Extraction of Chitin from *Hermitia illucens larvae*

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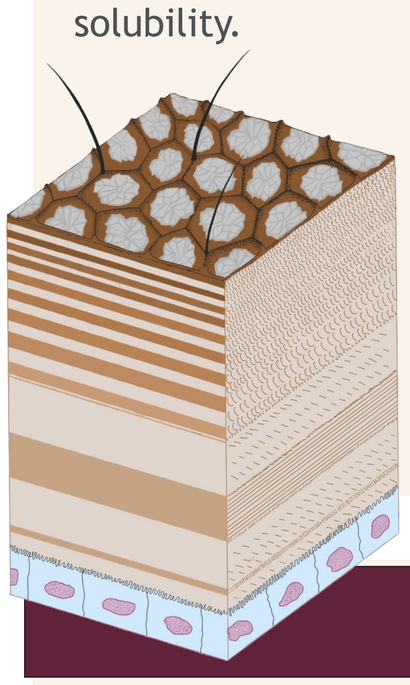
Introduction & Background

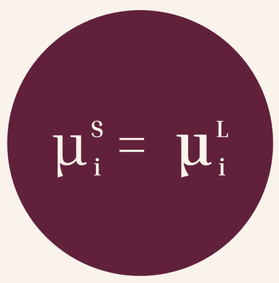
Hermitia illucens larvae are excelling as mini-livestock due to their high bioconversion capability of low-quality organic waste to produce high fat and protein larval mass.

Chitin, the biopolymer that forms the matrix of their exoskeleton, is currently an underutilised by-product from this process. Given this polymers high biocompatibility, its application in pharmaceuticals and biomedical field is limited only by its stubborn solubility.



Deep eutectic solvents (DESs) show considerable promise in this regard. Their extensive hydrogen bonding between constituents results in their negative deviation from ideal behaviour, and may also be key to their dissolution power.

Objectives



Collect SLE data for DES systems of interest

Modelling of SLE data by SAFT EoSs

Quantification of chitin solubility in DES systems

Future Work

1. Collect SLE data for choline chloride + levulinic acid system
2. Model the SLE behaviour in Clapeyron.jl environment using SAFT EoSs
3. Test solubility of purified shrimp chitin in DES systems
4. Test solubility of native chitin (from *H. illucens* larvae) in DES systems

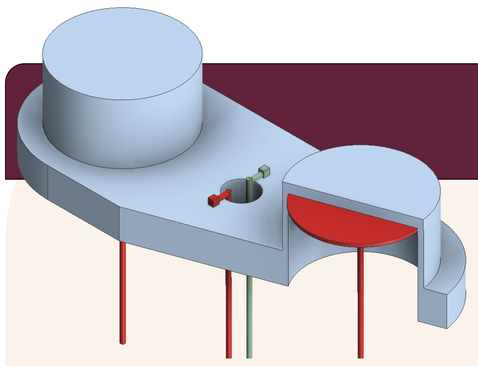


Fig.1 Tzero™ sensor in DSC

Methods

SLE Data

- Binary compositions prepared gravimetrically
- Differential scanning calorimetry (DSC) employed to collect SLE data: sample cyclically heated and cooled on Tzero™ sensor (Fig.1) thermal events interpreted as liquidus and solidus points (Fig. 2)

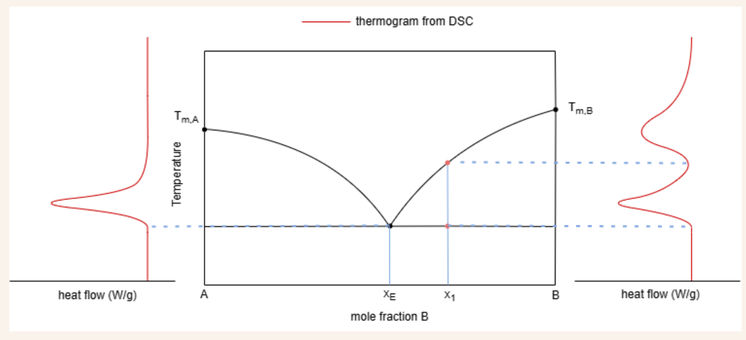


Fig.2 Interpretation of DSC thermogram to obtain SLE data

Chitin Solubility

- Gravimetric quantification of solubility
- Independent variables: DES composition, temperature and time

