

The Role of Metrology in Addressing Climate Change and Biodiversity: A Measurement Challenge

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Background



Climate change and biodiversity loss are two of the most critical global 21st century' challenges [1]. One pressing metrology challenge is measuring greenhouse gas (GHG) emissions, particularly carbon dioxide (CO₂). Reliable measurement of CO₂ emissions at both local and global levels is essential for meeting international climate targets, tracking progress, and developing effective mitigation strategies. [2]

Absorbines

Discussion and Conclusions

Over the next 50 years, the demand for precise CO₂ monitoring systems will escalate as the impacts of climate change worsen. The recent experience in organic and inorganic analytes will inspire new metrological tools' development for using in more complex matrices, as gases.

The challenge for metrology will involve evolving measurement technologies to meet these needs. This includes advancing remote sensing techniques, incorporating artificial intelligence for predicting emission trends, and enhancing sensor sensitivity to detect low atmospheric CO₂ concentrations.



The positive experience of INM of Colombia, together with that of other nmi's and industry, coordinated with BIPM, provides a cluster for cooperation. Optimal use of resources involve specialization of nmis for developing different reference materials (RM) by analytes and cooperation in sharing and adopting measurement methods and using RM.



Additionally, carbon capture and storage (CCS) innovation will require metrological frameworks to assess their effectiveness in emission reduction.



Metrology must also adapt to the complexities of measuring CO₂ in ecosystems, such as forests and oceans, where emissions are influenced by non-anthropogenic factors. Integrating CO₂ measurements with other environmental indicators, such as temperature and humidity, will be crucial for understanding the interrelationships between climate and ecosystems. Ensuring that CO₂ measurement methods remain traceable to international standards will be vital for maintaining global accountability in climate action.

Metrology, normalization, conformity assessment and accreditation together are a powerful tool for creating confidence around the behaviour of actors around the variables that affect the environment. Experiences in different markets show the possibilities quality infrastructure offers in building confidence in centralized and decentralized markets.

Results

Some metrology results have been obtained in environmental variables, but large challenges remain.

INM of Colombia, has developed measurement techniques, reference materials, together with validation of methods for different environments, matrices, and analyte concentrations.

INM' experience



National metrology institutes, in collaboration with the International Bureau of Weights and Measures (BIPM), have established internationally recognized measurement standards in heavy metals, pesticides, and even gases.



Major and minor elements in soil
Item
collaborative
Study with



Mercury in fish
Item
INM-039-1 – 231201

Cd, Hg and Pb in tilapia
Item
INM-041-1 – 230906

Pesticides in avocado
Item
Collaborative study with



Cadmium in Cocoa grain
Item
collaborative
Study with



References

1. Sachs, Jeffrey D (2012) From Millennium Development Goals to Sustainable Development Goals. The Lancet, Volume 379, Issue 9832, 2206 – 2211
2. Mathews, H Damon; Zickfeld, Kirsten; Knutti, Reto; and Allen, Myles R Focus on cumulative emissions, global carbon budgets and the implications for climate mitigation targets. *Environ. Res. Lett.* 13 010201. DOI 10.1088/1748-9326/aa98c9
3. Aguilar Ávila, Yeraldin; Ahumada, Diego, et al (2023) Guía Desarrollo de materiales de referencia-in-house para el control de calidad de residuos de plaguicidas en alimentos. INM/GTT-O/03
4. Instituto Nacional de Metrología. Servicios. www.inm.gov.co
5. Imágenes for Background, Results, Conclusions. Generated by ChatGPT

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