THE INFLUENCE OF LIGHT INTENSITY ON GROWTH OF THE MARINE PLANKTONIC ALGA *CHLORELLA* SP. UNDER LABORATORY CONDITIONS

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Abstract

Chlorella sp. cultures were exposed to the light intensities of 900, 2000, 4000, 6000, and 12000 lux until the steady phase of growth was achieved. Optimal growth at 6000 lux was established. The shortest period of log phase was recorded for the algae exposed at 6000 and 12000 lux, and the longest at 2000 lux. Algae at 900 lux were exposed to 12000 lux on the 23rd day of the experiment with successful growth.

Keywords: Chlorella, light intensity, growth rate

Introduction

The green phytoplankton alga *Chlorella sp.* is normally used in mariculture for human food, and for culturing zooplanktons in marine fish hatchery. In a microalgal culture under illuminated conditions, the production rate of cells depends on the distribution of light intensity and growth rate of cells (1). The aim of the research was to establish optimal light intensity in order to access maximal abundance of *Chlorella sp.* in the shortest time.

Material and methods

Chlorella sp. was isolated from the coastal waters of Kaštela bay, Central Adriatic Sea, and persistence in laboratory in a liquid medium. For each experiment 20 l of filtrated and sterilized (by UV lamp) sea water, 500 ml *Chlorella sp.* culture abundance $1.3x10^7$ cell ml^{-1}, 20.5 ml of nutrition medium "Walne" (2), and 0.25 ml of thiamine were added in three bags. In each experiment three different bags with algae culture were exposed to the certain light intensity estimated by the luxmeter: 900, 2000, 4000, 6000 and 12000 lux. The bags at 900 lux were exposed at 12000 lux on the 23rd day of the experiment. Light source for the intensities 900 – 600 lux were fluorescent tubes 40 W (220-240 V), and for the highest light intensity of 12000 lux VTFE lamp was used. Photoperiod 15 h light / 9 h dark was set by the timer mechanism. Cultures were continuously mixed by air pumps. Indoor and the temperature of the medium, as well as the salinity (psu) were controlled. The algae cells were counted daily at 9 am by the Bürcker-Türck counter.

Results and discussion

The initial abundance of algae was $3.3x10^5$ cell ml^{-1}. The seawater salinity was 37.5 psu at the beginning and at the end of the experiment it was between 42.0 psu (at 900 lux) and 43.3 psu (at 12000 lux). The temperature was between 23.9°C and 25.8°C. Photo bioreactors with diurnal cycles will save energy and improve organic carbon sources removal (3). (4) were tested the use of submarine lamps (1.20 m fluorescent tube, 90 W, 220-240 V) in large volume tanks (0.8 m^3) for the development of *Chlorella sp.* with the bloom technology. 10-16 x 10^6 cell ml^{-1} were obtained after a week. In our experiment maximal growth was at 6000 lux. After 7 days the abundance of *Chlorella sp.* was 19.1 x 10^6 cell ml^{-1}, and the maximal abundance was 85.9 x 10^6 cell ml^{-1} on the 15th day of the experiment (Fig. 1). Algae previously exposed at 900 lux, were in a steady phase on 23rd day, and then they were exposed at a significantly higher light intensity of 12000 lux that caused the growth after 48 hours, and a new steady phase was established after 7 days (Fig. 2). It seems that in the first part of the experiment the nutrition did not become depleted, so in the second phase the higher light intensity was stimulating the growth until the second steady phase was achieved.

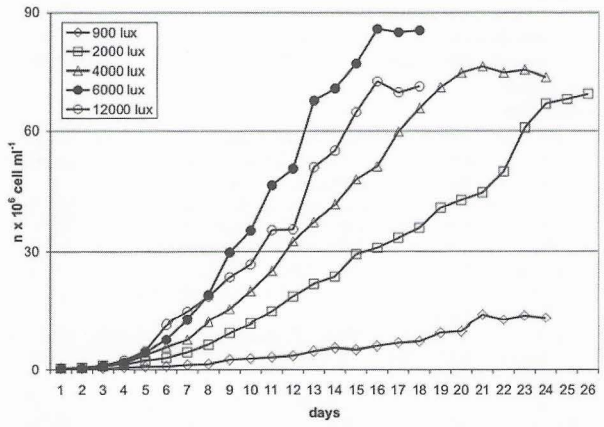

Fig. 1. The growth of *Chlorella sp.* under the different light intensities.

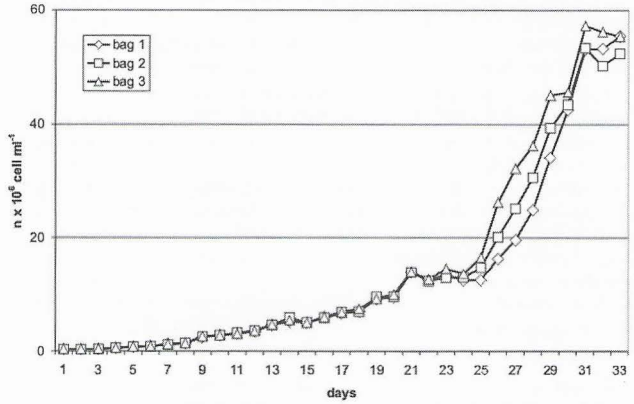

Fig. 2. A new growth of *Chlorella sp.* after changing the light intensity.

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