Nanova Environmental

+1 (573)-476-6355
www.nanovaenv.com
info@nanovaenv.com
3338 Brown Station Rd.
Columbia, MO 65202

Application Note #4: Performance Evaluation of NovaPID – A Highly Sensitive, Stable and Reliable GC Gas Detector

Runmiao Xue

KEY WORDS

NovaPID, photoionization detector, VOC detector

INTRODUCTION

The photoionization detector (PID) has been widely used for volatile organic compound (VOC) detection. It is a non-destructive and sensitive detector, which can be used for the detection of a wide range of VOCs. Nanova Environmental Inc. (NEI) has launched the innovative NovaPID which can be easily connected to a gas chromatograph (GC) with capillary column. With its microfluidic design, the NovaPID provides better sensitivity along with great stability and reliability.

NOVAPID AGING TEST

Two methods were used for the PID aging test. The first method consisted of injecting 1ppm BTEX into the PIDs continuously for 13.9 hours at a flow rate of 22 ml/min. For comparison purposes, a commercially available PID was also tested under these same experimental conditions except that the NovaPID was heated by a metal block to 60 °C. The results are shown in **Figure 1**.

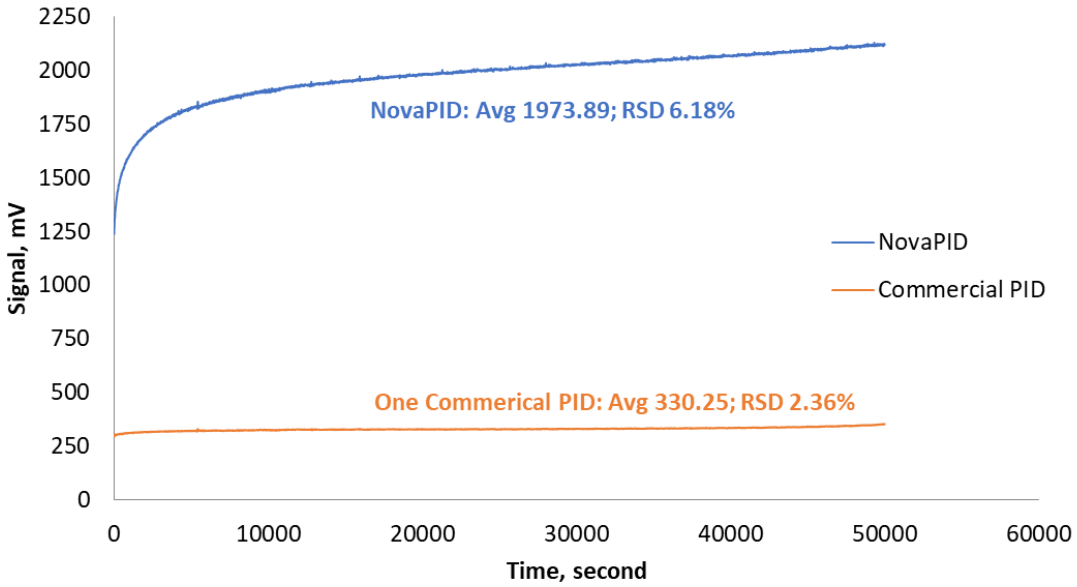

Figure 1. PID aging test with 1 ppm BTEX

The signal intensity of the NovaPID was 6 times higher than that of the commercial PID. The noise levels of both PIDs were determined by selecting 500 data points from 63429 to 65089s and calculating their standard deviation. The noise levels of the NovaPID and commercial PID were 0.32 mV and 0.20 mV, respectively. Higher signal intensity and similar noise level provide the NovaPID with the ability to obtain a lower detection limit. Compared to the signal at room temperature, the signal intensity of the NovaPID was 1.5 times higher when using at 60 °C. The results are shown in **Figure 2**. Therefore, NovaPID is recommended to be used at elevated temperature to obtain higher signal intensity and eliminate the VOC deposition on the UV lamp light-path window. However, it is not recommended to use NovaPID at a temperature of higher than 60 °C due to potential damage to the electronic parts.

