

Amino Acid Chirality Testing by Polarimetry

Reliable Quality Control in Pharmaceutical and Food Applications

Amino acids are fundamental building blocks of proteins and play a crucial role in numerous biological processes, including metabolism, nutrient transport, and biosynthesis. Due to their importance in pharmaceutical formulations, food production, and fermentation processes, precise control of their purity and concentration is essential. One of the most reliable and non-destructive methods for analyzing amino acids is the measurement of optical rotation using polarimetry. This technique enables fast and accurate determination of both concentration and enantiomeric composition.

Why Optical Rotation Matters

Amino acids are chiral molecules (except glycine), meaning they exist as two enantiomers (L- and D-forms). These enantiomers differ in their interaction with polarized light and often exhibit significantly different biological activity. When linearly polarized light passes through an optically active substance, the plane of polarization is rotated.

The magnitude of this rotation depends on:

- The concentration of the sample
- The molecular structure
- The wavelength of light
- The path length of the measurement cell

Because of this direct relationship, optical rotation serves as a key parameter for:

- Verification of purity
- Determination of concentration
- Identification of the correct enantiomer

This is particularly important in pharmaceutical applications, where the biological effect is often linked to a specific enantiomer.

Optical Activity and Chemical Influences

The optical rotation of amino acids is strongly influenced by their chemical environment.

Due to their amphoteric nature, amino acids contain both acidic ($-\text{COOH}$) and basic ($-\text{NH}_2$) functional groups, which can be protonated or deprotonated depending on pH.

As a result:

- The molecular structure changes with pH
- The isoelectric point (pI) affects the charge distribution
- The optical rotation varies accordingly

Also in industrial biotechnology, such as the production of monosodium glutamate (MSG), polarimetric measurements are essential for process monitoring and quality assurance.

Key control points include:

- Monitoring sugar purity before fermentation
- Verification of the correct amino acid enantiomer
- Control of product purity during processing
- Final quality approval

Solution from SCHMIDT + HAENSCH

Using the SCHMIDT + HAENSCH VariPol Polarimeter provides a highly precise method for determining the optical rotation of amino acids. The device enables fast and reliable measurement of specific rotation, ensuring accurate control of enantiomeric composition and compliance with pharmacopeial standards. The VariPol allows measurements under defined conditions of temperature and wavelength. In combination with the Aquisys3 software, it offers secure data management, full traceability, and compliance with regulations such as 21 CFR Part 11, while supporting efficient workflows. This integrated solution ensures reliable quality control, and guarantees consistent pharmaceutical product quality.



VariPol
Polarimeter

Product type	Product
Polarimeter	VariPol Modular Polarimeter
Accessories	VariTube Flow-through, 100 mm
Accessories	VariTouch Display
Accessories	Quartz control plate

Advantages

- High-precision optical rotation measurement
- Excellent temperature stability
- User-friendly software and workflow integration
- Fast and reproducible analysis
- Ideal for enantiomeric purity determination
- Compliance with pharmacopeial standards
- Reliable quality control of chiral pharmaceuticals
- 21 CFR Part 11 compliant
- non-destructive by design

Typical industries

- Raw material inspection
- Final product verification
- Pharmaceutical R&D
- Alcohol and Beverage Industry Sugar Industry
- Cosmetics / Pharmaceutical