

the titration vessel through the gas dispersion tube at a rate of about 100 mL/min; if necessary, heat the sample cylinder gently to maintain this flow rate.

Acceptance criteria: NMT 0.001%

ADDITIONAL REQUIREMENTS

- **PACKAGING AND STORAGE:** Preserve in tight cylinders, and prevent exposure to excessive heat.

Butyl Alcohol



CH₃CH₂CH₂CH₂OH 74.12

1-Butanol;
1-Butyl alcohol;
n-Butanol;
n-Butyl alcohol [71-36-3].

DEFINITION

Butyl Alcohol is *n*-butyl alcohol. It contains NLT 99.5% of *n*-butyl alcohol (C₄H₁₀O).

IDENTIFICATION

- **A. INFRARED ABSORPTION** (197F)
- **B.** The retention time of the major peak from the *Sample solution* corresponds to the 1-butanol peak from the *System suitability solution*, as obtained in the *Assay*.

ASSAY

• **PROCEDURE**

System suitability solution: USP 1-Butanol RS and USP 2-Methyl-1-Propanol RS (1:1)

Reference solution: 0.1% of Butyl Alcohol in water

Sample solution: Butyl Alcohol (neat)

Chromatographic system

(See *Chromatography* (621), *System Suitability*.)

Mode: GC

Detector: Flame ionization

Column: 0.53-mm × 30-m; coated with a 3.0-μm thickness of phase G43

Temperatures

Detector: 250°

Injection port: 140°

Column: See *Table 1*.

Table 1

Initial Temperature (°)	Temperature Ramp (°/min)	Final Temperature (°)	Hold Time at Final Temperature (min)
40	—	40	20
40	10	240	20

Carrier gas: Helium

Flow rate: 4.8–4.9 mL/min

Injection volume: 1 μL

Injection type: Split injection, split ratio is 30:1

[NOTE—A needle wash with the *Sample solution* is recommended to minimize the carry-over.]

System suitability

Sample: *System suitability solution*

[NOTE—The 2-methyl-1-propanol peak typically shows at about 11 min, and the 1-butanol peak at about 15 min. See *Table 2*.]

Table 2

Component	Relative Retention Time (RRT)
2-Methyl-1-propanol	0.7
1-Butanol	1.0

System suitability requirements

Resolution: NLT 2.0 between 2-methyl-1-propanol and 1-butanol

Relative standard deviation: NMT 2.0%

Analysis

Samples: *Reference solution* and *Sample solution*

Calculate the percentage of butyl alcohol in the portion of sample taken:

$$\text{Result} = (r_U/r_T) \times 100$$

r_U = peak response of butyl alcohol

r_T = sum of all the peaks except the peaks each of which with an area less than 0.1 times the area of the major peak from the *Reference solution*

Acceptance criteria: NLT 99.5%

IMPURITIES

- **LIMIT OF BUTYRALDEHYDE, 2-BUTANOL, ISOBUTYL ALCOHOL (2-METHYL-1-PROPANOL), AND BUTYL ETHER**

Reference solution: 0.1% of Butyl Alcohol in water

Standard solution: 0.2% of USP Butyraldehyde RS, 0.2% of butyl ether, 0.1% of USP 2-Methyl-1-Propanol RS, and 0.1% of USP 2-Butanol RS in Butyl Alcohol

Sample solution and Chromatographic system: Proceed as directed in the *Assay*.

System suitability

Sample: *Standard solution*

[NOTE—See *Table 3*.]

Table 3

Component	Relative Retention Time (RRT)
Butyraldehyde	0.45
2-Butanol	0.5
2-Methyl-1-propanol	0.7
1-Butanol	1.0
Butyl ether	1.8

System suitability requirements

Resolution: NLT 1.5 between all adjacent peaks

Analysis

Samples: *Reference solution*, *Standard solution*, and *Sample solution*

If any peaks are present in the chromatogram from the *Sample solution* that have the same retention times as the peaks due to butyraldehyde, 2-butanol, isobutyl alcohol (2-methyl-1-propanol), and butyl ether, subtract the areas of any such peaks from the peak areas at these retention times in the chromatogram from the *Standard solution*.

$$\text{Result } (\Delta r) = r_S - r_U$$

r_S = peak response of each individual impurity (butyraldehyde, 2-butanol, isobutyl alcohol, or butyl ether) in the *Standard solution*

r_U = peak response of each individual impurity (butyraldehyde, 2-butanol, isobutyl alcohol, or butyl ether), if present, in the *Sample solution*