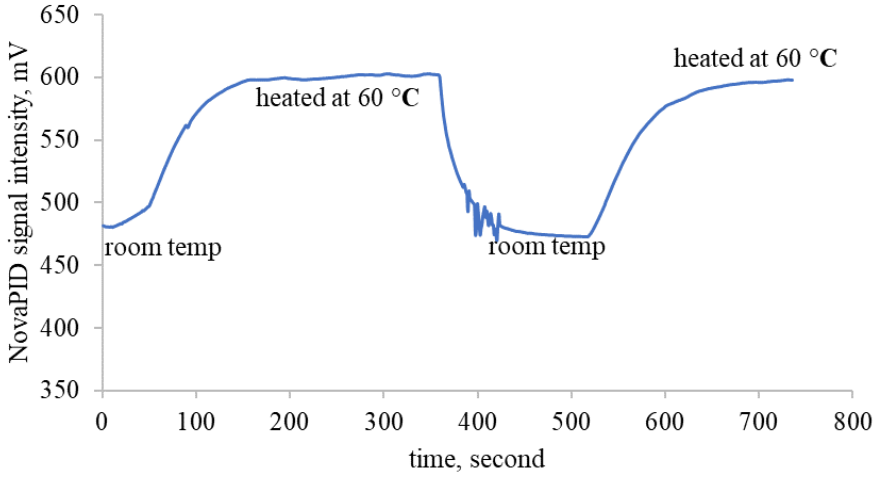

Figure 2. NovaPID signal intensity when using at room temperature and heated at 60 °C

This experiment was an extreme condition test. In general, PID testing is conducted with volatile organic compounds at ppb levels and with a flow rate of 2-3 ml/min. Despite the extreme conditions, the NovaPID showed impressive performance for 13.9 hours.

The second aging test was done by installing the NovaPID on NovaTest P300 and NovaTest A1000 devices for continuous tests. NovaTest P300 is a compact GC. NovaTest A1000 is an online air monitoring GC. The sample used was toluene at a concentration of 100 ppb. The results are shown in Figure 3. Both PIDs underwent continuous testing for 117 days. PID 1 was installed on NovaTest P300 and PID 2 was installed on NovaTest A1000. The PID signals showed a gradual decrease with time; however, the decrease was less than 30% after 117 days of continuous tests. The decrease could be related to the aging of the UV lamp or the contamination of the light-path window.

