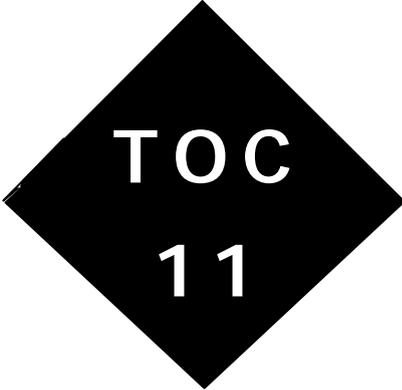


APPLICATION



POC measurement with TOC-4000 to prevent explosive gas mixtures in closed wastewater systems.

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A company with a closed wastewater system needed to know if dissolved flammable gases were in the piping system. Therefore, we must consider that wastewater pipes have two components:

- 1) wastewater
- 2) head space gases

The concentration of flammable head space gases in the pipes increases as the concentration of dissolved gases increase in the wastewater due to solubility and equilibrium effects. In the worst case, if the concentration of head space gases is too high, then the result could be an explosion.

For this application we utilized the Shimadzu On-Line TOC-4000 to measure Purgeable Organic Compounds (POC) in the wastewater. The customer was interested if the TOC-4000 could detect POC in the 0.1 ppm range. With this information, Shimadzu decided on four test compounds which can be considered POC type compounds. The compounds selected included typical solvents:

- 1) Chloroform
- 2) Toluene
- 3) Acetone
- 4) Methylene Chloride

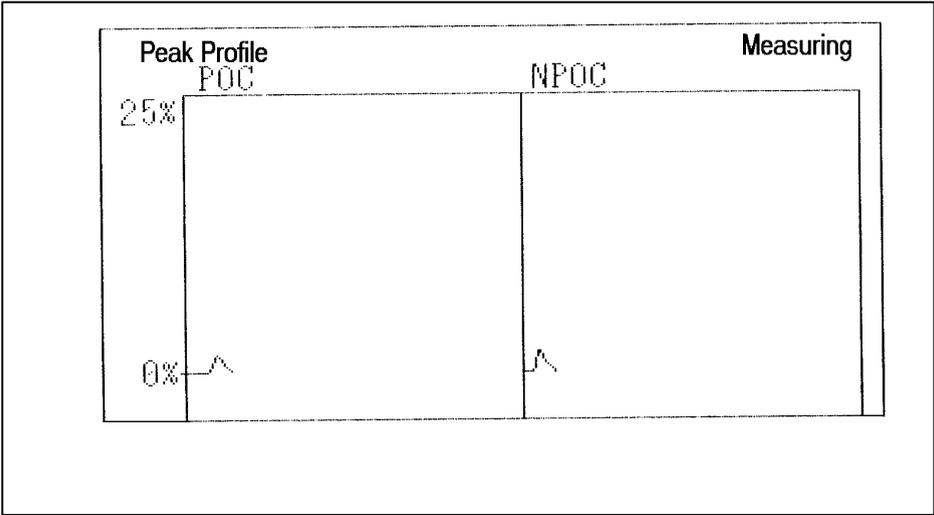


Fig. 1: Example of POC Peak Profile using Chloroform

TOC, ppm	POC, ppm	NPOC, ppm
0.4738	0.1082	0.3656
0.4615	0.1307	0.3308
0.6377	0.1339	0.5037

Tab. 1: Data of POC for Chloroform

CALIBRATION

For the POC determination a one-point calibration is performed with an Inorganic Carbon (IC) standard solution of 5 ppm. A 10 ppm solution of potassium hydrogen phthalate (KHP) solution was used for the Non-Purgeable Organic

Compounds (NPOC). Thus, the TOC standard is 15 ppm because the POC (5 ppm) + NPOC (10) ppm = TOC (15 ppm).

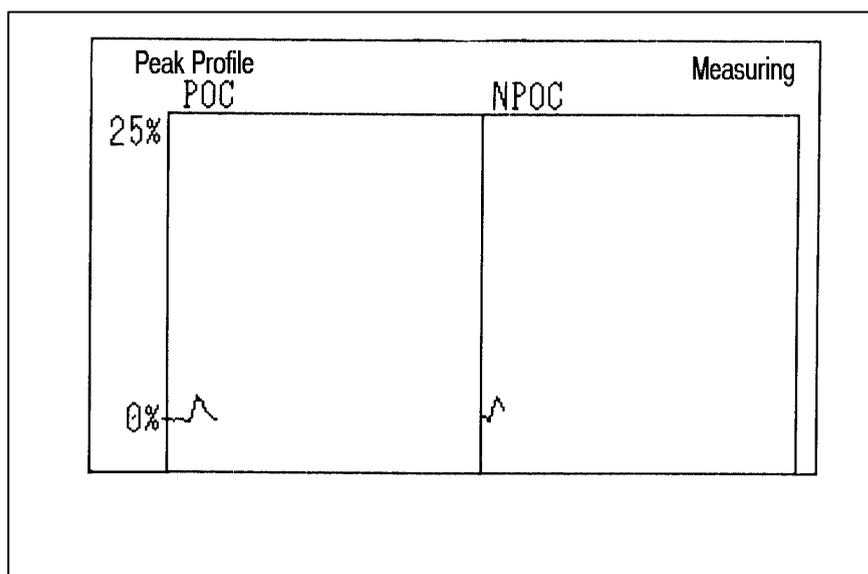


Fig. 2: Example of POC Peak Profile using Toluene

TOC, ppm	POC, ppm	NPOC, ppm
0.4252	0.1582	0.2670
0.4460	0.1421	0.3038
0.4511	0.1777	0.2733
0.4252	0.1593	0.2659
0.4768	0.1560	0.3207
0.4050	0.1376	0.2674

Tab. 2: Data of POC for Toluene

SAMPLES

The Chloroform, Toluene, Acetone, and Methylene Chloride solutions were diluted to a final concentration of 0.5 ppm. The samples are acidified, sparged and the POC is measured. Then the remaining solution is measured for NPOC. Because of

solubility and equilibrium effects, the concentration of organic material will be divided between POC and NPOC phases. Thus, the TOC (POC + NPOC) concentration should report values of about 0.5 ppm.

