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Application News

High Performance Liquid Chromatograph Nexera™ lite

Analysis of Total Lactic Acid by Dissolution Test of Synthetic Resin Container Containing Polylactic Acid as the Main Component

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User Benefits

- Dissolution testing of synthetic resin containers containing polylactic acid (PLA) as the main component is possible.
- Stable analysis is possible using a reversed-phase column available for 100 % aqueous mobile phase.

■ Introduction

In general, biodegradable plastics are defined as plastics that have the same durability as normal plastics but that are completely decomposed into carbon dioxide and water by the action of naturally occurring microorganisms after use. Among them is PLA, a sustainable material made from plant-derived starch and sugar.

Under the Japanese Food Sanitation Act, test methods and content standards are set in the "Specifications and Standards for Food and Food Additives, etc., Section 3, Apparatus, Containers and Packaging" for apparatus, containers and packaging that come into direct contact with foods and food additives from raw materials to ingestion.[1] In synthetic resins containing PLA as the main component, total lactic acid eluted using a leachate solution corresponding to the food used is analyzed by liquid chromatography. The standard specifies a total lactic acid content of 30 µg/mL or less.[2]

This article describes the measurement of total lactic acid in a cup containing PLA as its main component.

■ Analysis of PLA Standard Solution

Weighed 1.07 g of L-lactate lithium precisely and made into 1000 mL with ultrapure water using a volumetric flask. Transferred 3 mL of this solution into another volumetric flask and made into 100 mL with ultrapure water (30 µg/mL). Transferred 1 mL of this solution into a polypropylene tube and added 100 µL of 0.2 mol/L sodium hydroxide aqueous solution. The mixture was sealed and kept at a temperature of 60 °C for 15 minutes with occasional shaking. After cooling, 100 µL of 0.2 mol/L phosphoric acid was added, and this solution was used as the standard solution. Table 1 shows the analytical conditions. In this article, a reversed-phase column available for 100 % aqueous mobile phase was used.

The results of six repeated analyses of the standard solution showed that the repeatability (%RSD) of retention time and the peak area were <0.01 % and 0.5 %, respectively.

■ Dissolution Test of PLA Cup

The PLA cup that was used as the sample was washed thoroughly with water. The leachate was left at 60 °C for 30 minutes using 2 mL of ultrapure water per square centimeter of surface area. Transferred 1 mL of this solution into a polypropylene tube and added 100 µL of 0.2 mol/L sodium hydroxide aqueous solution. The mixture was sealed and kept at a temperature of 60 °C for 15 minutes with occasional shaking. After cooling, 100 µL of 0.2 mol/L phosphoric acid was added, and this solution was used as the sample solution. Fig. 1 shows chromatograms of the standard solution and the sample solution. The analytical results on the cup used show that total lactic acid content was below the value specified in the standard.

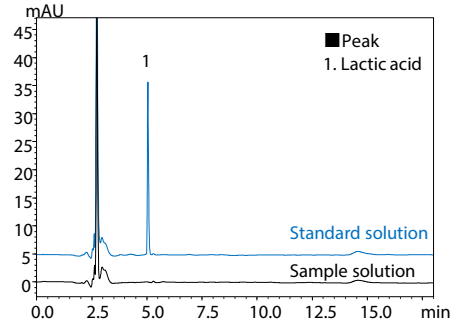

Fig. 1 Chromatograms of Standard Solution and Sample Solution

Table 1 Analytical Conditions

System:	Nexera lite
Column:	Shim-pack Scepter™ C18-120*1 (250 mm × 4.6 mm I.D., 5 µm)
Flowrate:	1.0 mL/min
Mobile Phase:	Water/Acetonitrile/Phosphoric acid=99 : 1 : 0.1
Column Temp.:	40 °C
Injection Volume:	100 µL
Vial:	SHIMADZU LabTotal™ for LC 1.5 mL, Glass*2
Detection:	210 nm (SPD-40V)

*1 P/N: 227-31020-06 *2 P/N: 227-34001-01

■ Conclusion

Stable analysis is possible at 30 µg/mL as specified in the standard for the dissolution test of synthetic resin containers. The analytical conditions in this article can be used to determine whether a PLA container is compliant with the standard or not.

References

1) Ordinance No. 370 of the Ministry of Health, Labour and Welfare, Japan (MHLW), December 28, 1959 (Partially revised by MHLW Ordinance 381, December 4, 2020).
2) Food Safety Directive 1030001 issued by the Manager of the Food Safety Division, Pharmaceuticals and Foods Department, Ministry of Health, Labour and Welfare (October 30, 2007).

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