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Investigating the interactions of monoolein liquid crystals with human microbiomes

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Lipid-based liquid-crystals are biocompatible nanomaterials offering selective and 'smart' drug-release properties which are an emerging technology in the research and development pipeline. Over the last decade, research on these nanomaterials has focused on their behaviour in response to physicochemical phenomena and after loading with pharmaceutical cargo. Over the next decade, research aims to address our lack of understanding about how these prospective drug-carriers are influenced by physiological environments. This study explored members of the human microbiome as a potential candidate. Bacterial species which inhabit popular sites of drug administration were mixed with monoolein cubosomes and bulk cubic phase gels. The effects on liquid crystal structure and drug release profile were examined using benchtop and synchrotron SAXS, cross-polarized light microscopy, and fluorescence measurements. Particle mixing with bacterial cell membrane components induced a transformation to hexagonal structure, consistent with the transfer of bacterial phospholipids to the matrix. Similarly, exposure to the representative skin bacteria S. aureus induced the transformation to hexagonal structure after 8 hours. S. aureus exposure also reduced the rate of hydrophilic dye release from bulk monoolein cubic phase over a similar timeframe. This transformation was consistent with an increase in oleic acid content by lipolysis of monoolein by lipase. This research demonstrates the influence that bacteria can have on the structure and drug release properties of monoolein liquid-crystalline drug-delivery systems. These findings are hoped to inform future research throughout the development of these prospective drug-carrier nanomaterials for healthcare applications and commercially viable products.

Level of Expertise

Student

Presenter Gender

Man

Pronouns

He/Him

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

No

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

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