

# Benzene Detection in Air with Zeeman Atomic Absorption Technique

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## Summary

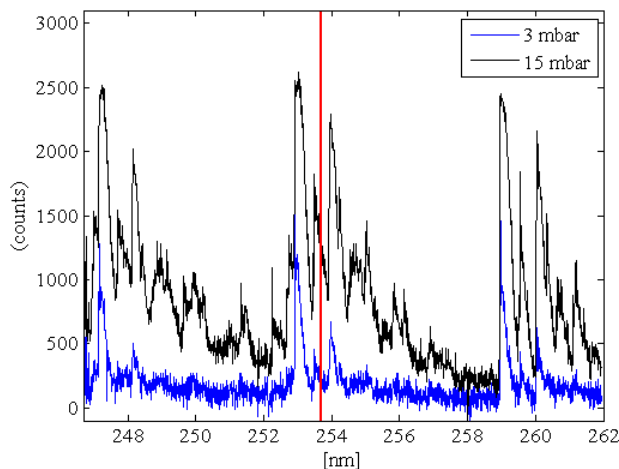
Detection and monitoring of benzene in air is an important yet not a fully resolved problem. We propose using the Zeeman atomic absorption technique (ZAAS) and present the first preliminary results in developing a new type of benzene detector based on this technique.

## Introduction

Benzene is a known carcinogenic compound produced in a variety of industrial processes. Both acute and chronic inhalation exposure to benzene can cause human health disorders [1]. Even though several methods exist for benzene detection in air (e.g. [2, 3]), none combine low limits of detection with a fast measurement procedure and small dimensions of the detector.

## Benzene Absorption Spectrum

Benzene absorption spectrum consists of several bands as shown in Fig. 1. The dependence of absorption on the benzene concentration allows for the use of optical methods in detection and monitoring.

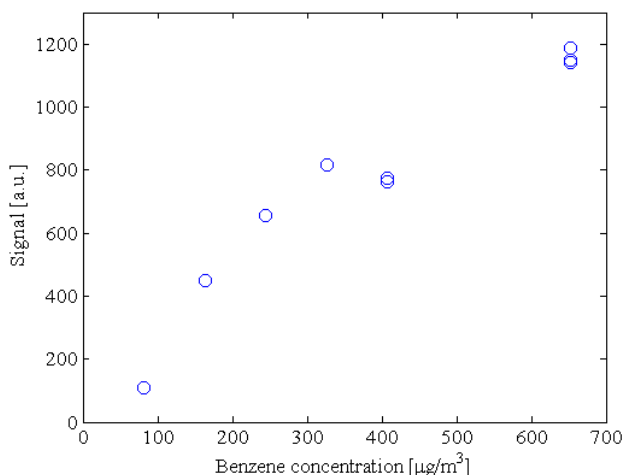


*Fig. 1. Benzene absorption spectra for two different benzene pressures in the measurement cell. Marked in red is the wavelength used in ZAAS.*

## First ZAAS Measurements

ZAAS method is based on measuring absorption signal of a source light of two well-defined wavelengths obtained from a single line by Zeeman splitting. In particular, the method has been successfully commercially

implemented for Hg detection in air and in water. In Fig. 2 we present our first preliminary benzene ZAAS measurements obtained using the Ohio Lumex RA-915 mercury analyzer. Large uncertainties (not shown) are associated with the actual benzene concentration in each of measurements. Nevertheless, data suggests that ZAAS could potentially be used in benzene detection and warrants further investigation.



*Fig. 2. ZAAS signal for different benzene concentrations*

## Conclusions

We conclude that the ZAAS method shows promise for use in benzene detection and monitoring in air potentially addressing shortcomings of the existing methods. Future work includes developing the theoretical framework for the use of ZAAS for benzene and consequently adapting the measuring apparatus.

## References

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- [3] Parsons et al., Real-time monitoring of benzene, toluene, a p-xylene in a photoreaction chamber with a tunable mid-infrared laser and ultraviolet differential optical absorption spectroscopy, Applied Optics, 50, A90-A99 (2011)

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