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HYDROGEN-BONDED ORGANIC FRAMEWORKS

A purely organic, crystalline matrix that can encapsulate, protect and preserve bio-molecules such as proteins, vaccines and enzymes.

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Technology potential

To be assessed:

- enhance, protect or target bio-molecules to specific sites during drug delivery.
- preservation of activity of temperature-sensitive vaccines.
- enzyme stabilisation to improve reaction efficiency &/or output.

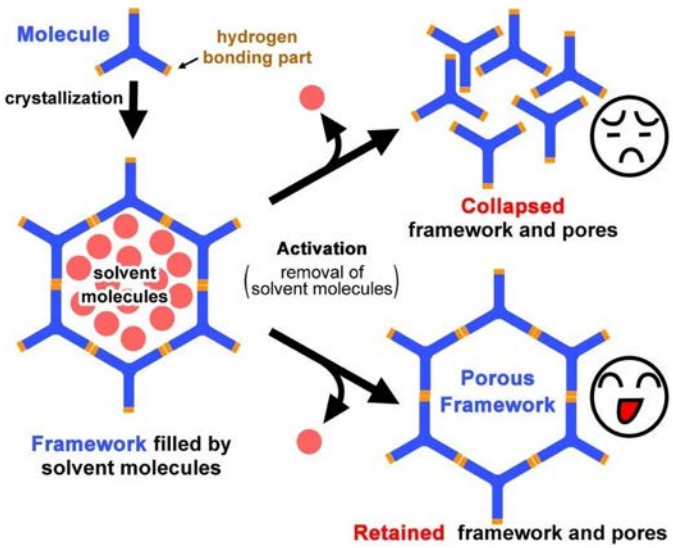
Technology overview

Hydrogen-Bonded Organic Frameworks (HOFs) are a class of porous framework material made from organic components that are assembled into crystalline networks via intermolecular hydrogen bonding.

This invention specifically utilises a family of HOFs to encapsulate bio-molecules and to protect them from inhospitable conditions. The process is carried out in 'one-pot' by simply mixing the organic components and the bio-molecule. The HOF components spontaneously co-crystallise around the bio-molecule as observed in confocal laser scanning microscopy (CLSM) imaging.

Structural data shows the HOF and the bio-molecule-HOF structures are the same, indicating that the porous structure is retained. The crystalline HOF shell protects the encased bio-molecule from unfavourable conditions including elevated temperature, organic solvents and proteolytic agents that would normally lead to decomposition of the protein structure and loss of native activity.

This has been demonstrated for one model enzyme which is well understood by the team and additional work is underway to generalise the invention to other bio-molecules and other HOFs.



Applications

As this is a platform technology, multiple application areas are possible including the use of HOF technology as a system to enhance, protect or target bio-molecules to specific sites during drug delivery.

Further, the activity of vaccines may be preserved by the use of HOFs, particularly where the cold-chain cannot be maintained during logistics, transportation and storage. As these frameworks are metal-free, they have the potential to overcome the toxicity limitations of Metal Organic Frameworks (MOFs) for such uses, as well as other materials e.g. Zeolite imidazolate frames (ZIFs), of typically smaller pore sizes and currently being used extensively in gas storage applications.

Opportunity

We are seeking commercial engagement (and further funding) to raise the TRL of the discovery.

The team seeks to partner with commercial interests in the ARC Linkage process or via state or federal government schemes to develop applications of the technology. Biotechnology companies, industrial bio-processing/ manufacturing or defence organisations may be potential partners.

IP Status

The technology is protected by Australian Provisional Patent #2019902133

Inventors

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The Sumby-Doonan team has been working in the area of biomimetic mineralisation using organic frameworks since 2015.

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FURTHER ENQUIRIES

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