Application Note
Pharma Industry

SCHMIDT HAENSCH

Controlling Camphor Content in Pharmaceutical Products

Determination of Camphor by Polarimetry

Camphor is a naturally occurring organic compound derived from trees of the laurel family, particularly Cinnamomum camphora. It is also industrially produced from precursors such as Alpha-pinene. The substance appears as a white, wax-like solid with a characteristic aromatic odor and is widely used in pharmaceutical, cosmetic, and technical applications.

In modern applications, camphor is mainly used in topical formulations such as ointments, gels, and inhalation products due to its cooling, mild anesthetic, and antimicrobial properties. Typical concentrations in medicinal products are below 10 %, as higher doses may lead to toxic effects.

Camphor as a Chiral Compound
Camphor is a chiral molecule, meaning it exists in two enantiomeric forms (mirror-image structures):

- D-camphor (naturally occurring, dextrorotatory)
- L-camphor

Synthetic camphor is typically produced as a racemic mixture containing equal amounts of both enantiomers, resulting in no net optical activity. The enantiomers exhibit different biological and toxicological properties. For example, L-camphor and racemic mixtures have shown higher toxicity compared to D-camphor in experimental studies. For this reason, monitoring enantiomeric composition and purity is essential in pharmaceutical quality control.

Why Monitoring is Essential
Camphor is used in a wide range of applications, including:
- Pharmaceutical ointments for muscle pain, inflammation, and respiratory conditions
- Cooling gels and anti-itch formulations
- Vapor products for cough suppression
- Cosmetic and dental applications
- Non-medical uses such as pest control or flavoring

Due to its pharmacological activity and potential toxicity, strict quality control is required. Variations in concentration or enantiomeric composition may lead to:

- Reduced therapeutic effectiveness
- Increased risk of side effects or toxicity
- Non-compliance with regulatory standards

Polarimetry is a well-established analytical technique for determining the optical activity of chiral substances such as camphor.

The optical rotation of camphor depends on:
- Concentration of the substance
- Optical path length
- Temperature
- Wavelength of measurement

For D-camphor, a specific rotation of approximately +44° (at 20 °C and 589 nm in benzene) has been reported.

By measuring optical rotation, polarimetry enables:
- Determination of camphor concentration
- Verification of enantiomeric composition
- Assessment of product purity

The method is standardized in AOAC 926.18, making it a recognized reference technique for camphor analysis in pharmaceutical products.

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Solution from SCHMIDT + HAENSCH

Using the SCHMIDT + HAENSCH VariPol Polarimeter provides a highly precise method for determining the optical rotation of pharmaceutical substances such as Camphor. The system 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 concentration, temperature, and wavelength for direct comparison with USP requirements. 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
Modular Polarimeter for Pharma

Product type	Product
Polarimeter	VariPol Modular Polarimeter
Accessories	VariPol Tube Flow Through, 100 mm
Accessories	VariTouch Display
Accessories	Quartz control plate

Advantages

- Reliable determination of camphor concentration
- Accurate analysis of enantiomeric composition
- Compliance with AOAC and pharmaceutical standards
- High measurement precision and repeatability
- Reduced risk of product deviations and batch rejection
- 21 CFR Part 11 compliant
- non-distructive by design

Typical industries

- Pharmaceutical quality control
- Analysis of ointments, gels, and inhalation products
- Cosmetic formulations
- Raw material inspection
- Research and development of chiral compounds