Welcome students I am miss Daizy Dmello, Assistant professor in chemistry at St Joseph Vaz College, Cortalim, Goa. In this session I will be dealing with the program Bachelor of Science 3rd yr, subject chemistry. Semester 6, the course code is CHD-103. The course title is selected instrumentation in Chemistry section B. The unit is UV visible Spectroscopy module name. Applications: Study of coordination compound, Cis trans isomerism, chemical kinetics Part B.

The outline of this module is applications of UV visible spectroscopy in terms of the following.
study of coordination compounds.
Cis trans isomerism chemical kinetics.

At the end of the session, the students will be able to study the coordination compound, illustrate Cis trans isomerism, and understand the chemical kinetics of the reaction.

So let's begin with the applications of UV visible spectroscopy.

In the previous module,

we have already seen three applications and studied them in detail.

We have seen the qualitative control of purity, quantitative analysis, and study of structural group in a molecule.

To add to it, we have more three applications, so in this module we are going to study in detail these three applications.

So they are.
To study the coordination compound ,Cis trans isomerism and chemical kinetics.

So the first application study of coordination compound.

Now the molar ratio of metal to ligand in a coordination compound is found out by using the jobs method of continuous variation.

What is done is equal molar solution of metal and ligand are mixed in different proportion.

That is, one is 1:9 to 9:1. To understand this better, I will show you a table how to prepare. In one column we have the metal solution, then ligand solution and total volume. The total volume should always remain the same, you just have to change the metal solution and ligand solution, suppose you are taking 1mL of metal solution,then you have to take 9mL of the ligand solution.

You can have a look at this table.

Second table also you have to take 8mL of the metal solution and do it.

You have to add 2 mL of the ligand solution to make the total volume as 10. You should not change the total volume. Total volume should remain same.

The lamba values are found out for these mixtures which you have prepared at lamba Max value of the complex. A color filter is used. Whose color is complementary to that of the complex.

A graph is plotted of OD versus the mole fraction of one of the constituent.

Mole fraction of metal is given as X and this corresponds to maximum OD is found out.

This value of OD then corresponds to maximum concentration of the complex solution.

The mole fraction of ligand is given as Y at maximum OD and it is found out by a formula.

Y is equal to 1 - X.

But the metal ligand ratio remains the same.That is, X is 2:1.

Here is the figure of jobs plot for mercury diphenyl carbazide complex. mole fraction of metal is given as X and mole fraction of ligand it is given as Y is equal to 1- X from the maximum OD you have to extrapolate the line on the X axis. Maximum OD corresponds to maximum Lambda Max value.

Next is Cis trans isomerism. This is one of the important application in UV visible spectroscopy to distinguish between cis and trans isomers.

The trans isomers absorbed at a longer wavelength that is at a less energy compared to cis isomers

Because trans isomers achieve coplanarity of the Pi electron system easily, whereas what happens in Cis isomer it is sterically hindered to understand this concept better.

Example is given of cinnamic acid, two different types of isomerism are given trans-cinnamic acid, and Cis cinnamic acid.

Tran cinnamic acid, absorbed Lambda, max value, at 2720 A.

As I have told you earlier, trans isomers absorb at a longer wavelength. Because, they achieve coplanarity of the Pi electron system.

Whereas in the figure you can see Cis Isomer is sterically hindered both the bulky groups are on one side. And the Lambda Max value is 2680 A.

So U.V visible Spectroscopy can tell us and distinguish the cis trans isomerism.

3rd application is chemical kinetics.

Now what do we do in chemical kinetics?

The amount of unreacted reactant at different time is determined.

Also, the rate of reaction is calculated as the amount of reactant consumed in unit time.

Now one important point is given in the slide, if the reactant or product is UV active. The amount of UV light absorbed will depend on the concentration of the reactant or the product at a given time.

Optical density values are found out at different time interval using the UV spectrophotometer.

The rate of reaction is calculated as the change in absorbance per unit time.

Same concept in same procedure can be adopted for visible light absorbing molecule.

The method used is usually for slow as well as fast reactions whose half time vary from milliseconds to a minute.

So we have done different types of applications in UV visible spectroscopy to conclude.

With UV visible spectroscopy, is used for qualitative and quantitative analysis of material used in dyes and pharmaceutical industries.

UV visible spectral scoping is an invaluable tool in quality control operation.

These are the references.

Thank you.