

Bathocuproine Method¹

Method 10238

0.1 to 8.0 mg/L Cu

TNTplus™ 860

Scope and application: For water, wastewater and process water. Digestion can be necessary to determine total copper.

¹ Adapted from Standard Methods for the Examination of Water and Wastewater.

**Test preparation****Instrument-specific information**

Table 1 shows all of the instruments that have the program for this test. The table also shows the adapter and light shield requirements for the applicable instruments that can use TNTplus vials.

To use the table, select an instrument, then read across to find the applicable information for this test.

Table 1 Instrument-specific information for TNTplus vials

Instrument	Adapters	Light shield
DR 6000, DR 5000	—	—
DR 3900	—	LZV849
DR 3800, DR 2800	—	LZV646
DR 1900	9609900 or 9609800 (A)	—

Before starting

DR 3900, DR 3800, DR 2800: Install the light shield in Cell Compartment #2 before this test is started.

Review the safety information and the expiration date on the package.

The recommended sample pH is 2.5–11.

The recommended temperature for samples and reagents is 15–25 °C (59–77 °F).

The recommended temperature for reagent storage is 15–25 °C (59–77 °F).

To make sure that all forms of the metal are measured, digest the sample with heat and acid. Use the Metals Prep Set TNTplus 890 to digest the sample.

DR 1900: Go to All Programs>LCK or TNTplus Methods>Options to select the TNTplus number for the test. Other instruments automatically select the method from the barcode on the vial.

Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

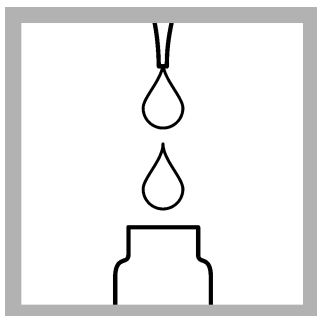
Items to collect

Description	Quantity
Copper TNTplus reagent set	1
Pipet, adjustable volume, 1.0–5.0 mL	1
Pipet tips, for 1.0–5.0 mL pipet	1

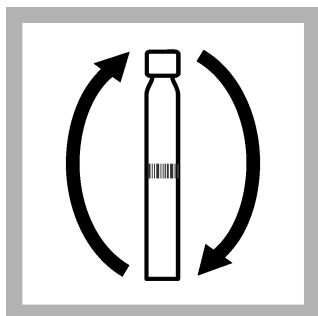
Sample collection and storage

- Collect samples in clean glass or plastic bottles that have been cleaned with 6 N (1:1) hydrochloric acid and rinsed with deionized water.
- To preserve samples for later analysis, adjust the sample pH to less than 2 with concentrated nitric acid (approximately 2 mL per liter). No acid addition is necessary if the sample is tested immediately.
- To determine dissolved copper, filter the sample before the acid addition.
- Keep the preserved samples at room temperature for a maximum of 6 months.
- Before analysis, adjust the pH to 4–6 with 8 N potassium hydroxide. Do not exceed pH 6 to prevent a copper precipitate.
- Correct the test result for the dilution caused by the volume additions.

Test procedure



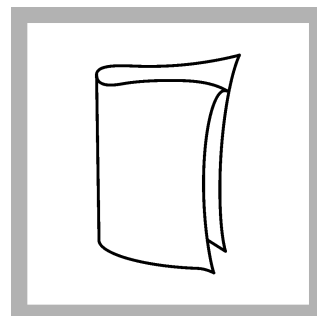
1. Use a pipet to add 2.0 mL of sample to the test vial.



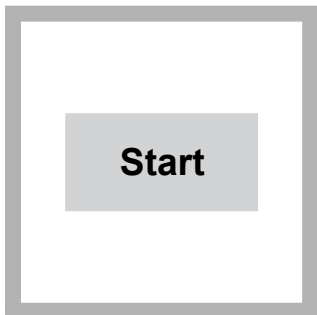
2. Tighten the cap on the vial and invert until completely mixed.



