New technique enables successful cultivation of stem cells on the surface of ionic liquids

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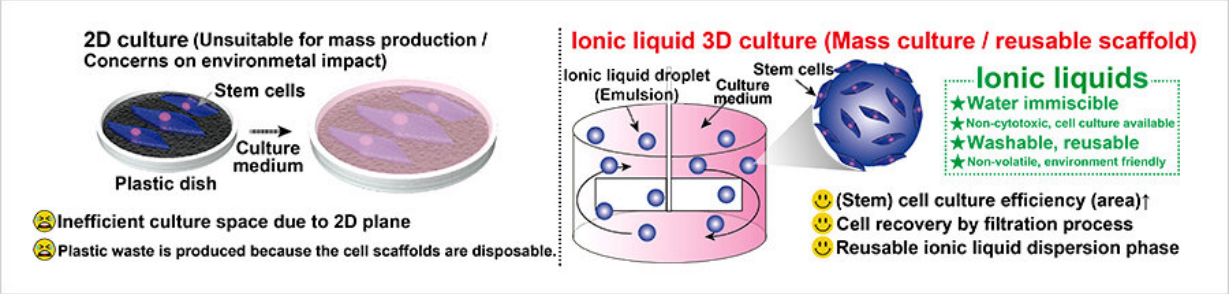

Comparison of conventional two-dimensional cell culture and the proposed ionic liquid three-dimensional culture in this study. Credit: National Institute for Materials Science

The National Institute for Materials Science (NIMS) has established a technique for cultivating human mesenchymal stem cells, widely used in regenerative medicine, on the surface of an ionic liquid.

This innovation promises a significant increase in the efficiency of cell culturing valuable cellular resources, traditionally carried out in plastic dishes, while also reducing plastic waste generated during culturing. The research is published in the journal *Advanced Materials*.

Conventionally, the culturing and proliferation of (stem) cells suitable for applications such as regenerative medicine utilize solid plastic dishes.

Cell culturing on the surface of a liquid, like oil that does not mix with water, has been a long-researched concept due to its potential to significantly increase the efficiency of culturing per unit volume by dispersing the liquid in the culture solution like "salad dressing."

Not only does this approach reduce the ever-increasing plastic waste, but it also paves the way for technological innovations, such as cell separation/recovery through filtration leveraging liquid properties and complete automation of the cell culturing process.

However, fluorinated liquids used in the research field, although less cytotoxic, have been highlighted for their low chemical degradability in the environment, bringing attention to the "forever chemicals" and raising concerns about the high costs and environmental impact as a trade-off for advancing cell culture technology.

The NIMS research team has now successfully cultured human mesenchymal stem cells on the surface of ionic liquids, which do not mix with water and exhibit extremely low cytotoxicity. Ionic liquids consist solely of positive and negative ions and are characterized by their non-evaporating and non-volatile properties.

After cell culture, the liquid can be cleaned, heated, dried, and sterilized, allowing for reuse instead of disposal. Further, the research group discovered that the combination of ions in the ionic liquid significantly changes the adsorption state of proteins on the liquid surface, which is crucial in forming superior liquid scaffolds.

Moving forward, the team aims to establish techniques to control the differentiation state of stem cells on the ionic liquid surface, improve the culturing efficiency of valuable stem cell resources through dispersion culture, and develop a culturing process that does not produce plastic waste.

The team will continue to advance the development of cleaning and sterilization processes for ionic liquids suitable for cell culture.

More information: Takeshi Ueki et al, Ionic Liquid Interface as a Cell Scaffold, *Advanced Materials* (2024). DOI: 10.1002/adma.202310105

Provided by National Institute for Materials Science

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