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The influence of organic carbon on bioremediation process of wastewater originate from aquaculture with use of microalgae from genera *Botryococcus* and *Scenedesmus*

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**Abstract.** Advantages of using algae for wastewater treatment include: low operational cost, possibility of recycling assimilated nitrogen and phosphorus within the algae biomass as a fertilizer, accumulated biomass for biofuel. Our purpose was to study the influence of organic carbon on bioremediation process of wastewater originate from aquaculture with use of microalgae from genera *Botryococcus* and *Scenedesmus*. Algae cultivation was initiated in a bioreactor of 500ml Erlenmeyer flask containing 250ml wastewater. The experiment was conducted in variants without any organic carbon sources and the other with organic carbon source – glucose (1,125g.l⁻¹). Light regime was adjusted at 15:9 h light:dark cycle in an illumination incubator until the end of experiment. The temperature was kept between 25 and 27°C. The pH varied between 6.5 and 7.5 and by this reason it was not adjusted. Species grown in wastewater with added glucose showed a better cleansing effect compared with the same grown in wastewater without any carbon sources. Better growth indicators and faster absorption of wastewater compounds was observed in *S. dimorphus*.

**Keywords:** aquaculture, biomass, *Botryococcus braunii*, organic carbon sources, *Scenedesmus dimorphus*, wastewater

**Introduction**

Microalgae have industrial and economic potential (Rai et al., 2000) as valuable sources for pharmaceuticals, health foods, carotenoids (Liu et al., 2000; Park and Lee, 2001), dyes, fine chemicals, biofuels (Cresswell et al., 1989; Faulkner, 1986; Markov et al., 1998). They may be able to solve emerging environmental problems with waste treatments (Lee and Lee, 2001; Nakajima et al., 1997, Uma et al., 2002). Microalgae remove excess nutrients efficiently at a minimal cost (Akimoto et al., 1998; Hirano et al., 1997; Hirata et al., 1996; Murakami and Ikenouchi, 1997). They can fix carbon dioxide by photosynthesis (Lee et al., 2000; Lee et al., 2001; Takano and Matsunaga, 1995) produce oxygen and can relieve biological oxygen demand in wastewater. Advantages of using algae for this purpose include: low operational cost, possibility of recycling assimilated nitrogen and phosphorus within the algae biomass as a fertilizer, accumulated biomass for biofuel (Choi and Lee, 2012).

Recent studies have reported that algal species *Botryococcus* (An et al., 2003), *Scenedesmus* (Xin et al., 2010) were used to remove nitrogen, phosphorus and organic matter (biochemical oxygen demand [BOD] and chemical oxygen demand [COD]) from raw wastewater. Microalgae cannot metabolize all the organic sources. Glucose is the most commonly used organic carbon source for heterotrophic cultures of microalgae (Perez-Garcia et al., 2011). Higher rates of growth are obtained with glucose compared with any other substrate, such as sugars, sugar alcohols, sugar phosphates, organic acids, and monohydric alcohols (Griffiths et al., 1960). This is because glucose possesses more energy content per mol compared with other substrates. For example, glucose produces 2.8 kJ/mol of energy compared to 0.8 kJ/mol for acetate (Boyle and Morgan, 2009).

Our purpose was to study the influence of organic carbon on bioremediation process of wastewater originate from aquaculture with use of microalgae from genera *Botryococcus* and *Scenedesmus*.

**Material and methods**

Algae species, cultivation, bioreactor

Two microalgae species were used in our study: *Scenedesmus dimorphus* (SKU: AC-1002) and *Botryococcus braunii* (SKU: AC-1006). Both microalgae strains were bought from Algae depot (USA) (www.algaedepot.com). The wastewater used as a media for tested
algae cultivation originated from semi closed recirculation aquaculture system (semi – closed RAS) used for fish cultivation. Effluent treatment included mechanical filter and biofiltration for effluent purifying (Figure 1).

