Introducing NIAGARA project. Safeguarding Human Health through Real-time Assessment of water pollutants.

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The quality of the environment, as well as the quality of the surroundings in which we live, has a relevant and significant influence on our health. In fact, this impact is known to be greater in children under 5 years of age and in people between 50 and 75 years of age. It is estimated that around 12 million people in the world die annually from living or working in highly polluted spaces and environments [1]. Environmental pollutants, which can range from chemical to microbiological agents, are responsible for the development of respiratory and cardiac diseases, as well as favouring the development of certain types of cancer. For example, in urban areas where industrial activity is high, access to clean water is very limited and soil degradation is notable due to the presence of chemical agents, the likelihood of developing these types of diseases is much higher [2]. In addition, the recent pandemic has highlighted the value of tracking different areas to trigger early warnings, significantly shortening response times [3]. On the other hand, people affected by chemical pollution of drinking water is projected to increase from 1.1 billion in 2000 to 2.5 billion in 2050. It is a harsh consequence of global change: rapid industrialization (industrial chemicals like polyaromatic hydrocarbons -PAHs- and heavy metals are among the most frequent chemicals found in natural water bodies), urbanization (megacities hold 50% of global population and are responsible of large wastewater discharges), the increase of intensive livestock for an increasing of global population (agricultural pesticides are also one of the most frequent pollutants in natural water bodies) [4].Therefore, there is a clear need to develop devices capable of monitoring the presence of environmental pollutants, which can directly affect the quality of the living conditions and have a direct impact on our health. At present, diagnostic techniques for environmental analysis (classical chromatographic, spectroscopic and cell culture methods) are often expensive and laborious, require several sample preparations steps, use toxic chemicals and are time-consuming. In contrast, biosensors, that are analytical tools that combine materials and nanomaterials, such as carbon nanotubes, metal nanoparticles or graphene, with biological elements, such as antibodies, aptamers or enzymes, can provide real-time and robust responses, as well as being portable and cost-effective devices [5]. The construction of a biosensor must consider the complexity of the environmental sample. In this sense, the integration of biosensors with devices capable of sampling automatically, as well as the different pre-treatment steps necessary to guarantee the reliability of the analysis by means of the biosensor, are of special relevance.

In this work, different approaches developed by ITENE in the field of environmental monitoring will be presented, most of them based on the use of biosensors integrated with devices capable of automating both the sampling and its pre-treatment, as well as the detection step. In addition, the NIAGARA project will be presented, which aim is to develop solutions capable of mitigating the impact of certain pollutants on drinking water and, consequently, on human health.

References

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Figures

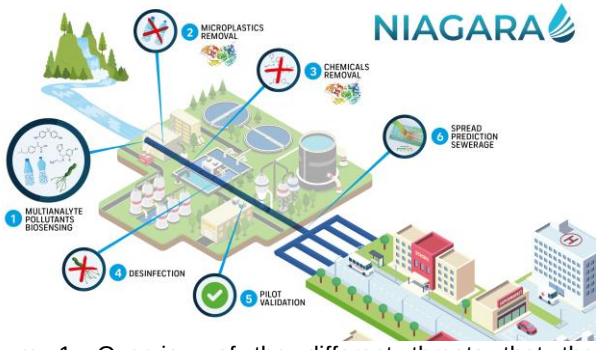

Figure 1. Overview of the different threats that the NIAGARA project intends to address throughout the drinking water treatment process.