High effective harvesting of microalgae Chlorella prothotocoides via flocculation with cationic starch

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Microalgal harvesting step accounts up to 30% of the total cost of biomass production. The aim of the study was to investigate the effect of an organic polymeric flocculant, Greenfloc 120, to flocculate microalgal species *Chlorella protothecoides*. Effect of pH on the flocculation process under optimal flocculant level was also investigated.

### Materials and Methods

Flocculation efficiency (FE) was calculated as:

\[ FE (%) = \frac{OD_{550}(t_0) - OD_{550}(t)}{OD_{550}(t_0)} \times 100 \]

where:
- \( OD_{550}(t_0) \): OD550 before flocculant addition
- \( OD_{550}(t) \): OD550 after flocculant addition

### Results

**Dynamics of flocculation efficiency (FE): biomass 0.44-0.72 g/L**

<table>
<thead>
<tr>
<th>pH</th>
<th>Mixing phase</th>
<th>Setting phase</th>
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<tbody>
<tr>
<td>4.0</td>
<td>-f; FE=20%</td>
<td></td>
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<tr>
<td>7.7</td>
<td>-f; FE=25%</td>
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<tr>
<td>10.0</td>
<td>-f; FE=60%</td>
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<td></td>
<td>+f; FE=91%</td>
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<td></td>
<td>+f; FE=98%</td>
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**Dynamics of flocculation efficiency (FE): biomass 0.78 g/L**

<table>
<thead>
<tr>
<th>pH</th>
<th>Mixing phase</th>
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<tbody>
<tr>
<td></td>
<td>-f; FE=40%</td>
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<td>-f; FE=60%</td>
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<td>+f; FE=98%</td>
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<td>+f; FE=98%</td>
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**Effect of pH on flocculation efficiency: biomass 1.1 g/L**

- pH (3.5-6.5): FE=40%
- pH (7.5-8.5): FE=60%
- pH (9.5-13): FE=80%

### Conclusions

This study demonstrated Greenfloc 120 as a promising agent for flocculation of *Chlorella protothecoides* at neutral and high pH. It can be concluded that:

- 40 mg flocculant/L: optimal level (FE>80%) for biomass concentrations 0.44-0.72 g/L
- 80 mg flocculant/L: optimal level (FE>80%) for biomass concentration 0.78 g/L

The best results were obtained at:

- pH 10 (FE=60-73%) in absence of flocculant
- pH 7.7 and pH 10 (FE=91-98%) in presence of flocculant (40 mg/L)

### Acknowledgments

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