

Simultaneous UV Estimation of Ibuprofen and Paracetamol

Practical 03 | Instrumental Methods of Analysis and Novel Drug Delivery Systems

Aim

To study Simultaneous UV Estimation of Ibuprofen and Paracetamol, and interpret the recorded observations.

Principle

- At two selected wavelengths, the total absorbance of a suitable two-component mixture can be represented as the sum of its component contributions. The absorptivity matrix must be nonsingular and the Beer-Lambert model valid in the chosen range.
- An optical response is related to analyte concentration over the validated working range.
- A blank, suitable standards and consistent optical conditions are necessary for interpreting the response.
- If the two components have nearly proportional responses at the chosen wavelengths, small absorbance errors can create large concentration errors.

Materials and Apparatus

- Pure component standards, assigned mixture, solvent and UV spectrophotometer.
- Assigned analyte, suitable reference standard, solvent/reagents and volumetric glassware.
- Specified optical instrument and compatible cells or sample-introduction system.

Method

1. Prepare separate component standards using the assigned solvent and reporting units.
2. Determine the component absorptivities at both selected wavelengths.
3. Measure the mixture absorbance at the same wavelengths and path length.
4. Check that the two-equation system is suitable and the response lies within the calibration range.
5. Solve for both concentrations and apply the actual dilution factor.
6. Report each component separately and assess the result against the prepared/declared mixture basis.

Observation Record

Complete this record using actual laboratory findings or the provided teaching data.

Observation / parameter	Record / finding
Wavelengths	_____
Component absorptivities	_____
Mixture absorbances	_____
Calculated concentrations	_____
Dilution	_____

Calculations and Interpretation

- $A_1 = a_{X1} CX + a_{Y1} CY$; $A_2 = a_{X2} CX + a_{Y2} CY$, for the same stated path length and units.
- $D = a_{X1} a_{Y2} - a_{X2} a_{Y1}$; D must be nonzero and sufficiently well conditioned.
- $CX = (A_1 a_{Y2} - A_2 a_{Y1})/D$.
- $CY = (a_{X1} A_2 - a_{X2} A_1)/D$.

Worked Illustration

Illustration: $A_1 = 0.300$, $A_2 = 0.350$ and $(a_{X1}, a_{Y1}, a_{X2}, a_{Y2}) = (0.020, 0.010, 0.005, 0.030)$ L/mg give $CX = CY = 10.0$ mg/L in the stated two-equation model.

The values in this illustration are for calculation practice.

Result

Record the actual finding, calculated value with units where relevant, and a conclusion supported by the observations.

Finding: _____

Conclusion: _____

Precautions

- Use clean compatible cells and consistent orientation where cells are used.
- Keep readings within the calibration range and examine the calibration fit.
- Avoid assuming that another analyte or solvent has the same response factor.

Viva Questions

1. Why measure the pure components?

Their wavelength-specific responses supply the coefficients needed to separate the mixture contributions.

2. Why choose two suitably different wavelength responses?

Nearly proportional component responses make the equations poorly conditioned, so small measurement errors can produce large concentration errors.

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