Aim: Determination of Absorption Maxima (λmax) and Effect of Solvents on Absorption Maxima of Organic Compounds

References

1. Silverstein, R. M., & Webster, F. X. (2014). "Spectrometric Identification of Organic Compounds." Wiley.
2. Pavia, D. L., Lampman, G. M., & Kriz, G. S. (2010). "Introduction to Spectroscopy." Cengage Learning.
3. William Kemp (2011). "Organic Spectroscopy." Palgrave Macmillan.

Principle

The absorption maxima (λmax) of a compound refer to the wavelength at which it shows maximum absorbance in a given solvent. Different solvents can alter the electronic transitions of a molecule due to polarity, hydrogen bonding, and solute-solvent interactions, leading to shifts in λmax values. Bathochromic shifts (red shifts) occur when λmax increases, while hypsochromic shifts (blue shifts) occur when λmax decreases.

Materials and Reagents

- UV-Visible Spectrophotometer
- Quartz Cuvettes
- Organic compound (e.g., benzophenone, acetophenone, etc.)
- Solvents: Ethanol, Methanol, Acetonitrile, Chloroform, Water
- Distilled Water
- Pipettes and Volumetric Flasks

Procedure

Preparation of Solutions

1. Prepare a stock solution of the organic compound (10 mg in 10 ml solvent) in each solvent.
2. Dilute the stock solution to obtain an appropriate concentration for UV analysis (e.g., 10-50 µg/ml).

Recording the Absorption Spectra

1. Turn on the UV-Visible spectrophotometer and allow it to warm up.
2. Set the wavelength range (200-400 nm for UV, 400-800 nm for visible).
3. Fill a quartz cuvette with the solvent (blank) and calibrate the instrument.
4. Replace the blank with the sample solution and record the absorption spectrum.
5. Identify the λmax (the peak wavelength with the highest absorbance).
6. Repeat the procedure for the same compound in different solvents.

Observations and Calculations

Sample Data Table

Solvent	Amax (nm)	Absorbance at λmax	Nature of Shift
Ethanol	250 nm	0.85	Reference
Methanol	248 nm	0.82	Hypsochromic
Acetonitrile	252 nm	0.88	Bathochromic
Chloroform	255 nm	0.90	Bathochromic
Water	245 nm	0.79	Hypsochromic

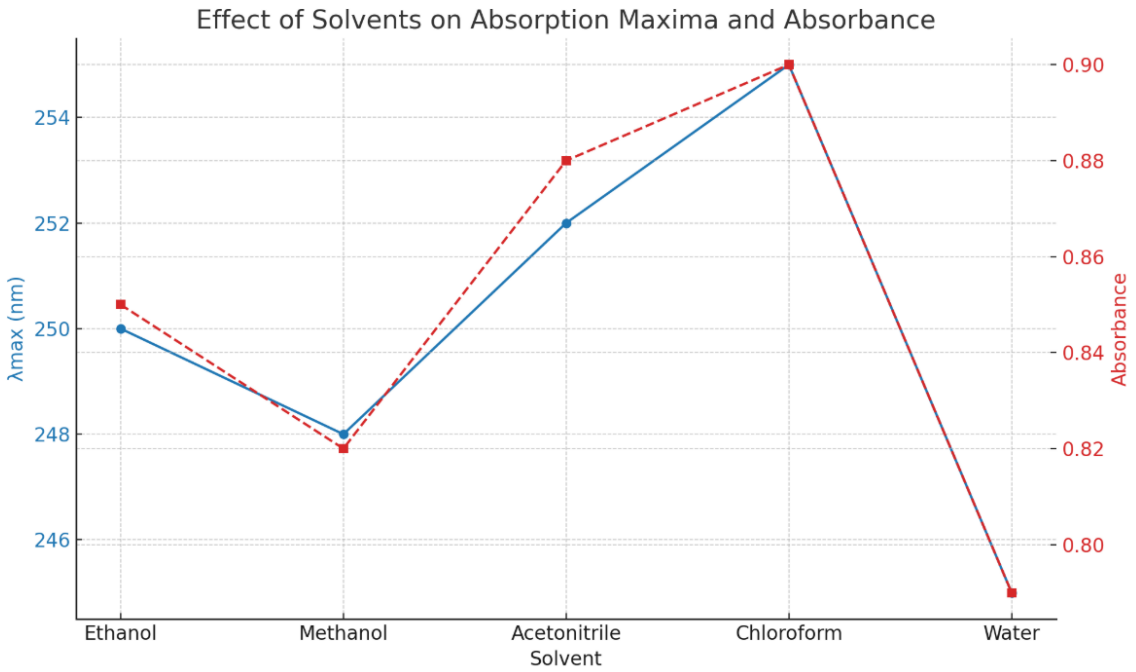
Results

1. The λmax of the organic compound was found to be 250 nm in ethanol.
2. The compound showed a bathochromic/hypsochromic shift in different solvents.
3. The solvent polarity and hydrogen bonding effects influenced the absorption maxima.

Discussion

- The variation in λmax with different solvents is due to solute-solvent interactions.
- Polar solvents like water induce a hypsochromic shift due to stronger solute-solvent interactions.
- Less polar solvents like chloroform may induce a bathochromic shift.

- The experimental values can be compared with literature values for validation.



The graph showing the effect of different solvents on absorption maxima (λmax) and absorbance. The blue line represents λmax values, while the red dashed line represents absorbance. Let me know if you need any modifications!

Conclusion

The absorption maxima (λmax) of an organic compound were successfully determined using a UV-Visible spectrophotometer. The effect of solvents on λmax was studied, showing that solvent polarity significantly influences electronic transitions.