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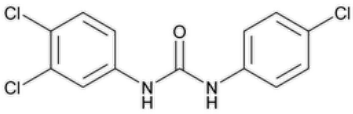
# Triclocarban



$C_{13}H_9Cl_3N_2O$ 315.58

Urea, *N*-(4-chlorophenyl)-*N*′-(3,4-dichlorophenyl)-;

3,4,4′-Trichlorocarbanilide;

1-(4-Chlorophenyl)-3-(3,4-dichlorophenyl)urea CAS RN®: 101-20-2; UNII: BGG1Y1ED0Y.

## DEFINITION

Triclocarban contains NLT 97.0% and NMT 103.0% of triclocarban ($C_{13}H_9Cl_3N_2O$), calculated on the dried basis.

## IDENTIFICATION

***Change to read:***

• **A.** ▲**Spectroscopic Identification Tests ⟨197⟩, *Infrared Spectroscopy*: 197K**▲ (CN 1-May-2020)

• **B.** The retention time of the major peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the *Assay.*

## ASSAY

• **Procedure**

**Mobile phase:** Acetonitrile, methanol, water, and glacial acetic acid (400:500:300:1.5)

**System suitability solution:** 0.1 mg/mL each of USP Triclocarban RS, USP Triclocarban Related Compound A RS, and USP Triclocarban Related Compound C RS in acetonitrile

**Standard solution:** 0.1 mg/mL of USP Triclocarban RS in acetonitrile. The solution is stable for 12 h.

**Sample solution:** 0.1 mg/mL of Triclocarban in acetonitrile. The solution is stable for 12 h.

**Chromatographic system**

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

**Mode:** LC

**Detector:** UV 265 nm

**Column:** 4.6-mm × 25-cm; 5-µm packing L1

**Flow rate:** 2 mL/min

**Injection volume:** 20 µL

**System suitability**

**Samples:** *System suitability solution* and *Standard solution*

[Note—The relative retention times for triclocarban related compound A, triclocarban, and triclocarban related compound C are 0.7, 1.0, and 1.6, respectively.]

**Suitability requirements**

**Resolution:** NLT 2.0 between triclocarban related compound A and triclocarban, NLT 2.0 between triclocarban and triclocarban related compound C, *System suitability solution*

**Relative standard deviation:** NMT 2.0%, *Standard solution*

**Analysis**

**Samples:** *Standard solution* and *Sample solution*

Calculate the percentage of triclocarban ($C_{13}H_9Cl_3N_2O$) in the portion of Triclocarban taken:

$$\text{Result} = (r_U/r_S) \times (C_S/C_U) \times 100$$

$r_U$ = peak response from the *Sample solution*

$r_S$ = peak response from the *Standard solution*

$C_S$ = concentration of USP Triclocarban RS in the *Standard solution* (mg/mL)

$C_U$ = concentration of Triclocarban in the *Sample solution* (mg/mL)

**Acceptance criteria:** 97.0%–103.0% on the dried basis

## IMPURITIES

• **Organic Impurities**

**Mobile phase:** Acetonitrile, methanol, water, and glacial acetic acid (370:380:250:1)

**Internal standard solution:** 0.12 mg/mL of *p*-nitrochlorobenzene in methanol

**Standard solution:** 2 µg/mL each of USP Triclocarban RS, USP Triclocarban Related Compound A RS, USP Triclocarban Related Compound C RS, USP Triclocarban Related Compound D Mixture RS, and 2.4 µg/mL of *p*-nitrochlorobenzene from the *Internal standard solution*. Dissolve and dilute with methanol to volume.

**Sample solution:** 0.2 mg/mL of Triclocarban and 2.4 µg/mL of *p*-nitrochlorobenzene from the *Internal standard solution*. Dissolve and dilute with methanol to volume.

