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THE INFLUENCE OF OXIDATIVE STRESS ON THE QUALITY OF PHYCOLOGICAL BIOMASS

Oxidative stress in living cells (excessive accumulation of reactive oxygen species) is characteristic practically for all intensive biotechnological processes, including phycologycal production. *Arthrospira platensis* Gomont (= *Spirulina platensis* (Gomont) Geitler), one of the most used cyanobacterium and valuable source of protein and antioxidants, is grown industrially in many countries and under very different conditions. Biomass production of *Spirulina* is constantly growing. In pursuit of high productivity, it is very important to keep the high quality of the biomass.

The influence of thermal, salt, illumination and chemical stress on strain *Arthrospira platensis* CNMN-CB-11 (*Spirulina*) under laboratory and production conditions was investigated. The obtained results suggest that production conditions were stressful compared to laboratory ones. Under optimal condition during accelerating growth phase in laboratory, the level of malondialdehyde

(MDA) in *Spirulina* significantly decreased, whereas industrial conditions stimulated MDA accumulation.

High temperature was a stress factor for *Spirulina* under both laboratory and production conditions. The amount of malondialdehyde in the biomass grown at high temperature (40 °C) was 3 times higher than at optimal temperature. Phycobiliprotein content in the first half of exponential growth phase dropped by 30-33 % compared to optimal conditions, both in laboratory and production conditions, but at the end of the life cycle, the amount of phycobiliproteins in biomass grown at different temperatures was approximately equal. Under laboratory conditions, lipid content in *Spirulina* biomass decreased practically twice and carbohydrates increased by 35 % at high temperature compared to the optimal temperature conditions. In the same time, the difference in lipid content was minimal, and the content of carbohydrates was lower under industrial production conditions.

Arthrospira platensis CNMN-CB-11 is a technological strain with short life cycle selected for industrial cultivation under continuous illumination. Thus, photoperiodism (12 h/L: 12 h/D) has determined a state of stress, leading to an increase of antioxidant enzymes (superoxiddismutase, catalase and peroxidase) activity up to 1.5 times. The protein content in *Spirulina* biomass was significantly lower under periodic illumination compared to continuous light (by 12.1-25.8%). The quantity of phycobilins and carbohydrates was higher (by 32% and up to 1.8 times, respectively) under light stress condition compared to continuous illumination.

Spirulina biomass under salt stress conditions contained 3 times more MDA compared to control. High concentrations of NaCl (40 and 50 g/L) substantially decreased the antioxidant activity down to 50%. Due to salt stress, biomass produced in a growth cycle decreased substantially. The amount of proteins and phycobilins decreased and lipid and polysaccharide content increased compared to control.

Spirulina responded to the chemical stress, induced by copper by increasing the amount of carbohydrates and lipids. Also, the quantity of phycobilin pigments in biomass of *Spirulina* significantly decreased under stress conditions.

All types of investigated stress are associated with increasing MDA amount in biomass and with the modification of the antioxidant enzymes activity and biomass composition. Depending on the type of stress and its intensity, the values

of these parameters may increase or decrease. Under moderate stress conditions, certain technological advantages such as increasing *Spirulina* biomass production and high levels of phycobilins and carbohydrates in biomass can be achieved.