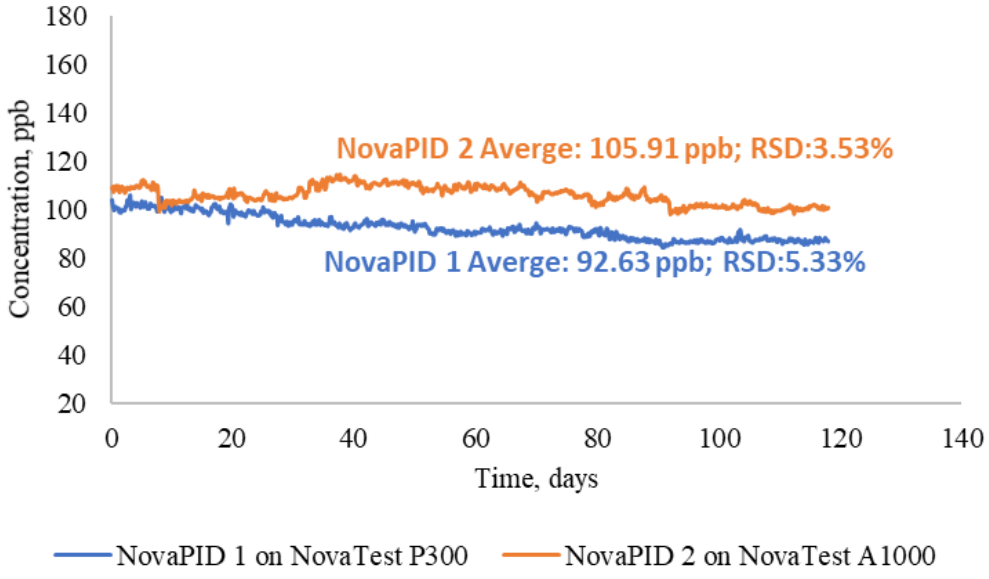

Figure 3. NovaPID aging test on NovaTest devices. Test time: 117 days

PEAK SHAPE COMPARISON BETWEEN NOVAPID AND COMMERCIAL PID

To compare the peak shape between the NovaPID and the commercial PID, both PIDs were installed on NovaTest P100 (another NEI's compact GC product) separately. A BTEX sample at a concentration of 1 ppm was used for the test. The sampling time was 0.2 min, and the carrier gas flow rate was 2.2 ml/min. The results are shown in Figure 4. Both PIDs showed good reproducibility; however, the

NovaPID provided better peak shape and greater peak height. The full width at half maximum (FWHM) of benzene, toluene, ethylbenzene, m,p-xylene, and o-xylene was 1.5, 2.0, 2.3, 2.5 and 2.5 s, respectively, when using the NovaPID, while it was 2.5, 4.0, 5.0, 9.0 and 7.5 s, respectively, when using commercial PID.