**Chromatographic system**

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

**Mode:** LC

**Detector:** UV 254 nm

**Column:** 4.6-mm × 15-cm; 5-µm packing L1

**Column temperature:** 40°

**Flow rate:** 1.3 mL/min

**Injection volume:** 20 µL

**System suitability**

**Sample:** *Standard solution*

**Suitability requirements**

**Signal-to-noise ratio:** NLT 10 for triclocarban related compound A, triclocarban related compound C, and triclocarban related compound D mixture

**Relative standard deviation:** NMT 2.0% for triclocarban

**Analysis**

**Samples:** *Standard solution* and *Sample solution*

Calculate the percentage of each impurity in the portion of Triclocarban taken:

$$\text{Result} = (R_U/R_S) \times (C_S/C_U) \times 100$$

$R_U$ = peak response ratio of each impurity to the internal standard from the *Sample solution*

$R_S$ = peak response ratio of corresponding specified impurity to the internal standard from the *Standard solution* (use the triclocarban peak response ratio to calculate for any individual impurity)

$C_S$ = concentration of each impurity in the *Standard solution* (µg/mL)

$C_U$ = concentration of Triclocarban in the *Sample solution* (µg/mL)

**Acceptance criteria:** See *Table 1*.

**Table 1**

| Name | Relative Retention Time | Acceptance Criteria, NMT (%) |
|---|---|---|
| *p*-Nitrochlorobenzene[a] | 0.45 | — |
| Triclocarban related compound A[b] | 0.64 | 1.0 |

| Name | Relative Retention Time | Acceptance Criteria, NMT (%) |
|---|---|---|
| Triclocarban | 1.00 | — |
| Triclocarban related compound C[c] | 1.66 | 1.0 |
| Triclocarban related compound D mixture[d] | 2.72 and 3.25 | 1.0 |
| Any other individual impurity | — | 1.0 |
| Total impurities | — | 2.0 |

[a] Internal standard—for information only.

[b] 1,3-Bis(4-chlorophenyl)urea.

[c] 1,3-Bis(3,4-dichlorophenyl)urea.

[d] Consists of two components, triarylbiuret 1 and triarylbiuret 2. Triarylbiuret 1 is [3,5-bis(4-chlorophenyl)-1-(3,4-dichlorophenyl)biuret] with RRT of 2.72. Triarylbiuret 2 is [1,5-bis(4-chlorophenyl)-3-(3,4-dichlorophenyl)biuret] with RRT of 3.25. The acceptance criteria is the sum of triarylbiuret 1 and triarylbiuret 2.

- **Chloroanilines**

**Dimethylformamide solution:** 5% dimethylformamide in 1 N hydrochloric acid

**Sodium nitrite solution:** 2.5 mg/mL of sodium nitrite in water

**Ammonium sulfamate solution:** 25 mg/mL of ammonium sulfamate in water

***N*-(1-naphthyl)ethylenediamine dihydrochloride solution:** 10 mg/mL in water

**Standard stock solution 1:** 560 µg/mL of 3,4-dichloroaniline and 440 µg/mL of *p*-chloroaniline dissolved in 2% of the final volume with the *Dimethylformamide solution*. Dilute with 0.2 N hydrochloric acid to volume.

**Standard stock solution 2:** 56 µg/mL of 3,4-dichloroaniline and 44 µg/mL of *p*-chloroaniline in 0.2 N hydrochloric acid from *Standard stock solution 1*

**Standard stock solution 3:** 5.6 µg/mL of 3,4-dichloroaniline and 4.4 µg/mL of *p*-chloroaniline in 0.2 N hydrochloric acid from *Standard stock solution 2*

**Standard stock solution 4:** 0.56 µg/mL of 3,4-dichloroaniline and 0.44 µg/mL of *p*-chloroaniline in 0.2 N hydrochloric acid from *Standard stock solution 3*

**Standard solutions:** Prepare *Standard solutions 1–9* as listed in *Table 2*. Transfer the aliquot of the *Standard stock solution* to each individual 25-mL volumetric flask. Place all flasks in an ice bath at 0° to 5° for 10 min. Add to each volumetric flask 1 mL of *Sodium nitrite solution*, shake well, and let the solution stand for 10 min in the ice bath. Add to each flask 1 mL of the *Ammonium sulfamate solution*, shake well, and allow the reaction to take place for 10 min inside the ice bath. Add 2 mL of the *N-(1-naphthyl)ethylenediamine dihydrochloride solution* to each *Standard solution 1–8*, and remove all volumetric flasks from the ice bath. Do not add the *N-(1-naphthyl)ethylenediamine dihydrochloride solution* to *Standard solution 9*. Dilute all solutions with 0.2 N hydrochloric acid to volume. Allow to stand for at least 30 s, and measure the absorbance within 15 min.

