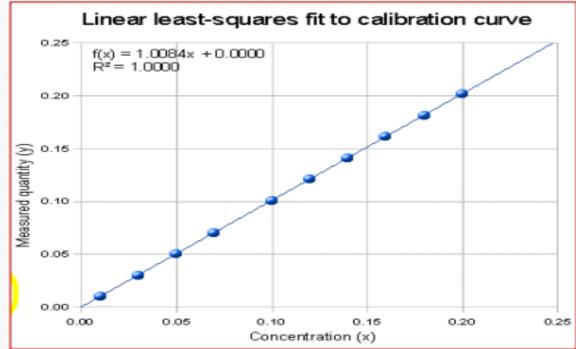# METHODS TO OBTAIN THE UNKNOWN CONC.

1. Curve fitting method:
☐To fit a straight line among
scattered points

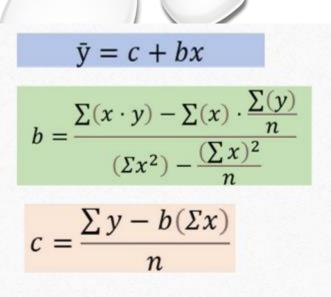## 2. Least square fitting method:

This method is based on the equation which minimizes the sum of the squares of deviation of the observed values from line.

$$\square \; \sum (y - \bar{y})^2$$

Where:

y = observed value

$\bar{y}$ = calculated value

Linear least-squares fit to calibration curve

$f(x) = 1.0084x + 0.0000$
$R^2 = 1.0000$

Methods to obtain the unknown conc.

2. Least square fitting method:

X conc(mg/ml)	Y (abs.)	X^2	X*Y
X1	Y1	$X1^2$	X1*Y1
X2	Y2	$X2^2$	X2*Y2
X3	Y3	$X3^2$	X3*Y3
X4	Y4	$X4^2$	X4*Y4
X5	Y5	$X5^2$	X5*Y5
Σx	Σy	Σx^2	$\Sigma x*y$
$(\Sigma x)^2$			

$$\bar{y} = c + bx$$

$$b = \frac{\sum(x \cdot y) - \sum(x) \cdot \frac{\sum(y)}{n}}{(\Sigma x^2) - \frac{(\Sigma x)^2}{n}}$$

$$c = \frac{\sum y - b(\Sigma x)}{n}$$

X conc(mg/ml)	Y (abs.)	x^2	X*Y	$\bar{y}$
X1	Y1	$X1^2$	X1*Y1	$\bar{y}1=c+bx1$
X2	Y2	$X2^2$	X2*Y2	$\bar{y}2=c+bx2$
X3	Y3	$X3^2$	X3*Y3	$\bar{y}3=c+bx3$
X4	Y4	$X4^2$	X4*Y4	$\bar{y}4=c+bx4$
X5	Y5	$X5^2$	X5*Y5	$\bar{y}5=c+bx5$
Σx	Σy	Σx^2	$\Sigma x*y$	
$(\Sigma x)^2$				

From these variables using the above equations we can obtain c & b, then by substitute each X value we can get ȳ (calculated value)

c= intercept of the least square line with the ordinate.

b= slope of the least square line.

n = number of values

CALIBRATION CURVE OF SALICYLIC ACID

SALICYLIC ACID ACTIVITY AND SOLUBILITY

* Activity: Salicylic acid topical is used to treat many skin disorders, such as acne, dandruff, psoriasis, corns, common warts, and plantar warts, depending on the dosage form and strength of the preparation.

* Solubility: Due to its lipophilic nature, its solubility in water is very poor i.e., 1.8 g/L at room temp.

Salicylic acid is soluble in organic solvents like carbon tetrachloride, benzene, propanol, ethanol and acetone.

The fundamental relationship Used in spectrophotometry is Beer and lambert laws in combination:

$$\log \frac{I_o}{I_T} = Kct$$

where :

I_o : Incident light.

I_T: Transmitted light.

K: Proportionality constant.

c: Concentration.

t: thickness of substance.

$\log \frac{I_o}{I_T}$: E = Extinction or Absorbance.

$E = -\log_{10} T$.

$T = \text{Transmission} = \frac{I_T}{I_o}$.

WHAT IS THE AIM OF EXPERIMENT

☐ **The aim is to prepare a calibration curve of salicylic acid from a series of standard solutions why?**
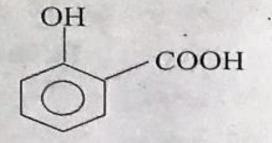
☐ **to use it as a reference curve to obtain the concentration of unknown sample of the same drug .**
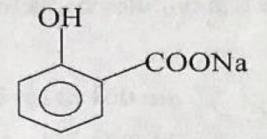
PROCEDURE AND CALCULATIONS:

☐ 1. prepare 250 ml of stock solution of sodium salicylate containing equivalent of 200 mg salicylic acid /100 ml

☐ Why sodium salicylate ?

Note : sodium salicylate is readily soluble in cold water , so it is used to prepare the stock solution of sodium salicylate after calculating its equivalent content of the acid .

☐ while salicylic acid is sparingly soluble in cold water (1 part in 550 parts of water), but more soluble in hot water (1part acid in 15 parts of boiling water), from which it can be recrystallized

OH	OH
COOH	COONa
Salicylic acid	Sodium salicylate

I- To calculate the number of (mgs) of (S.A) salicylic acid needed to prepare the stock solution:

mg of S.A	mls
200	100
x	250

$x = 500$ S.A.
needed $= 0.5$ g

II- To calculate the equivalent of sodium salicylate to 500 mg salicylic acid.

M. wt of sodium salicylate	M. wt of S.A
160	138
x	0.5

☐ 579.7 mg of sodium salicylate needed to prepare 200 mg of salicylic acid /100mL

☐ 2- dissolve 579.7 mg of sod. Salicylate in 180 mL of water then complete the volume to 250 mL by using volumetric flask (PRIMARY STOCK)

☐ 3- the PRIMARY stock solution of sodium salicylate containing equivalent of 200 mg\100 mL of salicylic acid , From this primary stock prepare other stock solution 100 mg \100 mL by using

☐ CIVI=C2V2

☐ 200%X V1= 100%X100

☐ V1=50 mL of primary stock and complete the volume up to 100 mL with D.W (SECONDARY STOCK)

☐ from this secondary stock Prepare serial dilutions (use volumetric procedures)

accurately prepare solutions containing equivalent of 50, 40 ,30 , 20 , 10mg/ 10 mL

☐ For example to prepare 50 mg\10 mL

☐ $C_1V_1 = C_2V_2$

☐ 100 mg x V_1 = 50 mgx10 mL

☐ V_1 =5 mL of stock solution to be taken and complete the volume by DW up to 10 mL

☐ Same procedure for other dilutions

☐ For 40 mg   4 mL of stock complete up to 10 mL by DW

☐ For 30 mg   3 mL of stock complete up to 10 mL by DW and so on for other dilution

☐ 4- set the spectrophotometer wave length at 265 nm(lambda max for salicylic acid)

☐ 5- the blank in this experiment is DW

☐ 6- auto zero the spectrophotometer by using blank

☐ 7-put the sample in the cuvette and read absorbance

8 –record your results concentration versus absorbance

9- draw your results by using graph paper

(make calculation using excel program)

10 - add trend line