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Optical Rotation Measurement for High-concentration Acidic Sample Solutions

< Key Points >

- The P-4000 polarimeters offer high durability for acidic sample measurements because of an acid-resistant coating on the sample compartment wall.

< Introduction >

In certain optical rotation tests described in the United States pharmacopeia (USP) and the Japanese pharmacopoeia (JP), sample preparation requires the use of acidic solutions such as 5 N hydrochloric acid (USP) or 6 mol/L hydrochloric acid (JP). Because optical rotation is temperature-dependent, it is important to monitor the temperature during measurements. The P-4000 series polarimeters are equipped with a temperature sensor that can be inserted directly into the cell. This cell sensor has an acid-resistant coating, allowing direct measurement of the temperature of acidic sample solutions. To protect the instrument when measuring acidic liquid samples, the P-4000 series incorporates the following features:

1. Acid-resistant coating on the sample compartment wall
2. Quartz window preventing acidic gas from entering the instrument*
3. Ventilation of acidic gas*
4. Connection to a ventilation duct**

* Standard feature only for the P-4200 and P-4300
** Optional for the P-4200 and P-4300

This application note describes the measurement of L-alanine in 6 mol/L hydrochloric acid.

< Keywords >
Polarimeter, acid resistant, 6 mol/L hydrochloric acid, L-alanine

Fig. 1 P-4200 Polarimeter

< Experimental >

- Sample
  L-alanine (research reagent)
  In accordance with the monograph described in JP XVIII[1)] (after drying, 2.5 g, 6 mol/L hydrochloric acid TS, 25 mL, 100 mm), the sample was prepared by dissolving dried L-alanine in a 6 mol/L hydrochloric acid solution.

- System
  Instrument: P-4200 polarimeter
  Cell: RQC-450 8.5-mm rectangular quartz cell (path length: 100 mm)

- Measurement conditions
  Light source: Na lamp Wavelength: D-line
  Integration time: 5 sec Number of repeats: 1

< Results and Discussion >

Table 1 shows the measurement results for the specific rotation of L-alanine. The acid-resistant cell sensor enables accurate monitoring of the sample temperature, even for a strong acid solution of 6 mol/L hydrochloric acid, allowing precise measurement of the optical rotation.

Table 1 Results for L-alanine

Specific rotation	Temperature during measurement / ºC
+14.824	20.4

< Conclusions >

The P-4000 series polarimeters allow accurate measurement of optical rotation for highly acidic sample solutions, such as 6 mol/L hydrochloric acid, while directly monitoring the sample temperature. Additionally, these polarimeters exhibit high resistance to acidic samples, enabling reliable operation while maintaining the instrument in optimal condition.

< References >

1. Ministry of Health, Labour and Welfare: June 7, 2021, MHLW Ministerial Notification No. 220, “The Japanese Pharmacopoeia 18th edition”, (2021).

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