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SPHERIFICATION TECHNIQUES IN BIOTECHNOLOGY: INNOVATIVE APPLICATIONS AND BENEFITS

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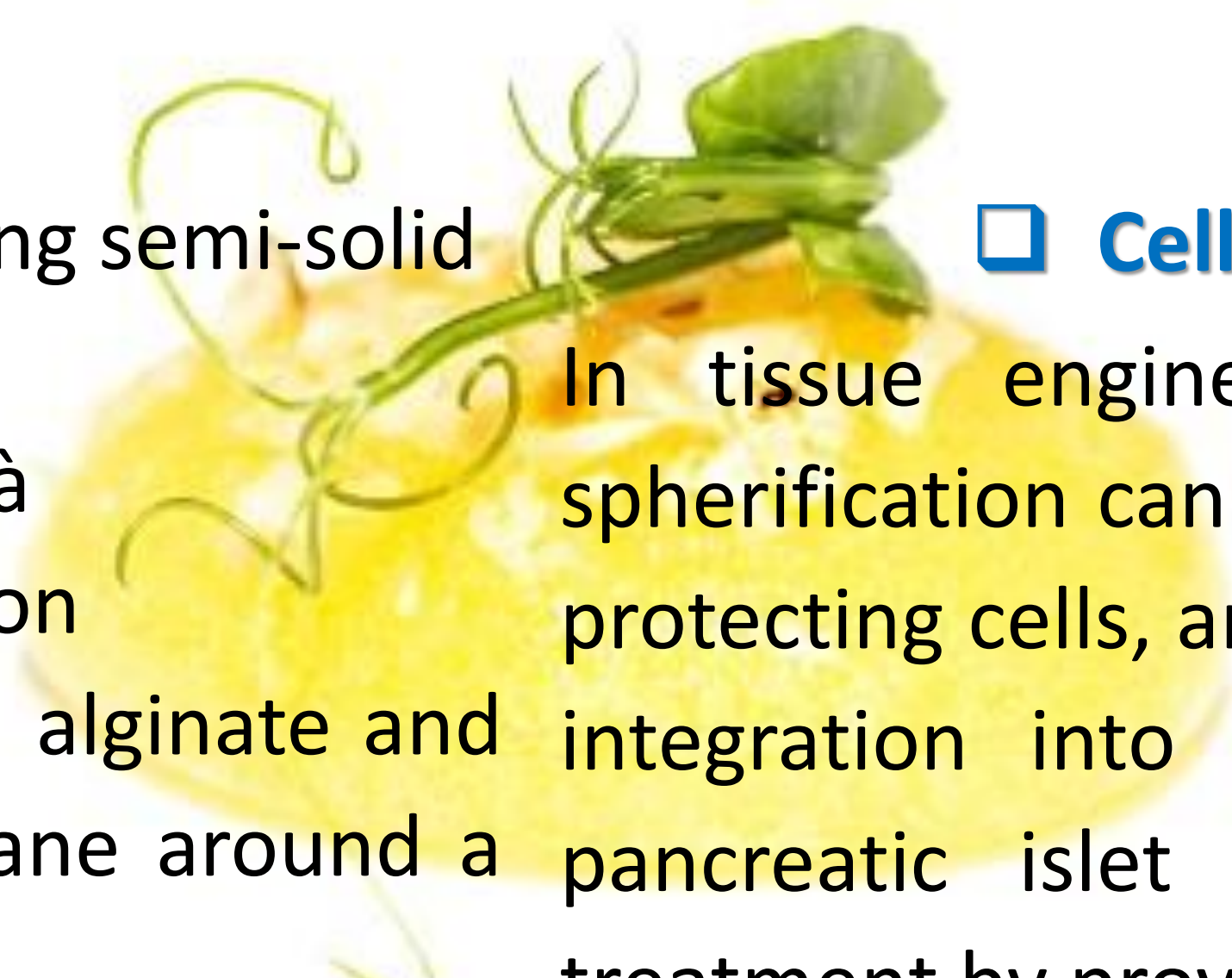
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Abstract: Spherification, a molecular gastronomy technique, is being innovatively applied in biotechnology. It uses sodium alginate and calcium ions to create gel-like membranes around liquids. In drug delivery, spherification allows for controlled release of medications. In tissue engineering, it encapsulates cells for protection and integration into tissues, aiding medical applications. Biocatalysis benefits by enhancing enzyme or microorganism activity and stability for industrial processes. In food biotechnology, it improves nutrient stability and bioavailability, creating functional foods. Despite challenges, spherification's precise control and versatility make it a valuable tool in modern biotechnology.

Introduction: Biotechnology is a broad field that involves using living organisms or their systems to develop products and technologies for a variety of applications. One interesting application within biotechnology is the use of culinary techniques like spherification, which originally come from molecular gastronomy but can be adapted for biotech purposes.

❑ **Spherification in Biotechnology** = creating semi-solid spheres with liquid interiors

- ✓ **Techniques** – popularized as Ferran Adrià
- ✓ **Methods** – direct and reverse spherification
- ✓ **Relying on** interaction between sodium alginate and calcium ions to form a gel-like membrane around a liquid center.



❑ **Cell encapsulation**

In tissue engineering and regenerative medicine, spherification can encapsulate cells within a gel matrix, protecting cells, and allowing their controlled release or integration into tissues. For example, encapsulated pancreatic islet cells could be used for diabetes treatment by providing a sustained insulin release.