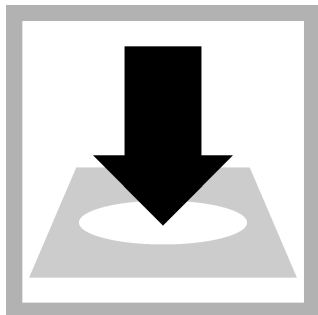
3. Start the reaction time of 3 minutes.



4. When the timer expires, clean the vial.



5. DR 1900 only: Select program 860. Refer to [Before starting](#) on page 1.



6. Insert the vial into the cell holder. DR 1900 only: Push **READ**. Results show in mg/L Cu.

Interferences

[Table 2](#) shows that the ions and levels were individually examined to the given concentrations and do not cause interference. No cumulative effects or influences of other ions were found.

Higher amounts of iron and chromium can cause high-bias results. Undissolved copper contained in complexes is only found after digestion.

Table 2 Interfering substances

Interfering substance	Interference level
Sn ²⁺ , Hg ²⁺	5 mg/L
Fe ²⁺ , Fe ³⁺	15 mg/L
Cr ³⁺ , Cr ⁶⁺	25 mg/L
Zn ²⁺ , Cd ²⁺ , Ni ²⁺ , Pb ²⁺	50 mg/L
Mg ²⁺ , K ⁺ , Na ⁺ , NH ₄ ⁺ , Ca ²⁺ , PO ₄ ³⁻ , CO ₃ ²⁻ , NO ₂ ⁻	500 mg/L
Cl ⁻ , NO ₃ ⁻ , SO ₄ ²⁻	1000 mg/L

Accuracy check

Standard solution method

Use the standard solution method to validate the test procedure, the reagents and the instrument.

Items to collect:

- 100-mg/L Copper Standard Solution
- 100-mL volumetric flask, Class A
- 4-mL volumetric pipet, Class A and pipet filler safety bulb
- Deionized water

1. Prepare a 4.0-mg/L copper standard solution as follows:

- Use a pipet to add 4.0 mL of a 100-mg/L copper standard solution into the volumetric flask.
- Dilute to the mark with deionized water. Mix well. Prepare this solution daily.

2. Use the test procedure to measure the concentration of the prepared standard solution.

3. Compare the expected result to the actual result.

Note: The factory calibration can be adjusted slightly with the standard adjust option so that the instrument shows the expected value of the standard solution. The adjusted calibration is then used for all test results. This adjustment can increase the test accuracy when there are slight variations in the reagents or instruments.

Method performance

The method performance data that follows was derived from laboratory tests that were measured on a spectrophotometer during ideal test conditions. Users can get different results under different test conditions.

Program	Standard	Precision (95% confidence interval)	Sensitivity Concentration change per 0.010 Abs change
barcode	4.0 mg/L Cu	3.9–4.1 mg/L Cu	0.04 mg/L Cu

Summary of Method

Copper (I) ions form an orange complex with the disodium salt of bathocuproine disulphonic acid. Copper (II) ions in the water sample are reduced to copper (I) ions by ascorbic acid before the complex is formed. The measurement wavelength is 478 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Item no.
Copper TNTplus reagent set	1	25/pkg	TNT860

Required apparatus

Description	Quantity/test	Unit	Item no.
Pipet, adjustable volume, 1.0–5.0 mL	1	each	BBP065
Pipet tips, for 1.0–5.0 mL pipet	1	75/pkg	BBP068
Light shield, DR 3800, DR 2800, DR 2700	1	each	LZV646
Light shield, DR 3900	1	each	LZV849

Recommended standards

Description	Unit	Item no.
Copper Standard Solution, 100-mg/L as Cu	100 mL	12842

Optional reagents and apparatus

Description	Unit	Item no.
DRB 200 Reactor, 115 VAC option, 9 x 13 mm + 2 x 20 mm, 1 block	each	DRB20001
Flask, volumetric, Class A, 100-mL glass	each	1457442
Metals Prep Set TNTplus	50/pkg	TNT890
Nitric Acid, concentrated	500 mL	15249
Potassium Hydroxide Solution, 8 N	100 mL MDB	28232H
Sampling bottle with cap, low density polyethylene, 500-mL	12/pkg	2087079
Water, deionized	4 L	27256



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