Actividades divulgación Proyecto AGROALNEXT_2023

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Localidad	
Provincia	
Fecha	6-8 de noviembre 2023
Proyecto:	Sensor económico y eficiente para el control del amoniaco en explotaciones ganaderas: NH3ControlFarm
Código proyecto	AGROALNEXT_2022/19
Grupo de investigación	Vniversitat de València · MINTOTA Grupo de investigación · Departament Química Analítica

INFORME DE LA ACTIVIDAD: Difusion del proyecto en congreso internacional

FOTOS DE LA ACTIVIDAD: Ponencia

Poster

Digital sensor options: NH_3ControlFarm

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1. Introduction

This work presents the possibility of obtaining direct analytical information from NH3ControlFarm sensors from a digital reading with portable devices thanks to two applications developed by the MINTOTA research group. These Apps allow the quantification of ammonia levels recorded with the NH3ControlFarm using a methodology based on the colorimetric change of these sensors in the presence of the analyte. On the one hand, the SpectraFree App works with the RGB, R (red), G (green), B (blue) colour intensity values, and allows the concentration of the analyte to be obtained directly by simply capturing an image with a smartphone. On the other hand, the GoSpectro App, which allows the recording of light and spectra, developed for Android and iOS licensed by Alphanov, directly quantifies the concentration recorded by the sensor using a fiber optic miniaturised spectrophotometer attached to a smartphone.[1 – 3]. The results obtained from the use of these two Apps for the estimation of ammonia with the NH_3ControlFarm have been satisfactory, achieving a direct response of the analyte concentration in a simple measurement way.

2. Experimental description

Go Spectro App

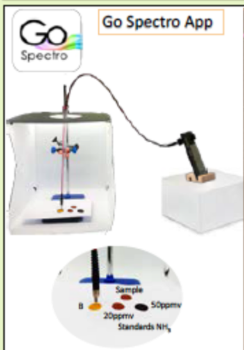

Figure 1. Measurement set-up with portable mini fiber optic spectrophotometer in a white led light box.

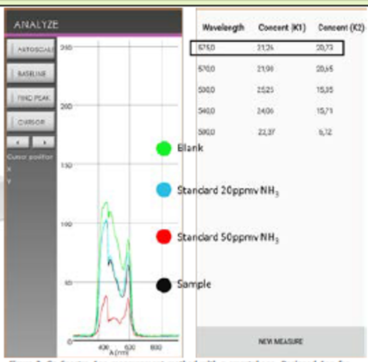

Figure 2. Go Spectro App measurement method with a smartphone. Designed App for calculating the analyte concentration of a sample using: spectra obtained by the fiber optic mini spectrometer.

The **Go Spectro App** allows to obtain with only a blank and two standards, the concentration of a sample directly at a corresponding wavelength. In addition to the spectra corresponding to each standard and sample measured.

Spectro Free App

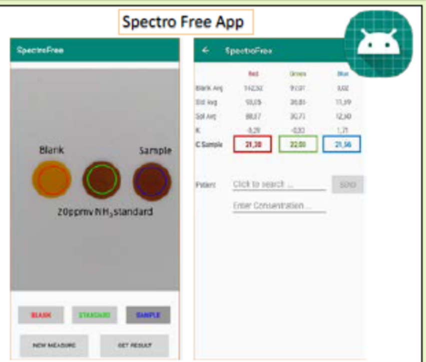

Figure 3. Spectro Free App measurement method with a smartphone. Intensity in color planes R (red), G (green), and B (blue).

The **Spectra Free App** allows to directly obtain the sample concentration with only a blank and one standard from the color intensity coordinates RGB (red/green/blue).

3. Results and discussion

3.1. Calibration spectra

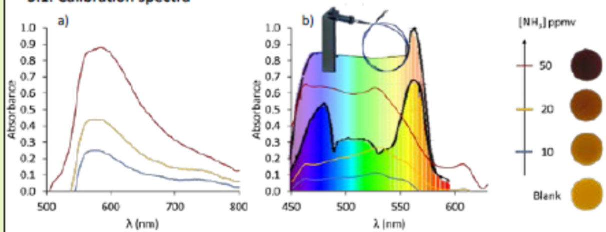

Figure 4. Spectra of different NH_3 standard solutions. (a) Reflectance as absorbance obtained from benchtop diffuse reflectance spectrophotometer at λ = 590 nm; (b) absorbance obtained from portable fiber optic mini spectrometer at λ = 575 nm; the images for each concentration assayed and overlapped background and sensor registers obtained by the app GoSpectro as an example.

3.2. Analytical Parameters

Table 1. Figures of merit obtained using the different methods for ammonia detection studied.

Method	Linearity (NH_3 ppmv) $b \pm S_b$	$a \pm S_a$	R^2	Linear interval (NH_3 ppmv)	LOD (NH_3 ppmv)	LOQ (NH_3 ppmv)
Diffuse reflectance	0.0183 ± 0.0014	0.08 ± 0.04	0.98	3 – 50	1.00	3.03
Go Spectro App	0.0130 ± 0.0003	0.197 ± 0.009	0.99	9 – 50	3.05	9.25
Coordinate intensity RGB (Red)	-2.31 ± 0.11	159 ± 3	0.99	9 – 50	2.86	8.67

3.3. Assessment of results for several samples

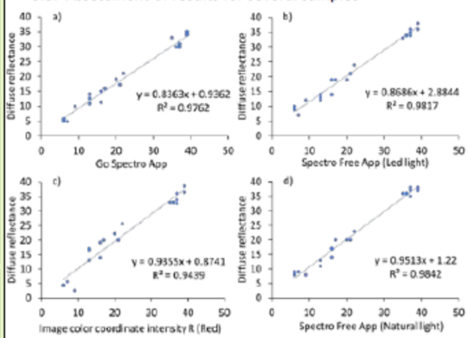

Figure 5. Linear regression of the results obtained from each portable measurement method compared to the laboratory diffuse reflectance spectrophotometer. Results obtained from diffuse reflectance with: (a) Go Spectro App, (b) Spectro Free App measured in white led light box, (c) color coordinate intensity (red) from an image, (d) Spectro Free App measured with natural light.

4. Conclusions

In both Apps, data can be easily saved and sent via a wireless network connection. In summary, these two smartphone Apps, which have been developed by the MINTOTA group, store and transfer these measurements allowing a fast, cost-effective and environmentally friendly estimation of ammonia levels with the NH_3ControlFarm sensor with the use of portable devices such as smartphones for in-situ analysis.

Acknowledgements

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[2] Pla-Tolós, J.; Moliner-Martínez, Y.; Molins-Legua, C.; Campíns-Falcó, P. Solid Glucose Biosensor Integrated in a Multi-Well Microplate Coupled to a Camera-Based Detector: Application to the Multiple Analysis of Human Serum Samples. *Sens. Actuators B Chem.* **2018**, *258*, 331–341.
[3] Martínez-Aviño, A.; de Diego-Llorente-Luque, M.; Molins-Legua, C.; Campíns-Falcó, P. Advances in the Measurement of Polymeric Colorimetric Sensors Using Portable Instrumentation: Testing the Light Influence. *Polymers* **2022**, *14*, 4285.

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