Algae cultivation was initiated in a bioreactor of 500ml Erlenmeyer flask containing 250ml wastewater. The experiment was conducted in variants without any organic carbon sources and the other with carbon source – glucose (1.125g/l). Three luminescent lamps Sylvania Aqua Star – 18w, 10 000 K were placed at a distance of 30 mm from flasks. Light regime was adjusted at 15:9 h light:dark cycle in an illumination incubator until the end of experiment. The temperature was kept between 25 and 27°C.

Samples for hydrochemical analysis were taken in the start of the trial, at 24h, 96h and 168h after the start of the experiment in three replicates. The samples with volume one ml was appropriately diluted with deionized water and the average value was recorded by absorbance at 650 nm with the help of spectrophotometer DR 2800 (Hach Lange).

The isolation of pigments from algae cells included the following procedures: harvesting 2 ml of microalgae cells by centrifugation at 10000 rpm, two times for 3 min and discarding the supernatant, suspension of cells in 2 ml methanol/water 90:10 v/v and mixing of the suspension for 1 min., cooling the samples at room temperature, centrifugation the samples were centrifuged at 300 rpm for 10 min, for freeing them from algal cells (Lee and Lee, 2002). Every variant of the experiment was conducted in six replications.

The measurement of pH was made with a portable combined meter and with a pH probe (Hach Lange). Other analyzed hydrochemical parameters were measured spectrophotometrically with spectrophotometer DR 2800 (Hach Lange). The methods and range of tests which were used during the experiment are shown in Table 1.

Table 1 Methods and range of tests used for monitoring the water quality parameters during experiment

<table>
<thead>
<tr>
<th>Ammonia</th>
<th>Indophenol blue</th>
<th>0.015 – 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrite – nitrogen</td>
<td>Diazotization</td>
<td>0.015 – 0.6</td>
</tr>
<tr>
<td>Nitrate – nitrogen</td>
<td>2.6 dimethylphenol</td>
<td>5 – 35</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>Koroleff digestion</td>
<td>5 – 40</td>
</tr>
<tr>
<td>Phosphorus (ortho + total)</td>
<td>2.6 dimethylphenol</td>
<td>0.05 – 1.5 mg l (^{-1}) PO-P</td>
</tr>
<tr>
<td></td>
<td>Phosphormolybdenum blue</td>
<td>0.15 – 4.5 mg l (^{-1}) PO</td>
</tr>
</tbody>
</table>

Results and discussion

Growth rate of B. braunii and S. dimorphus cultivated in wastewater originate from aquaculture with glucose carbon source.

The optical density of S. dimorphus was 1.31 in wastewater with carbon source – glucose used as a growing media in 168 hour; which had by 37.4% higher optical density compared with wastewater without carbon source for the same strain (Figure 2). For B. braunii higher value of optical density (1.16) was measured again in wastewater with glucose carbon source. The highest chlorophyll content was determined in S. dimorphus cultivated in wastewater with organic carbon source – glucose. It was by 12.6% higher than the chlorophyll content for B. braunii cultivated in the same conditions (Figure 3).

In our study the quantity of carotenoids in S. dimorphus was higher (1.47 mg l \(^{-1}\)) in cultures grown in wastewater with glucose.
organic carbon source, compared with the carotenoids of *B. braunii* (1.42 mg.l\(^{-1}\)) cultivated in the same conditions (Figure 4). For *S. dimorphus* cultivated in wastewater from RAS without carbon source the quantity of carotenoids was by 19% less compared with its quantity when the growing process was accomplished in wastewater originating from RAS with glucose carbon source.

The least amount of chlorophyll and carotenoids were measured for *B. braunii* cultivated in wastewater from RAS without carbon source. The algae species *B. braunii* and *S. dimorphus* showed good growth potential in the wastewater with glucose organic carbon source as well as in wastewater from RAS without carbon source.

