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Spray-Dried Multiscale Nano-Bio Composites Containing Living Cells

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Technology description

A new technique that furthers the process of Cell Directed Assembly (CDA) by using a spray drying approach for the scalable production of biomaterials with fully encapsulated, live cells.
This technique has been tested and results have shown that this method works with multiple cell types and resulted in dry powders exhibiting a unique combination of properties including: highly ordered 3D nanostructures, extended lipid fluidity, tunable macro-morphologies and aerodynamic diameters, and high physical strength.

Background

Encapsulated cells have a wide range of applications and have been studied intensely ever since the demonstration of physical entrapment of cells within silica gels. Ongoing research has been conducted in hopes of incorporating living cells in inorganic gels and nanostructures to have the capability to include encapsulation within other silica gels, calcium mineral layers, vapor phase sol gel matrices, and solution phase lipid-silica matrices. So far, these studies have strived to enhance cell viability, and improve chemical and mechanical stability. The problem with these methods lies in their limitations reducing their general applicability including limited long term viability, thin-film architectures with low material yields, and limited success in cell lines other thanE.coliand yeast.
The process of Cell Directed Assembly (CDA) serves to encapsulate cells in order to preserve cell functionality and accessibility in a 'solid-state' sensor without need of an external fluidic system. Still, the absolute yield of CDA is limited. By incorporating scalable spray drying, CDA could be adapted to the large scale production of cellular encapsulated composites with retained bio-functionality.

Technology Description

Researchers at the University of New Mexico and Sandia National Labs have introduced a new technique that furthers the process of Cell Directed Assembly (CDA) by using a spray drying approach for the scalable production of biomaterials with fully encapsulated, live cells. This technique has been tested and results have shown that this method works with multiple cell types and resulted in dry powders exhibiting a unique combination of properties including: highly ordered 3D nanostructures, extended lipid fluidity, tunable macro-morphologies and aerodynamic diameters, and high physical strength.

Application area

Robust, scalable production of biomaterials with fully encapsulated, live cells
Allows for cell viability in otherwise harsh material preparation conditions
Cellular functionality is preserved (e.g. growth)
Particles can be engineered to a variety of sizes and shape characteristics depending on application
Improved the performance and flexibility of cellular encapsulation
Potential for long term preservation of living cells for use in delivering live-cell vaccines
Applications include biomaterial and biomedical research, specifically biosensors, microbial fuel cells, inhaled delivery of live-cell compounds, artificial organs, and vaccines

Institution

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