World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:19, No:02, 2025

Printed Electronics for Enhanced Monitoring of Organ-on-Chip Culture Media Parameters

Authors : Alejandra Ben-Aissa, Martina Moreno, Luciano Sappia, Paul Lacharmoise, Ana Moya

Abstract : Organ-on-Chip (OoC) stands out as a highly promising approach for drug testing, presenting a cost-effective and ethically superior alternative to conventional in vivo experiments. These cutting-edge devices emerge from the integration of tissue engineering and microfluidic technology, faithfully replicating the physiological conditions of targeted organs. Consequently, they offer a more precise understanding of drug responses without the ethical concerns associated with animal testing. When addressing the limitations of OoC due to conventional and time-consuming techniques, Lab-On-Chip (LoC) emerge as a disruptive technology capable of providing real-time monitoring without compromising sample integrity. This work develops LoC platforms that can be integrated within OoC platforms to monitor essential culture media parameters, including glucose, oxygen, and pH, facilitating the straightforward exchange of sensing units within a dynamic and controlled environment without disrupting cultures. This approach preserves the experimental setup, minimizes the impact on cells, and enables efficient, prolonged measurement. The LoC system is fabricated following the patented methodology protected by EU patent EP4317957A1. One of the key challenges of integrating sensors in a biocompatible, feasible, robust, and scalable manner is addressed through fully printed sensors, ensuring a customized, cost-effective, and scalable solution. With this technique, sensor reliability is enhanced, providing high sensitivity and selectivity for accurate parameter monitoring. In the present study, LoC is validated measuring a complete culture media. The oxygen sensor provided a measurement range from 0 mgO2/L to 6.3 mgO2/L. The pH sensor demonstrated a measurement range spanning 2 pH units to 9.5 pH units. Additionally, the glucose sensor achieved a measurement range from 0 mM to 11 mM. All the measures were performed with the sensors integrated in the LoC. In conclusion, this study showcases the impactful synergy of OoC technology with LoC systems using fully printed sensors, marking a significant step forward in ethical and effective biomedical research, particularly in drug development. This innovation not only meets current demands but also lays the groundwork for future advancements in precision and customization within scientific exploration.

Keywords : organ on chip, lab on chip, real time monitoring, biosensors
Conference Title : ICMN 2025 : International Conference on Microfluidics and Nanofluidics
Conference Location : Barcelona, Spain
Conference Dates : February 10-11, 2025