Carbon and nitrogen are necessary elements for algal growth and maintenance. According to Lee and Lee (2002), *Chlorella* spp., which is of the same family as *Scenedesmus* and *Botryococcus* spp., preferred glucose as organic carbon source. Lee and Lee (2002) studied the possibility of *C. kessleri* nitrogen treatment was tested in wastewaters one contained glucose for an organic carbon source and the other without organic carbon sources. They established better growth in glucose-containing wastewater. This result suggests that this algal strain preferred glucose as organic carbon source to inorganic CO\(_2\). According to Abeliovich and Weisman (1978) the green alga *S. obliquus* readily adapted to heterotrophic growth in the dark, utilizing glucose as the sole carbon source. They established 1.3–1.7 optical density in carbon source glucose and 1.8 chlorophyll.

**Table 2. Hydrochemical parameters during the experiment with *B. braunii***

<table>
<thead>
<tr>
<th>Parameter</th>
<th><em>B. braunii</em> (wastewater)</th>
<th><em>B. braunii</em> (wastewater+glucose)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.92±0.004 8.18±0.01 8.10±0.09 8.15±0.021 8.305±0.06 7.87±0.02 8.30±0.02 8.58±0.02 8.87±0.007 8.90±0.007</td>
<td>7.92±0.004 8.18±0.01 8.10±0.09 8.15±0.021 8.305±0.06 7.87±0.02 8.30±0.02 8.58±0.02 8.87±0.007 8.90±0.007</td>
</tr>
<tr>
<td>NH(_4)+</td>
<td>0.319±0.002 0.31±0.05 0.23±0.01 0.22±0.14 0.17±0.07 0.317±0.002 0.24±0.009 0.22±0.006 0.21±0.001 0.17±0.007</td>
<td>0.319±0.002 0.31±0.05 0.23±0.01 0.22±0.14 0.17±0.07 0.317±0.002 0.24±0.009 0.22±0.006 0.21±0.001 0.17±0.007</td>
</tr>
<tr>
<td>TN</td>
<td>24.8±0.02 12.81±0.15 11.82±1.63 11.55±0.07 11.35±0.35* 24.9±0.002 18.8±0.21 17.05±0.21 16.05±1.06 14.3±0.56*</td>
<td>24.8±0.02 12.81±0.15 11.82±1.63 11.55±0.07 11.35±0.35* 24.9±0.002 18.8±0.21 17.05±0.21 16.05±1.06 14.3±0.56*</td>
</tr>
<tr>
<td>PO(_4)</td>
<td>2.01±0.15 1.35±0.04* 1.15±0.02* 0.95±0.03* 0.92±0.01* 2.01±0.02 0.975±0.04* 0.77±0.01* 0.75±0.02* 0.7±0.03*</td>
<td>2.01±0.15 1.35±0.04* 1.15±0.02* 0.95±0.03* 0.92±0.01* 2.01±0.02 0.975±0.04* 0.77±0.01* 0.75±0.02* 0.7±0.03*</td>
</tr>
<tr>
<td>TOC</td>
<td>45.2±0.004 31.65±0.004 30.7±0.015 28.2±0.12 27.7±0.03* 45.1±0.04 33.95±0.01 33.45±0.04 33.4±0.17 25±0.02*</td>
<td>45.2±0.004 31.65±0.004 30.7±0.015 28.2±0.12 27.7±0.03* 45.1±0.04 33.95±0.01 33.45±0.04 33.4±0.17 25±0.02*</td>
</tr>
</tbody>
</table>