Results

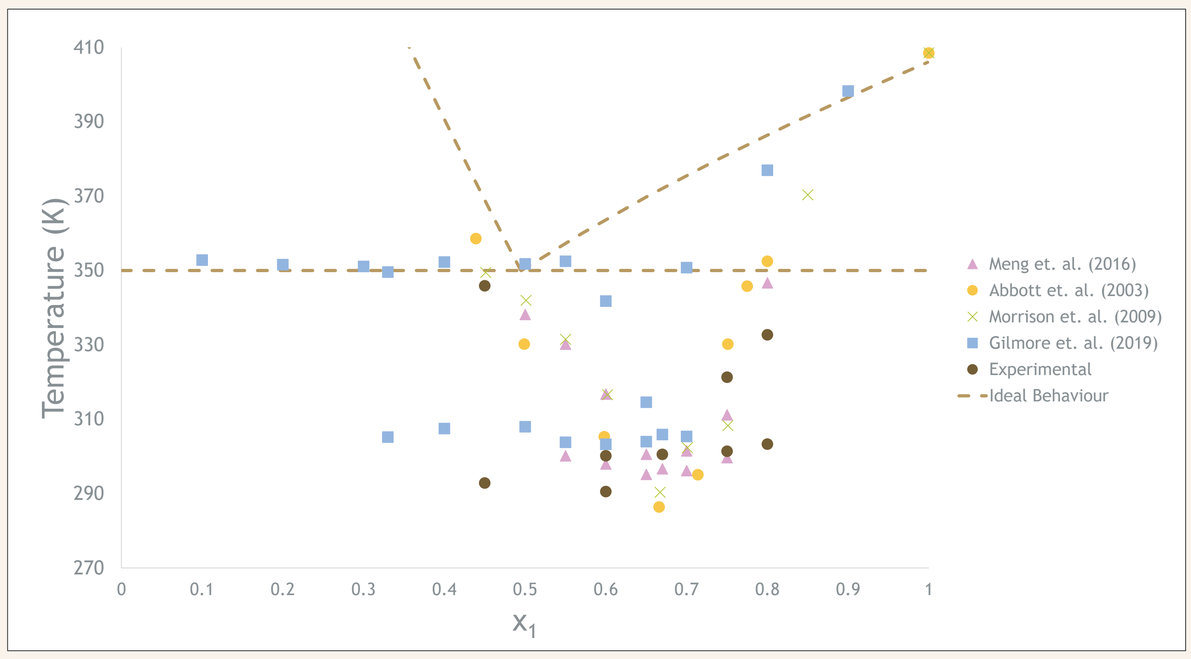


Fig. 3 SLE data for the urea (1) + choline chloride (2) DES system

Where ideal behaviour is determined from

$$\ln x_i^L \gamma_i^L = -\frac{\Delta h_m}{RT}\left(1 - \frac{T}{T_m}\right) \qquad \text{for } \gamma_i = 1$$

- The urea + choline chloride system is confirmed to be a DES given its negative deviation from ideal behaviour. $T_{E,ideal}$ exceeds $T_{E,exp}$ by more than 50 K.
- Eutectic composition is identified to be $x_1 = 0.67$.
- Solid-solid transition identified in choline chloride at 350 K.

References

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3. Meng, X., Ballerat-Busserolles, K., Husson, P., Andanson, J.-M., 2016. Impact of water on the melting temperature of urea + choline chloride deep eutectic solvent. New J. Chem. 40, 4492–4499.
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