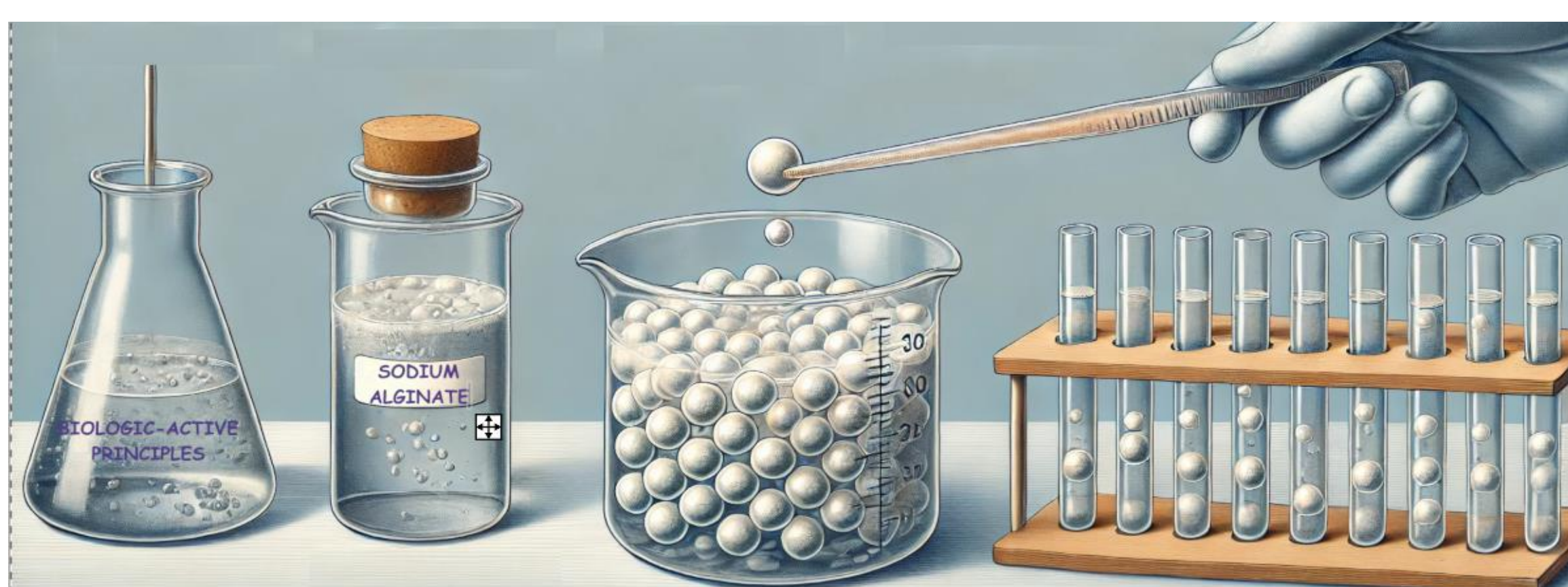
➤ Direct spherification:

- ❖ Liquid mixed with sodium alginate is dropped into a bath of CaCl_2 . Ca^{2+} reacts with the alginate and form a gel-like membrane around the droplets, creating nice spheres.



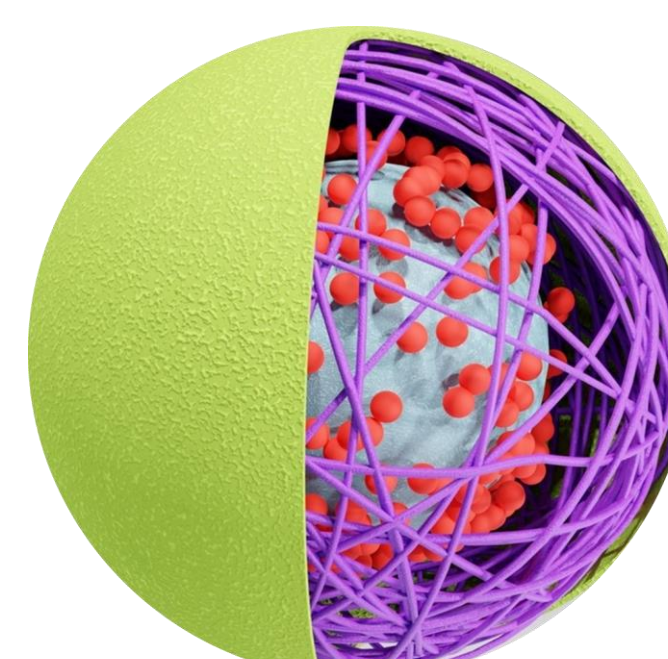
➤ Reverse spherification:

- ❖ Liquid mixed with calcium lactate or CaCl_2 is dropped into a bath of sodium alginate. Ca^{2+} reacts with the alginate and form a gel-like membrane around the droplets in the alginate bath, creating nice spheres.



❑ **Advances and challenges**

- ✓ precise control over the spheres size and shape.
- ✓ possibility to encapsulate a wide range of substances – liquids, cells, and enzymes.
- ✓ protects encapsulated products from environmental factors and degradation.
- ✓ the spheres' stability can vary, and they may break down over time.
- ✓ scaling up the process for industrial applications can be challenging.
- ✓ requires careful control of conditions and concentrations to ensure consistent results.



Hoisin

Cilantro

Sriracha