Optimization Methods for Optical Ammonia Sensor.

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Summary: This paper describes an optical sensor system for quantifying ammonia at low concentration. An open path optical technique is used to measure ammonia concentration within the Ultraviolet region. Experimental results describing the operation of the sensor with wavelengths combination technique to optimize the measurement is presented. The results show the sensor is best measuring ammonia concentration at combination wavelengths (around 212 nm) with the Lower Detection Limit of 4.31 ppm and 1 *s* response time is achieved.

Keywords: optical sensor; ammonia measurement; lower detection limit.

1. Introduction

There are many types of ammonia sensors which have their own advantages and disadvantages and have been discussed in details in [1]. However not many sensor can detect very low concentration within a short duration which is less than 3 s. This is particularly true in sensors based on solid state devices such as semiconductors. In addition, an optical fibre based gas sensor can have many advantages in terms of low weight and small size [2], resistance to high temperature [2-3], no electromagnetic interference, and can have distributed measurement rather than a point sensor [4].

2. Experimental Setup

The experimental arrangement is shown in **Figure 1**.

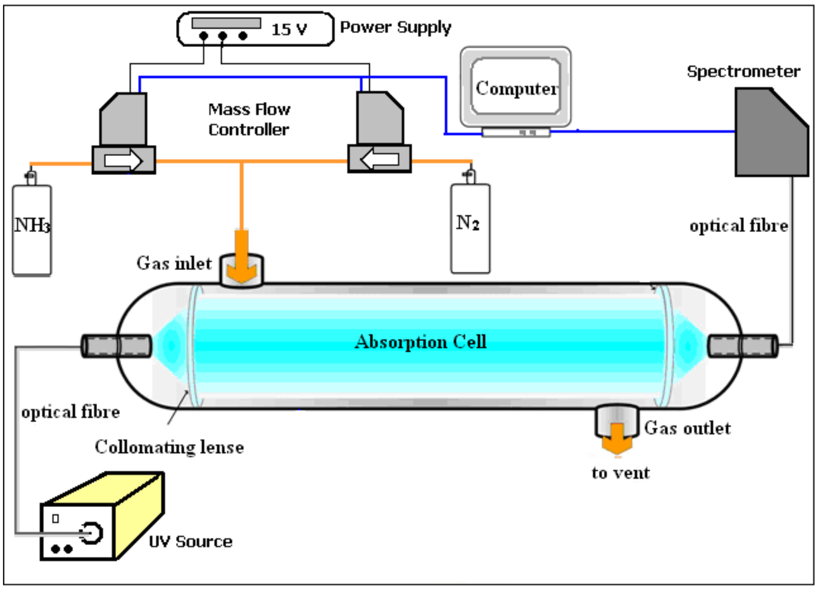

Fig. 1: Laboratory experimental setup.

3. Results

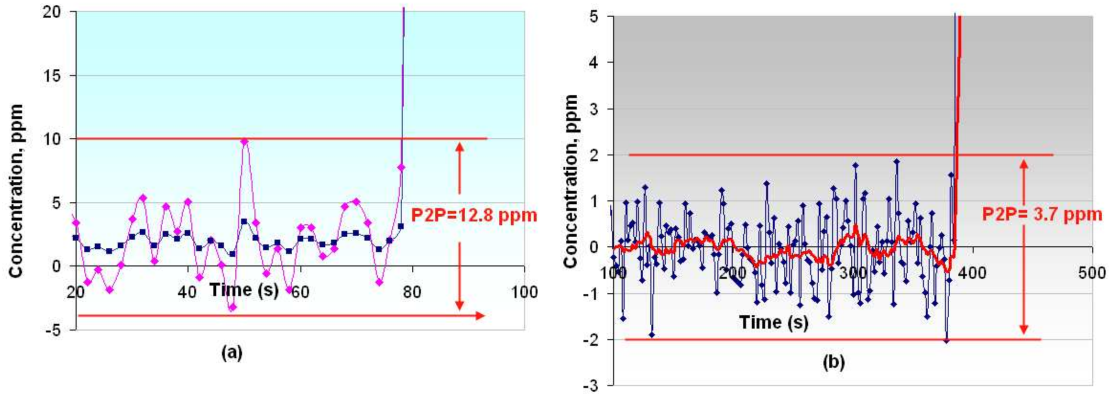

Fig 2: Peak to peak (a) before and (b) after wavelength combination.

4. Conclusion

A novel optical measurement for NH_3 gas at different integration time is described and reported. In the early experiment where integration time was set to 2 s, the Lower Detection Limit was reduced to 2.25 *ppm*. This shows a significant improvement (75%) when wavelength combination technique is introduced. However when the integration time was lowered down to 1 s, only 18 percent Lower Detection Limit reduction was achieved even though the similar wavelength combination technique is used. The final Lower Detection Limit achieved for 1 *s* integration time is 4.31 *ppm*. Although the achieved value is not significant but the response time of this sensor system which is 1 s is improved by 100%. Thus, future work will focus on other methods in order to reduce P2P value and gain better Lower Detection Limit. Finally a full set of experimental tests along with in-situ experiments will be carried out in order to fully quantify the sensing system.

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