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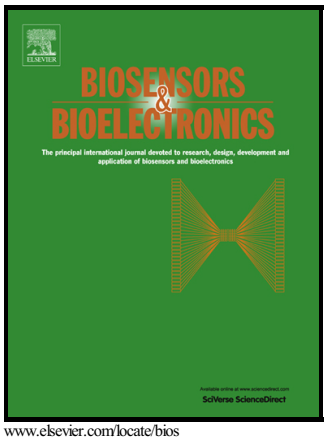

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Utilization of Graphene Electrode in Transparent Microwell Arrays for High Throughput Cell Trapping and Lysis

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Abstract

Here we present a high-throughput, transparent microfluidic device with embedded microwell arrays sandwiched between transparent electrodes made from graphene (at the bottom) and indium tin oxide (at the top) for dielectrophoretic cell trapping and electrical lysis. Graphene suppresses unwanted faradaic reaction effects on the cells and the medium that is typically observed in ITO based electrodes from application of DC field for electrical lysis. This is because graphene is more electrochemically inert than indium tin oxide (ITO) where ITO undergoes reduction-oxidation (redox) reaction in the presence of electrolyte in most standard cell medium. This redox process also compromises ITO's electrical properties and optical transparency over multiple use. The presented microfluidic device shows high efficiency for cell trapping and lysis and an electrochemically stable behavior for long operational life.

Highlights

- Paper presents a high-throughput, transparent microfluidic device with embedded microwell arrays sandwiched between graphene and indium tin oxide electrodes for dielectrophoretic cell trapping and electrical lysis.
- Indium tin oxide is not electrochemically stable as it undergoes electrochemical redox reaction and consequently looses its transparency over time under DC electric fields for lysis
- Graphene is shown to be more electrochemically stable than ITO with no change in optical transparency due to redox reaction under DC electric fields for lysis.

Keywords: Dielectrophoresis, Graphene, Lysis, Cell trapping, Redox reaction, Lab-on-chip

1. Introduction