Molecularly Imprinted Polymers Nanoparticles for Antibiotic Detection in Aqueous Systems

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Water is a vital resource for life on Earth. According to the *United Nations Sustainable Development Goals*, all countries must ensure the availability and sustainable management of water and sanitation by 2030 (1). Developing fast, effective, low-cost, accurate, and simple analytical technologies to detect contaminants in water bodies is essential to guarantee their safety for human use, recreation, and food production (2). This study investigates the development and application of molecularly imprinted polymer nanoparticles (nanoMIPs) as selective platforms for detecting tetracycline and gentamicin in aqueous systems. MIPs offer high selectivity toward target molecules, mimicking the recognition properties of natural receptors (3). We synthesized two types of nanoMIPs using a solid-phase approach: one using lymecycline, a target molecule structurally analogous to tetracycline (TC), to obtain MIP-TC, and another using gentamicin (GEN) to obtain MIP-GEN. In each case, the template molecule was used to generate specific artificial recognition sites. For the detection of antibiotics, we designed a *pseudo*-enzyme-linked immunosorbent assay (*pseudo*-ELISA) by substituting conventional monoclonal antibodies with nanoMIPs. Each assay was capable of identifying TC and GEN, respectively, at subnanomolar concentrations with high specificity. The assay exhibited a strong linear response and low limit of detection, highlighting its potential for environmental monitoring applications.

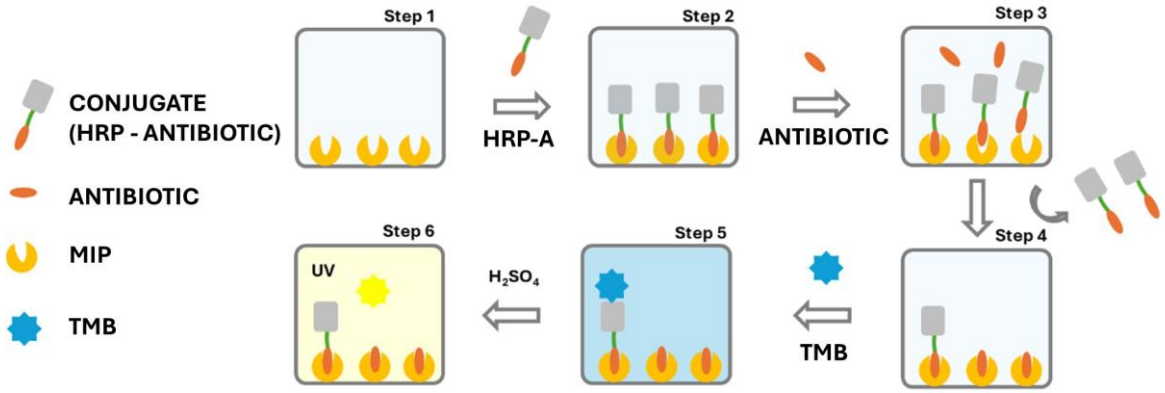

Fig 1. *Pseudo*-enzyme-linked immunosorbent assay by substituting conventional monoclonal antibodies with nanoMIPs for antibiotic detection.

Acknowledgments: The authors thank the National Research and Development Agency for funding, through the EXPLORACION Project 13220020.

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