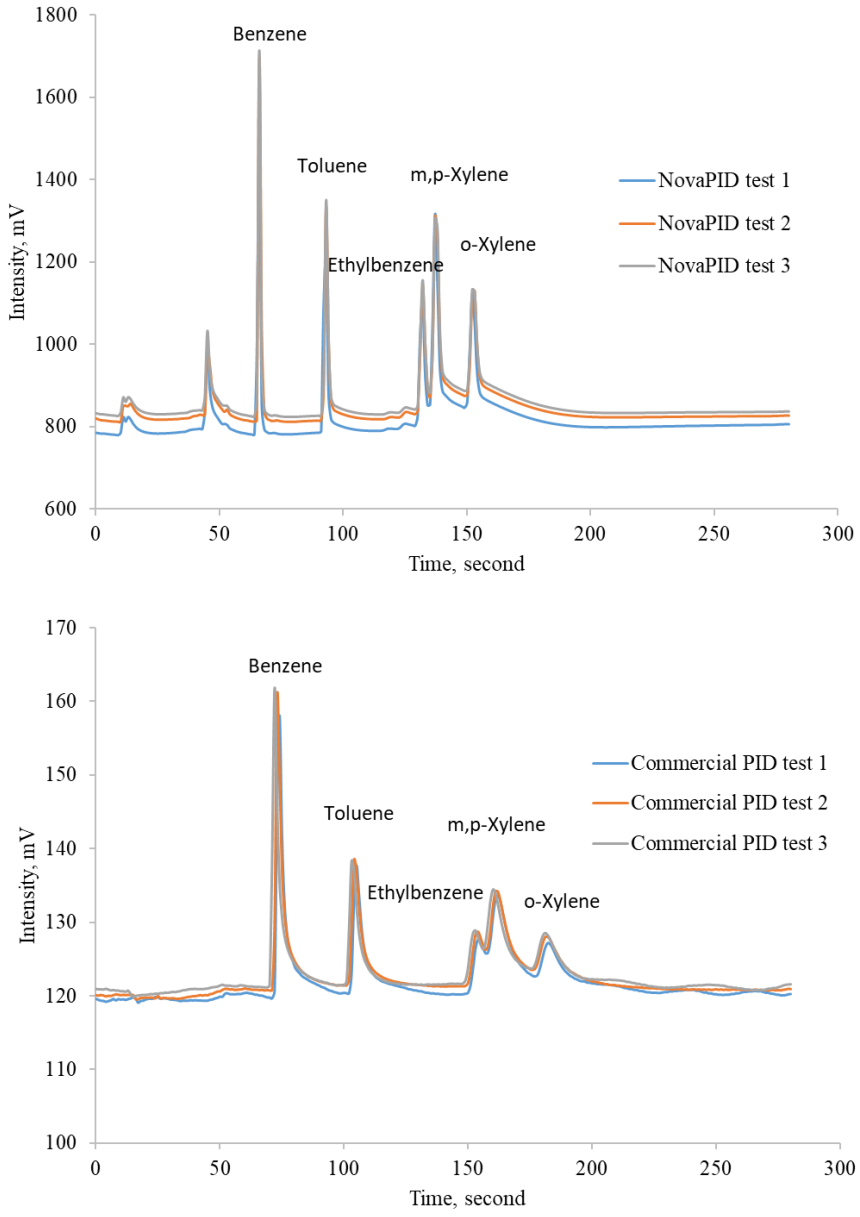

Figure 4. BTEX tests using NovaPID and Commercial PID connected to NovaTest P100 compact GC. BTEX concentration: 1 ppm; Sampling time 0.2 min; Carrier gas flow rate: 2.2 ml/min.

The results further demonstrate the great sensitivity of the NovaPID. When coupled with GC device, the NovaPID provided better separation.

PERFORMANCE COMPARISON BETWEEN NOVAPID AND FLAME IONIZATION DETECTOR (FID)

To compare the performance between the NovaPID and an FID, both detectors were connected at the outlet of NovaTest P100. A TO14 sample and a three-compound mixture sample were tested separately. The results are shown in Figure 5. Both detectors provided sharp and symmetric peak shapes. Based on calculation, the noise intensity of NovaPID was 0.004 pA and that of the FID was 0.015 pA (shown in Figure 6). In Figure 5, the signal to noise ratio of Benzene was 545 when using the NovaPID and 175 when using the FID. The results proved that the NovaPID provided better sensitivity than the FID. Without the need of the explosive hydrogen gas, the NovaPID is also more convenient and safe to use as a VOC detector.

