

**Title: Method validation for spectrophotometric quantification of airborne ammonia in the assessment of occupational exposure to ammonia.**

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## **Abstract**

### **Introduction**

Ammonia is a toxic gas that causes acute and chronic illness and diseases such as pulmonary fibrosis and inflammation of the lungs. According to the South African Regulations for Hazardous Chemical Agents, 2021; Occupational Health and Safety Act, 1993, ammonia exposure should be monitored in workplaces to assess the health implications associated with possible exposure.

Due to health risks associated with workers' respiratory exposure to ammonia, there is a need for occupational exposure assessment in workplaces where ammonia is produced or generated as a by-product or is used as an ingredient in the production of other industrial products. However, the challenge is the lack of availability of affordable and cost-effective analytical methods for ammonia analysis. Most of the existing developed methods for routine ammonia analysis involve expensive techniques, consumables and highly skilled personnel.

### **Methods**

The aim of this study was therefore to validate a simple in-house method based on NIOSH 6015 for the quantification of airborne ammonia using UV-Vis spectroscopy. The validated method is based on indophenol blue formation by phenol and hypochlorite reaction with ammonia. The indophenol blue is equivalent to ammonia concentration measured by the absorbing light in the UV-vis spectrophotometer at the wavelength of 630 nm. The validation was completed following evaluation of performance characteristics such as

precision, accuracy, limit of quantification, linearity, ruggedness, reproducibility, repeatability and measurement uncertainty.

### Results and discussion

The method was deemed suitable for measurement of airborne ammonia with recovery percentage of above 90%. The limit of quantification was found to be 0.42 µg/ml with coefficient variable (R-value) greater than 0.99. Measurement uncertainty is 17.88% at 95% confidence interval with a coverage factor of  $k = 2$ .

### Conclusion

Based on the above validation results and calculated figures of merit, this method is deemed suitable for the routine analysis of ammonia adsorbed on sulphuric acid-treated silica gel tubes.