**Experiment Design for Dynamic Simulation of** ***Desmodesmus sp.* F51 Production lutein**

Experimental objective:

1. Constructed models for Desmodesmus sp. F51 growth and lutein production;
2. Off-line and on-line dynamic simulation of biomass growth and lutein production.

Experimental project:

Four fed-batch processes were carried out, and algae biomass concentration, lutein content, and culture nitrate concentration were checked at different culture time.

Table 1: Operating conditions of two experiments

|  |  |  |
| --- | --- | --- |
| Operation conditions | Exp 1 | Exp 2 |
| Initial Biomass g/L | 0.07 | 0.07 |
| Initial nitrate con. mM | 8.8 mM | 8.8 mM |
| Flow rate, L/h | 0.003 (start 60h end 144h) | 0.003 (start 60h end 144h) |
| Influent nitrate con. mM | 0.5 M (42.5g/L) | 0.5 M (42.5g/L) |
| Light μmolm-2s-1 | 150 | 300 |
| Volume increase, L | *0.252* | *0.252* |
|  |  |  |
|  | Exp 3 | Exp 4 |
| Initial Biomass g/L | 0.07 | 0.07 |
| Initial nitrate con. g/L | 30 mM (2.55 g/L) | 30 mM (2.55 g/L) |
| Flow rate, L/h | 0.003 (start 60h end 144h) | 0.003 (start 60h end 144h) |
| Influent nitrate con. mM | 0.5 M (42.5g/L) | 0.5 M (42.5g/L) |
| Light μmolm-2s-1 | 480 | 600 |
| Volume increase, L | *0.252* | *0.252* |

Operation of photobioreactor: The photobioreactor (PBS) used to cultivate was a 1L glass vessel (1L culture volume). The PBS was operated at 35 ̊C, pH 7.5 and an agitation rate of 300 rpm under different light intensity. The 2.5% CO2 with 0.2 vvm was fed into the culture continuously during cultivation.

Note:

1. The strain is *Desmodesmus sp.* F51;

2. The medium used for the culture of the strain was Modified Bristol’s medium;

3. 0.07 g/l inoculums size was used in the fed-batch cultivation;

4. Initial nitrate concentration is 8.8 mM. The 500mM NaNO3 was fed into the culture medium according to optimized result.

5. Liquid sample were collected from the culture medium at set time intervals (each 12 h) to determine the biomass, nitrate concentration and lutein content.

Experimental record:

1. Initial nitrate concentration, biomass concentration and lutein content;

2. Recorded these data at each 12 hr.