*P≤0.05

**Table 3. Hydrochemical parameters during the experiment with *S. dimorphus***

<table>
<thead>
<tr>
<th>Parameter</th>
<th><em>S. dimorphus</em> (wastewater)</th>
<th><em>S. dimorphus</em> (wastewater+glucose)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.88±0.01 8.16±0.03 8.13±0.16 8.18±0.09 8.19±0.04 7.97±0.01 8.29±0.01 8.47±0.02 8.77±0.014 8.89±0.014</td>
<td>7.88±0.01 8.16±0.03 8.13±0.16 8.18±0.09 8.19±0.04 7.97±0.01 8.29±0.01 8.47±0.02 8.77±0.014 8.89±0.014</td>
</tr>
<tr>
<td>NH(_4)+</td>
<td>0.318±0.01 0.29±0.004 0.25±0.02 0.23±0.02 0.18±0.001* 0.317±0.003 0.25±0.01 0.21±0.009 0.15±0.01*</td>
<td>0.318±0.01 0.29±0.004 0.25±0.02 0.23±0.02 0.18±0.001* 0.317±0.003 0.25±0.01 0.21±0.009 0.15±0.01*</td>
</tr>
<tr>
<td>TN</td>
<td>24.9±0.02 13.17±0.60 11.58±1.68 11.15±0.91 11.15±0.49* 24.9±0.003 12.8±0.01 11.8±0.02 11.55±0.03 11.35±0.05*</td>
<td>24.9±0.02 13.17±0.60 11.58±1.68 11.15±0.91 11.15±0.49* 24.9±0.003 12.8±0.01 11.8±0.02 11.55±0.03 11.35±0.05*</td>
</tr>
<tr>
<td>PO(_4)</td>
<td>2.01±0.03 1.45±0.07* 1.05±0.01* 0.85±0.07* 0.75±0.02* 2.01±0.04 0.88±0.05* 0.8±0.01* 0.79±0.03* 0.67±0.02*</td>
<td>2.01±0.03 1.45±0.07* 1.05±0.01* 0.85±0.07* 0.75±0.02* 2.01±0.04 0.88±0.05* 0.8±0.01* 0.79±0.03* 0.67±0.02*</td>
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<tr>
<td>TOC</td>
<td>45.2±0.01 30.25±0.16 29.3±0.03 27.3±0.15 24.15±0.07* 45.3±0.01 34±0.04 33.6±0.043 30.9±0.17 21.9±0.02*</td>
<td>45.2±0.01 30.25±0.16 29.3±0.03 27.3±0.15 24.15±0.07* 45.3±0.01 34±0.04 33.6±0.043 30.9±0.17 21.9±0.02*</td>
</tr>
</tbody>
</table>

*P≤0.05
The efficiency in total phosphorus removal from wastewater was better in wastewater with glucose organic carbon source used for *S. dimorphus* cultivation compared with the same condition of *B. braunii* cultivation. In the beginning of a level of phosphorus compounds 2.01 mg/L was measured. At the end of the experiment for *S. dimorphus* cultivation in wastewater with glucose carbon source, phosphorus decreased by 66.6%, while for *B. braunii* – by 65.1%.

Valderrama et al. (2002) obtained 76.6% removal efficiency for TN by *C. vulgaris* in the treatment of industrial wastewater. Choi and Lee (2012) obtained that TN concentration was decreased by 77.5% accumulated in *C. vulgaris* until 4 day in wastewater. Gonzalez et al. (1997) obtained 55% of phosphorus uptake from agro-industrial wastewater with *C. vulgaris* and *S. dimorphus*. Choi and Lee (2012) showed results that a maximum of 48.76% of PO4-P was removed of *C. vulgaris* cultivating in wastewater. Glucose carbon source could induce good enhanced biological phosphate removal performance reported (Jeon and Park, 2000).

**Conclusion**

Our results showed that wastewater from aquaculture with carbon source glucose promotes better algal growth of *S. dimorphus* and *B. braunii* compared to wastewater without carbon source. *S. dimorphus* and *B. braunii* can be used for biological treatment of wastewater originate in aquaculture.

**References**


Uma L, Selvaraj K, Subramanian G, Nagarkar S and Manjula R,


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Results

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Discussion: The objective of this section is to indicate the scientific significance of the study. By comparing the results and conclusions of other scientists the contribution of the study for expanding or modifying existing knowledge is pointed out clearly and convincingly to the reader.

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