

Free Ammonia Analysis in the Presence of Monochloramine Using CHEMetrics® Visual Ammonia (HBA) CHEMets Test Kit, Cat. No. K-1420

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Overview

Chloramination, the disinfection of water with chloramines, is routinely used as the secondary disinfection process to maintain long-lived residuals in water distribution pipelines. Monochloramine is formed by the reaction of free ammonia (NH_3 and NH_4^+) with free chlorine. Without free ammonia residual, di- and tri-chloramines are formed by the reaction of excess free chlorine with monochloramine. To prevent formation of these less desirable chloramines, chloramination processes are optimized for monochloramine production in drinking water distribution systems by maintaining a free ammonia residual. Additionally, insufficient free ammonia and excess free chlorine can lead to formation of hazardous trihalomethanes in distribution systems. Conversely, excess free ammonia increases the potential for undesirable nitrification. A sudden drop in free ammonia in the system suggests that it is being converted to nitrite.

Monitoring free ammonia concentrations in addition to the monochloramine and free chlorine levels can help operators optimize their chloramination processes.

Sequential Monochloramine and Free Ammonia Analysis

The most expeditious way to measure free ammonia in the presence of monochloramine using CHEMetrics visual kits is to use Ammonia CHEMets® Test Kit, Cat. No. K-1420.

The hydroxybenzyl alcohol (HBA) chemistry employed with the K-1420 Ammonia Test Kit measures the sum of free ammonia and monochloramine (referred to as "Total Ammonia"). Free ammonia first reacts with hypochlorite to form monochloramine, and monochloramine then reacts with HBA in the presence

of sodium nitroferricyanide to form a green-colored complex.

To determine free ammonia only, two R-1402 CHEMets ampoules are required. The first ampoule is used to measure only monochloramine by excluding addition of hypochlorite to the sample. The second ampoule is used to determine "total ammonia." To determine the free ammonia concentration, the monochloramine result is subtracted from the total ammonia result. With the K-1420 CHEMets test kit, the total ammonia and monochloramine results are obtained by visually matching the developed color in the test ampoules to the color standards of the C-1404 ammonia comparator. The analyst then performs the calculation manually to determine the free ammonia concentration as ppm ammonia-nitrogen ($\text{NH}_3\text{-N}$).

Free Ammonia Test Procedure using K-1420 Ammonia CHEMets® Kit

1. To measure monochloramine only, complete all steps **EXCEPT step 4** of the 0 – 4 ppm Test Procedure in the K-1420 kit instructions (i.e. do NOT add A-1406 Activator Solution). Record the monochloramine result (MCA), expressed as ppm nitrogen (N).
Note: To convert the monochloramine result to ppm monochloramine as chlorine ($\text{NH}_2\text{Cl-Cl}_2$), multiply by 5.
2. Use a new R-1402 ampoule to measure total ammonia by completing **ALL** steps in the K-1420 0 – 4 ppm Test Procedure. Record the total ammonia result (TA), expressed as ppm N.
3. Subtract the monochloramine result (MCA) obtained in Step 1 from the total ammonia result (TA) obtained in Step 2 to determine the free ammonia result (FA) in ppm ammonia-nitrogen ($\text{NH}_3\text{-N}$).

$$FA = TA - MCA$$