Re-thinking protein fractionation from Algae

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Background

• Algae are considered a potential sustainable source of biomolecules, in particular proteins, for food and feed applications.

• Several processes have been reported in literature for the extraction and fractionation of proteins from micro and macroalgae. However, in general, the proposed technologies lead to low purities–yields (Fig. 1).

• How to improve the extraction-fractionation performance for the recovery of proteins from algae?

• In this work we present several insights on protein fractionation from algae and propose future research directions.

Extraction-fractionation: A matter of cell structure?

Figure 1. A protein fractionation process from green microalgae. Numbers indicate amount of unit operations. Data from Schwenzfeier et al., (2011).

Figure 2. Process performance with different algal strains. Numbers indicate amount of unit operations. Data from Kandasamy et al., (2012) (green markers: macroalgae) and Safi et al., (2014) (red markers - microalgae).

Novel solvents? thorough selection and reuse

• Prefer external fields over solvents.

• If solvents are needed, food grade, naturally derived solvents are a must

• Three phase partitioning: higher yields and purity.

• Efficient methods for solvent recovery are a must.

Figure 3. TPP for microalgae (left) and macroalgae (right) using Ionic Liquids.

Functionality, purity and conformation trilemma

Table: Protein concentrate Foam Capacity

<table>
<thead>
<tr>
<th>Protein concentrate</th>
<th>Foam Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algae</td>
<td>95 %</td>
</tr>
<tr>
<td>Winged bean</td>
<td>36 %</td>
</tr>
<tr>
<td>Soy</td>
<td>235 %</td>
</tr>
<tr>
<td>Mucuna bean</td>
<td>58 %</td>
</tr>
</tbody>
</table>

Figure 4. Proposed process and functionality of protein concentrates from microalgae (Waghmare et al., 2016).