INDUCED OXIDATIVE STRESS - A BIOTECHNOLOGICAL TOOL IN PHYCOBIOTECHNOLOGY

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Phycological production is becoming more attractive due to several advantages, one of which is the use of very compact surfaces for the cultivation process. Moreover, phycological biomass is a profitable source of proteins, polysaccharides, lipids, pigments and other products with high biological activity. These benefits determine the obvious interest of biotechnologists for mass cultivation of microalgae and cyanobacteria in different type bioreactors. Cultivation under industrial conditions are associated with oxidative stress, and this can compromise biomass quality. For these reasons, the stress associated with the accumulation of free radicals and degradation products of macromolecules, is regarded as a major challenge, an economic risk factor, as well as a risk to human health. However, a moderate stress may be associated with certain benefits for industrial cultures of microalgae and cyanobacteria. It would allow increasing biomass production, a more rapid accumulation of polysaccharides, altering the contents of pigments, etc.

In order to enhance the performance of an industrial strain, in this case *Spirulina platensis* CNMN-CB-11, we showed how to apply a stress condition as an efficient tool of biotechnology. *Spirulina platensis* CNMN-CB-11 was adapted to grow under continuous illumination. It was shown that the application of photoperiodism (12 hours of light and 12 hours of darkness) can induce a state of oxidative stress in culture, as indicated by a considerable increase in the amount of malondialdehyde by 0.5-3.7 times. At the same time, light stress induced an increased accumulation of phycobiliproteins (up to 45% higher than under conditions of continuous illumination), carbohydrates (2 times higher) and lipids.

Another stress factor for spirulina is temperature. During hyperthermia (cultivation of spirulina at 40°C), on the background of low amounts of the main biologically active components, in spirulina biomass increased significantly the activity of primary antioxidant enzymes - superoxide dismutase, catalase and peroxidases. Conditions of hypothermia (continuous cultivation of spirulina for at least 12 hours at 4°C) induced the expression of desaturase *desD* and the accumulation of ɣ-linolenic acid into biomass.

Hyperosmotic stress (caused by high quantities of NaCl in nutrient medium - 20-40g/l) induced a significant increase in the quantity of lipids (up to 63%) and carbohydrates (up to 81%) in algal biomass. It was also observed an increase in the amount of lipids and carbohydrates under the action of copper ions on spirulina culture.

Actually, moderate stress (e.g., controlled periodic illumination) brings certain technological advantages, such as increased biomass production and high levels of phycobilins and carbohydrates. However, this situation should be treated with maximum precautions, because any stress is associated with a high risk of accumulation of free radicals. Where the purpose of biomass production process is not its integral use, but the extraction of certain bioactive components (e.g., lipids, phycobilins, polysaccharides), moderate stress advantages can be successfully applied as simple, cheap and efficient technological solutions.