

Eliminate TKN and Get Better Total Nitrogen Data

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Introduction

Nitrogen is a principle element referred to when discussing nutrient pollution and, along with phosphorus, is largely responsible for the occurrence of algal blooms. Two different techniques, wet chemical oxidation that determines nitrogen colorimetrically and

high-temperature oxidation that determines nitrogen by chemiluminescence, can provide laboratories with efficient, cost-effective alternatives to Total Kjeldahl Nitrogen (TKN) for the determination of total nitrogen.

Discussion

The EPA approved method for Total Nitrogen, Total Kjeldahl Nitrogen (TKN) plus nitrate/nitrite, is cumbersome, time consuming, hazardous, and not very effective at determining total nitrogen in ambient water. The TKN method does not measure nitrate or nitrite nitrogen; TKN measures organic nitrogen and the ammonium ion. TKN is sufficient in POTW or municipal influents because these samples rarely have nitrate, however, sewage treatment, industrial plant effluents, and ambient water consist predominantly of inorganic nitrogen (nitrate) with only traces of organic nitrogen.

Alternative methods used for the determination of total nitrogen measure all nitrogen compounds and report

them as a single result. The methods rely on alkaline persulfate digestion (PO) followed by colorimetric detection of nitrate nitrogen, or high temperature catalytic combustion (HTCC) with chemiluminescence detection.

Nydaahl studied the persulfate oxidation method extensively and determined the results of 10 sewage treatment plant effluents were equivalent to the results obtained by the TKN method (Figure 1). Nitrate was measured colorimetrically on a visible spectrophotometer similar to the Shimadzu UV-1800 (Figure 2).



Figure 1: Comparison of TKN with persulfate digestion

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Figure 2: Shimadzu UV-1800 UV-Visible spectrophotometer

Kroon compared TKN with an automated UV PO method and found no significant differences in surface waters or wastewaters. Bronk, and others, compared the PO method with the HTCC method and found that they provide reproducible results that are consistent with each other.

Chen, in comparing HTCC with chemiluminescence detection (on an instrument similar to Figure 3) with PO in soil extracts found the results were highly correlated (Figure 4), with the exception of greater values by HTCC when nitrogen concentrations were high.



Figure 3: Shimadzu TOC-L Total Organic Carbon Analyzer with Nitrogen Module installed

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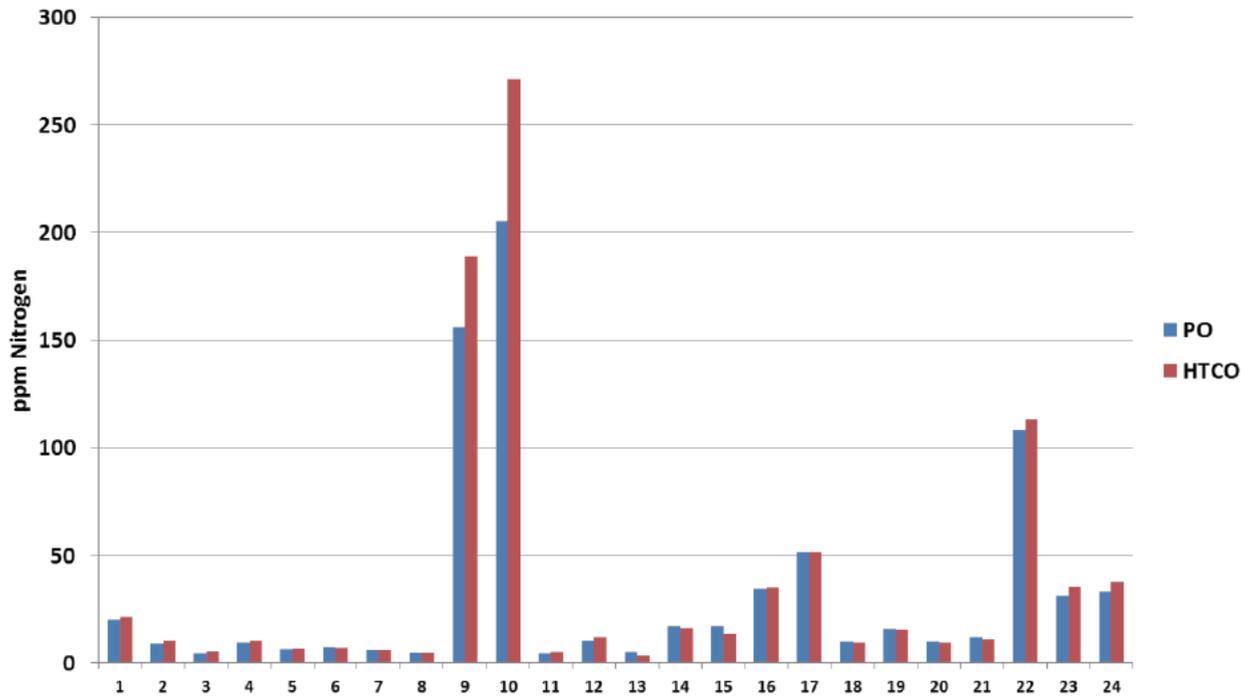


Figure 4: Comparison of persulfate and HTCC TN in soil extracts

Conclusion

Values of total nitrogen by TKN, PO, and HTCC are highly correlated, making both PO and HTCC suitable alternatives to TKN. Results by HTCC may be slightly higher than those by PO in samples containing high concentrations of TN.

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