CONDITIONS

Type: TOC2 (NPOC + POC)
 Acid Volume: 100 uL
 Spare Time: 2.5 min

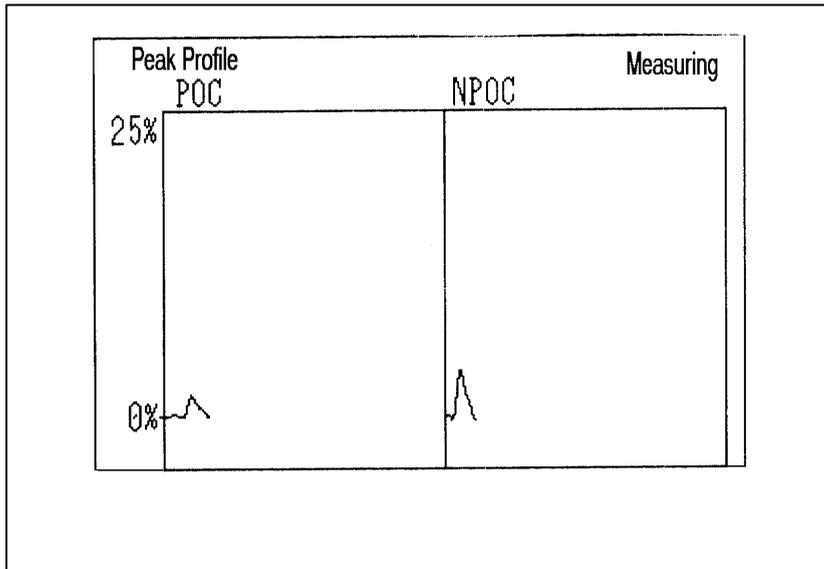


Fig. 3: Example of POC Peak Profile using Methylene Chloride

TOC, ppm	POC, ppm	NPOC, ppm
0.5963	0.1186	0.4776
0.6490	0.1404	0.5086
0.6107	0.1411	0.4695
0.6221	0.1249	0.4972
0.6194	0.1244	0.4950

Tab. 3: Data of POC for Methylene Chloride

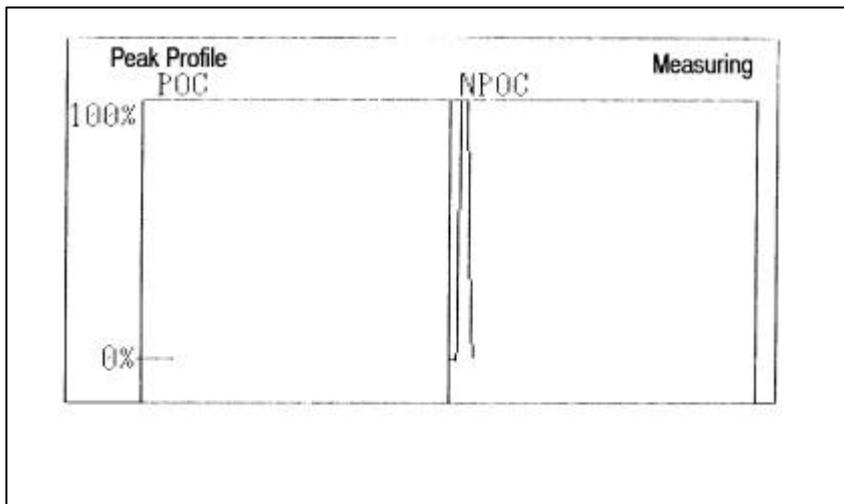


Fig 4: Example of POC Peak Profile using Acetone

TOC, ppm	POC, ppm	NPOC, ppm
13.784	0.0000	13.784
13.856	0.0000	13.856

Tab. 4: Data of POC for Acetone*

***Note:** A 0.5 ppm solution showed no POC, so a 15 ppm acetone solution was also measurement.

APPLICATION

Compound	# of Measurements	Average POC	Standard Deviation
Chloroform	3	0.1243 ppm	+/-0.0114
Toluene	6	0.1552 ppm	+/-0.0130
Methylene Chloride	5	0.1299 ppm	+/-0.0092
Acetone	2	No POC detected	

Tab.5: POCs measurement for various compounds

CONCLUSION

The data and peak profiles clearly indicate 0.1 ppm of POC can easily be detected. At 0.1 ppm POC, the baseline is well differentiated from the peak. The concentration in the POC phase will vary from compound to compound depending on the solubility and equilibrium effects. Chloroform, Toluene, and Methylene Chloride resulted in POC concentrations in the 0.12 ppm to 0.16 ppm range, while Acetone shown no measurable POC because of the high solubility in water. Also, notice that in all cases the TOC (POC + NPOC) results are in the 0.5 ppm concentration range as expected.

This paper has proven On-Line TOC is a useful tool for monitoring low level POC in closed waste streams where explosive gases can collect. In the process industry, the operators can be automatically notified of potential explosive POCs immediately. Once the operator is notified, the operator can verify the specific compound by GC. The identified compound can be trace back to the problem source if many facilities are using a single waste stream.

