Assessment of Volatile and Semi-Volatiles Toxic Organic Contaminants in Drinking Water

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ABSTRACT

Volatile organic compounds (VOCs), semi-volatile organic compound (SVOC), heavy transition metals, arsenic, radioactive nuclides, and nitrates/nitrites constitute major contaminants of drinking water. This work primarily concentrates on VOCs and recently we have started some assays on SVOC as well. Water sources that we have sampled and analyzed include residential drinking groundwater in Orangeburg and Calhoun Counties, bottled water, and limited number of samples from the houses with municipal services. A purging-trap-GC-MS equipped with autosampler was used to analyze the samples for possible VOC contamination applying the EPA-Method 524.2. More than seventy groundwater wells randomly located at the above-mentioned counties were analyzed for over two-years period. Thus far the results are insuring a VOC-free drinking groundwater for the residents in these rural areas. A water sample from a spring water source (in Blackville, SC) was assayed in which it contains trace amounts of tetrahydrofuran, THF. Water samples from a particular residential source supplied by municipal water system were found to have traces of chloroform and bromodichlormethane. Also a drinking-bottled-water was assayed for VOCs and found that it contains chloroform. The source of contamination however is unknown, further studies are required for identifying and remediating the pollution sources.
The EPA-Method 525.2 which requires solid-liquid extraction procedure has been applied for assaying SVOC. We are at calibration stages for SVOC and have not produced enough results or more information on this respect.

Instrumentation

•SOLATEK 72 Multi-Matrix Vial Autosampler

EKMAR 3100 Purge and Trap Concentrator

ERKINELMER Autosystem XL Gas Chromatography

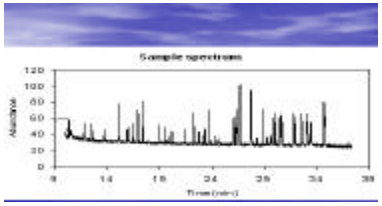
ERKINELMER Turbomass Gold Mass-spectrometer.

A computer is communicating with various ing

Calibration:

All Standards were purchased from ACCUSTANDARD, Inc
Stock Solution: sixty widely used VOCs of 2.00 µg/mL
Internal Standard: 4-bromofluorobenzene (BFB)
Surrogate standard: 1,2-Dichlorobenzene-D_4 2.00 µg/mL
Secondary standards: prepared from primary standards
All standards were prepared in the same manner: if 5-µL of it was added to 5-mL of sample there will be 5-ng standard in 1-mL of sample.

The GC Column: a 60-m borosilicate narrow bore column (0.25-mm).
Temperature Programming in the range of 30-240°C for GC-column, EPA recommend ramps were applied.
The satisfactory chromatogram that enabled us to quantify all the components of the standard is shown below:



Water Sources:

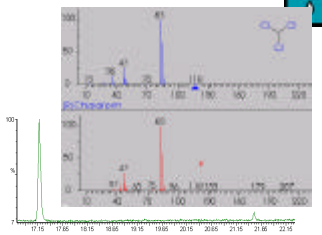
Residential Household Wells
(Orangeburg and Calhoun Counties)
Bottled Water
Houses With Municipal Services
Rain Water
Spring Water Source (in Blackville, SC)

Sampling Locations

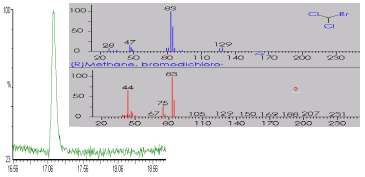
Experimental

The EPA method 524.2 was used for preparing the standards, and samples alike. A relatively fast (5-10°C/min) GC oven ramping at a temperature range of 35° to 240°C, has been used.
Water samples were brought and analyzed from drinking wells located in Orangeburg County and surrounding. The water samples were stored in refrigerator before use and all the samples were analyzed in less than five days from the time of samplings. During the experimentation, the 40-mL vials were used to take samples whose pHs were adjusted to 2 by adding 6-M hydrochloric acid.

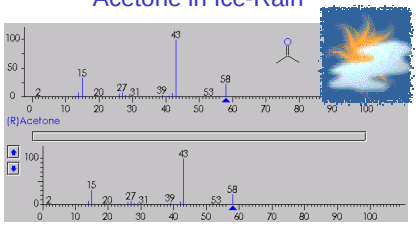
Chloroform in Tap Water



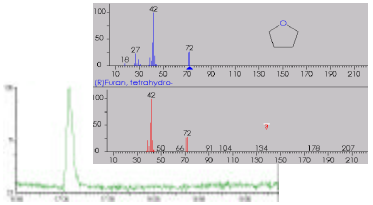
Bromodichlorometane



Acetone in Ice-Rain



THF Blackville Spring Water



Conclusions

roundwater samples form the house-wells of various regions in Orangeburg and neighboring counties were **free of VOCs**.

pring water located in Blackville (SC) shows that it is polluted with trace amount of THF.

ome tab-waters contains trace amounts of chloroform and one sample had traces of

Acknowledgements

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