**Table 2**

| Standard Solution | Standard Stock Solution Used | Volume of Standard Stock Solution (mL) | Concentration of Total Chloroaniline (ppm) |
|---|---|---|---|
| 1 | Standard stock solution 4 | 2 | 20 |
| 2 | Standard stock solution 4 | 5 | 50 |
| 3 | Standard stock solution 4 | 10 | 100 |
| 4 | Standard stock solution 4 | 15 | 150 |

| Standard Solution | Standard Stock Solution Used | Volume of Standard Stock Solution (mL) | Concentration of Total Chloroaniline (ppm) |
|---|---|---|---|
| 5 | Standard stock solution 3 | 2 | 200 |
| 6 | Standard stock solution 3 | 3 | 300 |
| 7 | Standard stock solution 3 | 4 | 400 |
| 8 | Standard stock solution 3 | 5 | 500 |
| 9 | Standard stock solution 3 | 5 | 0 |

**Sample stock solution:** Dissolve 500 mg of Triclocarban with 5 mL of the *Dimethylformamide solution* in a 50-mL beaker, and shake the solution. Continue shaking the solution while adding 15 mL of 0.2 N hydrochloric acid to precipitate the product, and shake for 15 min. Filter the suspension into a 50-mL volumetric flask, and dilute with 0.2 N hydrochloric acid to volume.

**Sample solution:** Transfer 10 mL of the *Sample stock solution* to a 25-mL volumetric flask, and place in an ice bath at 0° to 5° for 10 min. Add 1 mL of the *Sodium nitrite solution*, shake well, and let the solution stand for 10 min in the ice bath. Add 1 mL of the *Ammonium sulfamate solution*, shake well, and allow to stand for 10 min. Add 1 mL of the *N-(1-naphthyl)ethylenediamine dihydrochloride solution*, and remove the solution from the ice bath. Dilute with 0.2 N hydrochloric acid to volume. Allow to stand for at least 30 s, and measure the absorbance within 15 min.

**Sample solution blank:** Follow the procedure described in the preparation of the *Sample solution* but do not add the *N-(1-naphthyl)ethylenediamine dihydrochloride solution*.

**Instrumental conditions**

**Mode:** UV

**Analytical wavelength:** 552 nm

**Analysis**

**Samples:** *Standard solutions* and *Sample solution*

Calibrate the absorbance to zero with *Standard solution 9*. Generate a calibration curve of absorbance against concentration of total chloroaniline using the data from *Standard solutions 1–8*. Determine the concentration, $C_S$, in µg/mL, of chloroanilines in the *Sample solution* using the calibration curve. Calculate the concentration, in ppm, of chloroanilines in the portion of Triclocarban taken:

$$\text{Result} = (C_S/C_U) \times F$$

$C_S$ = concentration of chloroanilines in the *Sample solution* (µg/mL)

$C_U$ = concentration of Triclocarban in the *Sample solution* (µg/mL)

$F$ = conversion factor to ppm ($10^6$)

**Acceptance criteria:** NMT 400 ppm

## SPECIFIC TESTS

• **Loss on Drying ⟨731⟩**

**Sample:** Dry a sample at 110° for 4 h.

**Acceptance criteria:** NMT 0.2%

## ADDITIONAL REQUIREMENTS

• **Packaging and Storage:** Preserve in well-closed container. Store at ambient temperature and humidity.

• **USP Reference Standards ⟨11⟩**

USP Triclocarban RS

USP Triclocarban Related Compound A RS

1,3-Bis(4-chlorophenyl)urea.

$C_{13}H_{10}Cl_2N_2O$ 281.14

USP Triclocarban Related Compound C RS

1,3-Bis(3,4-dichlorophenyl)urea.

$C_{13}H_8Cl_4N_2O$ 350.03

USP Triclocarban Related Compound D Mixture RS

Mixture of triarylbiuret 1 (3,5-bis(4-chlorophenyl)-1-(3,4-dichlorophenyl)biuret and triarylbiuret 2 (1,5-bis(4-chlorophenyl)-3-(3,4-dichlorophenyl)biuret).

$C_{20}H_{13}Cl_4N_3O_2$ 469.15

**Auxiliary Information** - Please check for your question in the FAQs before contacting USP.

| Topic/Question | Contact | Expert Committee |
|---|---|---|
| TRICLOCARBAN | Documentary Standards Support | SM12020 Small Molecules 1 |
| REFERENCE STANDARD SUPPORT | RS Technical Services<br>RSTECH@usp.org | SM12020 Small Molecules 1 |

**Chromatographic Database Information:** Chromatographic Database

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