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## Ana Vieira

Ana Vieira<sup>a</sup>, Diogo Cachetas<sup>a,b,c</sup>, Bruna Alves<sup>a</sup>, Marilia Santos<sup>a</sup>, Begoña Espiña<sup>a</sup>,  
Laura M. Salonen<sup>a,d</sup>, Laura Rodriguez-Lorenzo<sup>a</sup>

<sup>a</sup> INL- International Iberian Nanotechnology Laboratory, Av. Mestre José Veiga, 4715-330, Braga, Portugal

<sup>b</sup> Centre of Biological Engineering, University of Minho, Braga, Portugal

<sup>c</sup> LABBELS –Associate Laboratory, Braga/Guimarães, Portugal

<sup>d</sup> CINBIO, Universidade de Vigo, Department of Organic Chemistry, 36310 Vigo, Spain

[ana.vieira@inl.int](mailto:ana.vieira@inl.int)

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## Rapid SERS-based detection of sulfonamides in aquatic environments

Antibiotics play a crucial role in healthcare by treating bacterial infections and preventing severe complications. However, their extensive use and misuse, combined with the limited efficiency of current wastewater treatment processes in removing pharmaceutical residues, have contributed to the presence of antibiotics in various environmental compartments, including aquatic systems [1-2]. The continuous release of these compounds into the environment promotes the development of antibiotic-resistant bacteria, causing a significant threat to public health. To mitigate this issue, the European Union has established monitoring requirements and detection limits for several classes of commonly used antibiotics [3].

Sulfamethoxazole, a sulfonamide antibiotic, is widely prescribed to treat urinary tract infections and is therefore considered a priority contaminant for environmental monitoring. The development of rapid, sensitive, and portable detection methods is a critical need for this class of molecules and other antibiotic families. However, the analysis of complex matrices, such as seawater, remains challenging due to interferences from salts and naturally occurring organic matter during the measurements.

In this work, Au nanoparticle-based composites were employed as both adsorbent materials for antibiotic molecules and surface-enhanced Raman scattering (SERS) substrates for their detection. The SERS detection of different sulfonamides was performed in tap water, groundwater, and seawater. The SERS analysis of sulfonamides in tap water and groundwater was successfully carried out with almost no sample preparation; however, a desalination step was needed for their detection in seawater. The dual functionality of Au nanoparticle-based composites enabled the sensitive detection and discrimination of sulfonamide antibiotics at low concentrations in different water types.

### References

- [1] Chin *et al*, *Environmental Advances* (2023) 11, 100331.
- [2] Sarvestani *et al*, *Science of total Environment* (2026) 1036.
- [3] European Commission, Directive 2006/118/EC. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52022PC0540>.

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