

Smart electrode surfaces for sensing contaminants of environmental concern

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Preventive monitoring of chemical pollution is a challenge, since methodologies and mechanisms for real-time analysis and fast screening of potentially contaminated sites are very expensive and cumbersome. Currently, real-time monitoring of chemicals (organics, inorganic substances, heavy metals, oil) in the water matrices are mostly done in lab settings and/or using time and money consuming techniques. In this context, electrochemical (bio)sensors are promising systems when on-site analysis is needed for a rapid decision-making. Indeed, main advantages in using electrochemical systems consist of simplicity of use, portability and low-cost of the instrumentation, and the ability to limit the use of tedious sample pre-treatment procedures, especially if coupled to lab-on-a-chip platforms. However, electrochemical sensors can also face limitations: presence of electrochemically active interferences in the sample, weak long-term stability, and troublesome electron-transfer pathways.

The development of innovative smart electrode surfaces, decorated with natural or biomimetic architectures, is an interesting research topic for next-generation electrochemical sensing, to face the complex chemical-physical behavior of novel hazardous molecules, improve electron transfer and minimize fouling effects.

In this perspective, different approaches on electrode surface modifications and challenging strategies to develop innovative electrochemical (bio)sensors will be here illustrated. In-depth studies of the electron transfer mechanisms and electrochemical kinetics related to the recognition reaction were carried out to magnify the analytical performance of the developed (bio)sensors.

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References

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