CHAPTER 1

Chapter-1. Introduction

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Sub Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>1.1</td>
<td>Introduction of analytical organic reagents</td>
<td>2</td>
</tr>
<tr>
<td>1.2</td>
<td>A brief review on first and second order derivative</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Spectrophotometry</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 1

Introduction:

Section 1.1: Introduction of analytical organic reagents

Hydrazones are consist of 2 N (nitrogen atom) were it becomes an active and reactive following the nucleophilic reaction and also consist of active carbon site which involves in dual action such as nucleophilic and electrophilic action. Due to the dual nature of hydrazones to involve as E and N reaction these compounds are considered to be important classes which are considered widely as a reagent.1.
Some of the important class of the drugs derives from the formation of Hydrazones. The oxygen present -CHO or >C=O is replaced with NNH₂, which is used for the synthesis of NHN=CH-(Azomethine)⁴.

\[
\text{Iproniazid} \quad \text{Isocarboxazid}
\]

\[
\text{Nifuroxazid}
\]

Semicarbazone is an condensed products obtained from the reaction between semicarbazide with (-CHO) aldehyde and (>C=O) ketone to form the semicarbazone and classified as imine.

Reaction from Ketone

\[
\text{H}_2\text{NNHC(=O)NH}_2 + \text{RC(=O)R} \rightarrow \text{R}_2\text{C}=\text{NNHC(=O)NH}_2
\]

Reaction from aldehyde

\[
\text{H}_2\text{NNHC(=O)NH}_2 + \text{RCHO} \rightarrow \text{RCH}=\text{NNHC(=O)NH}_2
\]

Replacement of (O) oxygen atom with that of (S) sulfur atom in semicarbazone which forms thiosemicarbazone which is a analog of semicarbazone⁵.

\[
\text{ThioSemicarbazone} \quad \text{Semicarbazone}
\]
Thiosemicarbazone become an biologically important compound which is interested many scientist in the field of anti-viral and anti-cancer and most importantly forms an complex (metal complex) with Cu and Fe in cells. These thiosemicarbazone \([R^1R^2C=N^3-N^2H-C(=S)-NR^3R]\) which forms an metal complex via S, N\(^2\) and N\(^3\). These compound were found in the 20\(^{th}\) century but were only identified as a drug in the 50\(^{th}\) century as the drug of choice for leprosy and T.B. During the 60\(^{th}\) century these thiosemicarbazone were popularized by the medical scientist as an antiviral drug. The derivatives of thiosemicarbazone have proven to show remarkable change in the development of anticancer agents and recently entered clinical studies (Phase III)\(^6,7\). These Thiosemicarbazone also been studied for the various biological activities in the treatment of antitumor, ribonucleotide reductase, anticonvulsant and antimicrobial.
Spectrophotometry is widely employed analytical technique and more popular because of the common availability of instrumentation and simple procedures as well as speed, precision and accuracy results.

Though number of spectrophotometric methods\textsuperscript{8-16} is available for the estimation of almost all the metal ions in the periodic table at trace metal, they suffer either from lack of specificity or selectivity. This necessitates to increase more or less complicated procedures to overcome this detrimental influence. Therefore, in order to achieve greater degree of selectivity the significance is being devoted to develop direct and derivative spectrophotometric procedures for the estimation of metal ions when present in admixture.

**Section 1.2: A brief review on first and second order derivative spectrophotometry**

Analysis of isolated compound for the mixed matrixes is one of the challenges faced by the analyst. For every addition of the operational procedures in a method increases the time and the coast
of analysis which not only makes the procedure complicated but also increases high risk of loss of desired compound. Derivative spectroscopy is one of modern methods of analysis both in the qualitative and quantitative analysis formed by unresolved bands which is increasingly used by the researchers for its selectivity and sensitivity. It is the method by which the digital data signals of multicomponent system can be made into a single form of noised data. The first derivative spectrophotometry was introduced in the year 1953 by Singleton and Cooler. Later the method was developed into a new generation of analytical method during 20th century1-2.

This is a technique by which the spectrum of zero-order forms the base for the first and second order derivative spectrophotometry. The following shows the sequence of reaction happen from the zero order to different segments of derivative spectrophotometry.

Application of derivative technique of spectrophotometry offers a powerful tool for quantitative analysis of multi-component mixtures. When derivatised, the maxima and minima of the original function take zero values, and the inflections are converted into maxima or minima, respectively. The derivative curves are more structured than the original spectra, thus enabling very tiny differences between the original spectra to be identified. DS method has been widely used to enhance the signal and resolve the overlapped peak-signals due to its advantages in differentiating closely adjacent peaks, and identifying weak peaks obscured by sharp peaks.
Based on the scientific literature the following trends in applications of derivative spectrophotometry can be distinguished. Derivative spectrometry has been used in environmental analysis for some inorganic pollutants.

Multi component analysis derivative spectrophotometry (DS) has been mainly used in pharmaceutical analysis for assaying of a main ingredient in a presence of others components or its degradation product. The most numerous procedures based on derivative spectra have been devoted for determination of one component without sample purification. Another field of DS application is the use of it for simultaneous determination of two or more components. As a form of derivative spectrum is more complicated in comparison to its initial zero order, usually derivatives of low orders are employed for analytical purposes. The main characteristics of DS is to enhance the resolution of overlapping spectral bands is the consequence of differentiation which discriminates against broad bands in favor of sharp peak to an extent which increases parallel to the derivative order.