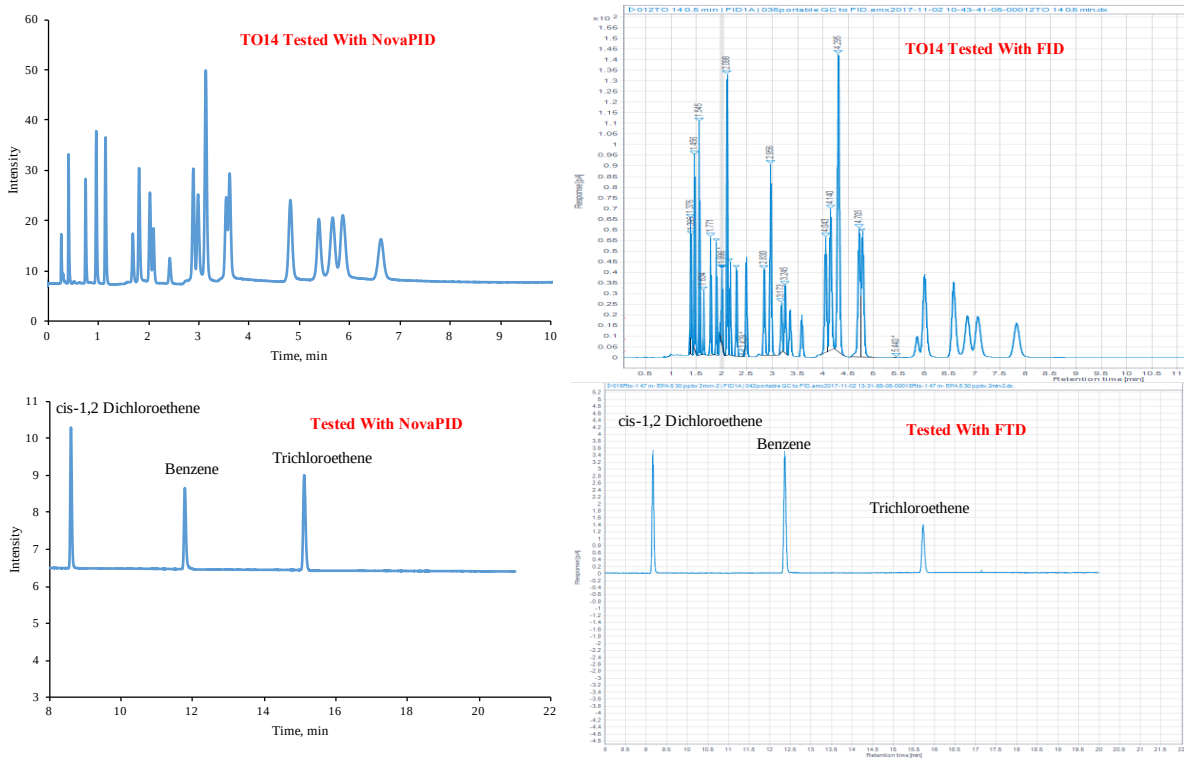

Figure 5. Sample Chromatograms when using the NovaPID and a commercial FID, respectively. Injected sample included TO14 and a three-compound mixture. Both the NovaPID and the FID were installed at the outlet of NovaTest P100 separately for the test.

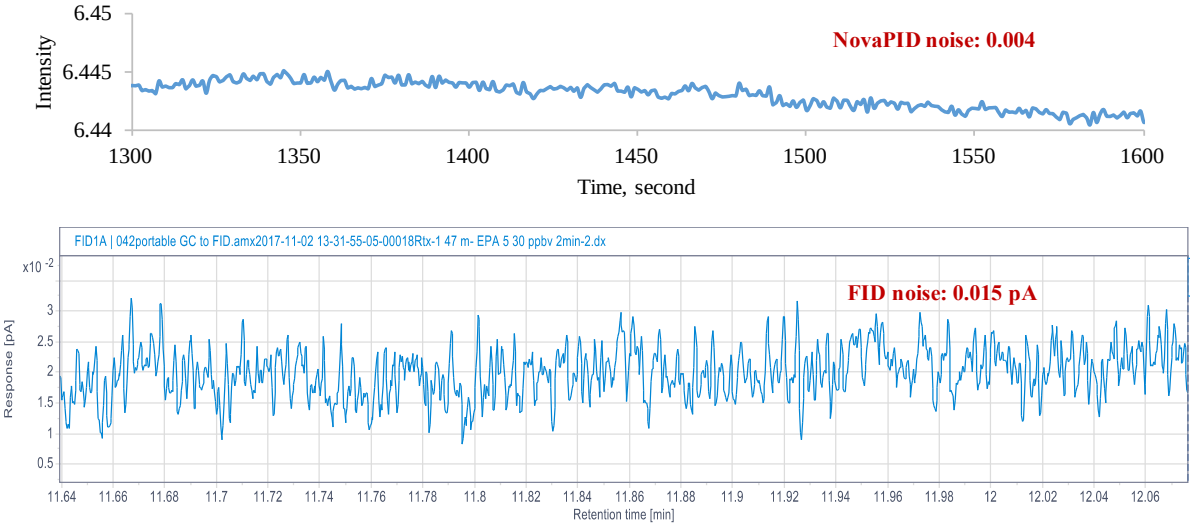

Figure 6. The noise level of NovaPID and FID

CONCLUSION

According to the results, the NovaPID has showed long-lasting stability during tests under extreme condition and regular condition. It provided better peak shapes and higher sensitivity when compared to a commercial PID, and similar sharp and symmetric peak shapes but better sensitivity when compared to a commercial FID. No explosive hydrogen gas is needed when using the NovaPID, which provides the user with more convenience and less safety concerns.

The NovaPID has been demonstrated to be a sensitive and reliable tool for accurately determining VOC concentration. As a result, the NovaPID is an excellent choice for both indoor and outdoor air pollution monitoring.

For more information about the device, please contact us at

info@nanovaenv.com