Chemical Kinetics and Determination Methods of Chemical Kinetics

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Abstract:
This article present a chemical kinetics and determination method of chemical kinetics.This information is specially helpful for how the reaction occurs.It focuses on the understanding the rate of chemical reactions.We hope, this article will be useful and it highlights recent advances and identify important areas for future research.This article also describe the types of order of chemical kinetics.Their methods with the given equations and values obtained from them will be useful in plotting the graph against concentration v/s time and the review also emphases on the application of this reactions in pharmacy field and also factors affecting on them. [1]

Keywords: Chemical Kinetics, Order of reactions, Equations , Rate of reactions, Methods for determination.

Introduction: **[2]**
Chemical kinetics is a subfield of physical chemistry that focuses on calculating the rate of chemical reactions. Although it covers conditions under which the reaction rate may change, it is helpful in predicting how quickly a chemical reaction will occur. The sequence of chemical processes, their rates, and component concentration can all be determined using chemical kinetics.
Concentration, temperature, pressure, and catalyst are a few of the factors that affect chemical reactions. Chemical processes are timed using changes in concentration (dc) with respect to time (dt), which are represented as.

Rate of reaction = $\pm\, dc/dt$

Where the positive (+) sign indicate the increase in concentration with respect to the time and negative (-) sign indicate the decrease in concentration with respect to time .

Applications in Pharmacy:
- Drug Stability
- Dissolution
- Pharmacokinetics
- Drug Action

- **Drug Stability**:- **[3]**

Chemical kinetics give a basis for predicting drug's stability. The drug stability studies can be used to understand the level of drug inactivation caused by various adverse environmental factors.

- **Dissolution:-**

Normally, the drug is expected to release from the solid dosage forms and immediately go into molecular solution.

- **Pharmacokinetics:-**

It involves the study of transport of the drugs from the site of application to blood, from blood to tissue spaces and other body parts and finally its removal from body.

- **Drug Action:-**

Interaction of drugs with Biomembranes or receptors are being interpreted using kinetic models.It provides quantitative differences and therapeutic category.

Types of order reaction:[4]

There are three types of the order of reaction, Which are as follows:-

1) First order
2) Second order
3) Zero order

1)First order reaction:

First order reactions are those in which the speed of a chemical reaction depends only on one reactant. In 1918, Harned demonstrated that the amount of hydrogen peroxide still in the reaction mixture at any given moment was directly proportional to the rate at which the catalyst broke down (0.02 mkl). The first order expression refers to this reaction. You may express the first order rate equation as,

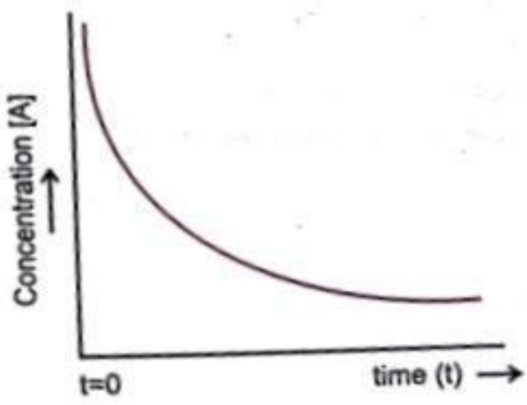
e.g = $2H_2O_2 \rightarrow 2H_2O + O_2$

$$-dc/dt = ka$$

Where, dc/dt = Change in rate and time interval

a = Concentration

K = Constant



2) Second order reaction:

Second order reactions are those in which the rate of reaction is dependent on both reactants. The frequency of the speed at which a decomposes is the same as the rate at which B decomposes, and both are proportional to the concentration product between the reactants when the concentration of determine now rapidly the reaction continue with each term raised to the first power for A and B.

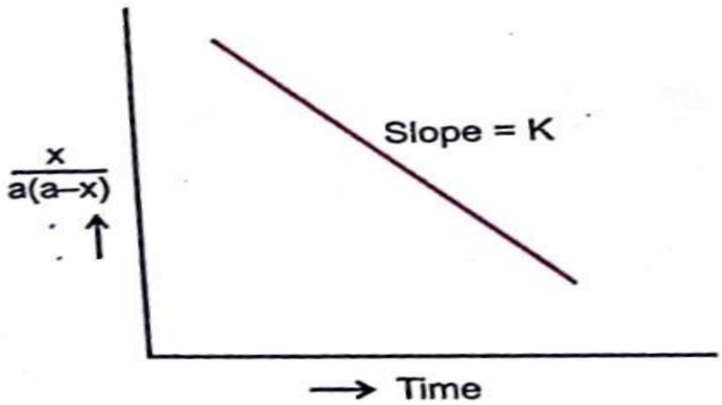
Products A+B

The following are possible forms for the equation:

$-dA/dt= -dB/dt-=k [A^1] [B^1]$

Where ,A&B= concentration

K = constant

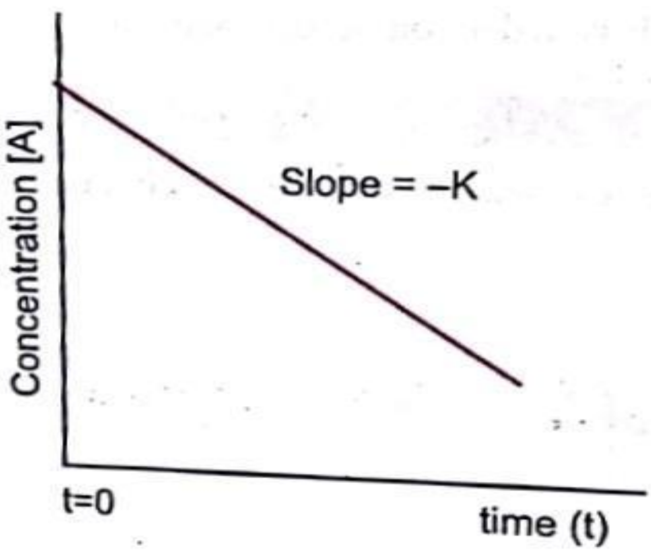


3) Zero order reaction :

Zero order reactions are those in which the rate of the reaction is independent of the reactant.The rate equation for the change in absorbance, A over time is based on Garrett and Carper's3 assertion that a multisulfa product color loss (measured by a decline in spectrophotometric absorbance at a wavelength of 500 nm) occurs at a zero order rate.

It is expressed in the following way:

$-dc/dt =k$



Factors affecting on chemical reaction:-[5]

1) Concentration :- The reaction rate is increase due to the reason of the high leve concentration. This are increased collisions between reacting particles .

2) Surface area in solid :- The particles have the large surface area then reaction is occur fastly.

3) Temperature:- The high temperature is increase the rate iof chemical reaction.Due to the increase and more energetic collisions between reacting particles. When rise 10 ^{0}c temperature then the reaction rate is double.

Method of determination of order of reaction :-[6-9]

There are three methods which are used to determinethe order of reactions:

1) Graphical method
2) Substitution method
3) Half-life method

1) Graphical method:

This method involves experimentation and visualization to calculate data. We can determine the rate of using the graph that has been plotted. This reaction is known as a zero order reaction because the plotted graph shows a straight line between concentration and time. First order reactions are defined as those the relationship between log concentration and time is linear, and second order reactions are defined as those where the relationship between log concentration and time is not linear.

2) Substitution method:

In this method, experiments are used to calculate the data. In the equation for the zero, first, and second orders of reaction, the data is substituted. We then discover K's value. Order of reaction is indicated by the value of k.

Order of Reaction	Rate equation
Zero	$k_0 = \frac{A_0 - A_t}{t}$
First	$k = \frac{2.303}{t} \log \left[\frac{A_0}{A_t} \right]$
Second	$k = \frac{1}{at} \cdot \frac{x}{(a-x)}$

3) Half -life method :For each time period in a kinetic study the value of $T_{1/2}$ can be estimated by computing the value of k using the about method

Order of Reaction	$t_{1/2}$
Zero	$t_{1/2} = A_0/2k$
First	$t_{1/2} = 0.693/k$
Second	$t_{1/2} = 1/ak$

while the half-life of a first order reaction is independent of the initial reaction concentration ,if it is directly proportional to the starting reactant concentration in a zero order reaction half-life order is inversely related to initial reactant conc.

$T_{1/2} \propto \frac{1}{a^{n-1}}$

Where n is the order of reaction.When two reaction are carried out at a_1 & a_2 initial concentration that are distinct from one another these can be,

$t_{1/2}(2) \propto 1/a_1^{n-1}$

By Dividing this equationwe get,

$$\frac{t^1/_2(1)}{t^1/_2(2)} = \frac{1/a_1{}_{n-1}}{1/a_2{}_{n-1}}$$

By Applying log equation simply this equation becomes,

$$n = \frac{\log t_{\frac{1}{2}}(1)/t_{\frac{1}{2}}(2)}{\log(a_2/a_1)} + 1$$

By drawing a graph between the value of a v/s t for two different initial concentration by taking reading of ½ a_1& ½ a_2 the half-life can be determined from the graph ,the order of the reaction can be found by changing half -life & beginning concentration value (a & a_2) the equation above .[10]

Conclusion :- Rate of chemical reaction is based on First order and zero order kinetics, with the help of above equations we can easily determine the order kinetics of molecule, Determination of which involves some techniques such as: Graphical , substitution, Half life methods ,at the end by plotting the graph between obtained values the half life and order of reaction can be found.

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