

THE INFLUENCE OF THE MAGNETIC FLUIDS ON GROWTH IN *CHLORELLA*

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Abstract: The dynamics of absorbance and number of cells/ml of nutritive medium from cultures of *Chlorella vulgaris* Beij. treated with magnetic fluid relayed on water (50G) were investigated for one culture cycle (15 days). The magnetic fluid was added in Arnon nutritive medium of algal suspension in increasing concentrations from 0.25‰ to 1‰. In the first 7 days of the culture cycle a slowly growth was observed and after this a period of intense growth was noticed. For the concentrations of 0.25‰ and 0.5‰ the number of *Chlorella* cells/ml reached a maximum in the 10th day of the experiment and after this day the number of cells per volume unit from these two treatments decreased continuously till the end of the experiment (the 15th day). For the concentration of 1‰, the maximal number of cells per volume unit was recorded in the 14th day of experiment when it was almost equal with the control. The growth of the *Chlorella vulgaris* cells was inhibited in case of all treatments of magnetic fluid from the 11th day of the culture cycle and the cells number from the variants with magnetic fluid was exceeded by control at the end of the two weeks of cultivation.

Key words: *Chlorella vulgaris*, magnetic fluids, growth

Introduction

The algal cultures are the subject of a special theoretical and practical interest for the definition of optimal culture conditions, able to ensure an intense growth and implicitly a good productivity.

The algal biomass accumulating a great quantity of protein substances is used in the animal food, in the pharmaceutical industry and even in the human food.

Excepting these practical applications of the algae culture, it was raised the problem of their utilisation like a source of food in case of some long space flights and therefor of their cultivation in a space ecosystem under microgravity conditions and under a magnetic field different from that terrestrial.

Many researchers (Tenforde 1990, Asashima et al. 1991, Haque & Kreuzberg 1993) showed that through treatments with biocompatible magnetic fluids is changed the plant metabolism and it is possible to induce some phenotypic and genotypic effects able to stimulate the plant productivity.

There are granules of magnetite of different size and aspect in some bacterium and algae cells. The magnetosomes, from the bacterium or algae cells, are formed by the

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crowding of some magnetite crystals, strong magnetised, at which it add bivalent iron, hydrated ferric oxide and ferrhydrit. At algae, the magnetosomes have the role to orientate the movements of algae in the liquid medium along the force lines of the terrestrial magnetic field (Frankel & Blakemore 1989).

The unicellular green alga *Chlorella vulgaris* was considered by Warburg like a standard species for the research of the physiological processes and most of the papers which refer to the physiological processes of algae used with prevalence this alga. This is the reason for choosing of this alga for this experimental study.

The influence of the magnetic fluid relayed on water on the growth of unicellular green alga *Chlorella vulgaris* Beij. was investigated in this paper.

Material and methods

Chlorella vulgaris alga was cultivated on Arnon nutritive medium (Boldor et al. 1983).

The experiments were carried out in a chamber with artificial illumination of 8000 lux. To avoid mutual shadowing, the algal suspensions, in cylindrical glass recipients of 1000 ml, were bubbled with steady stream of air produced by aquarium pumps. The culture medium was inoculated with an amount of algal biomass producing a 100000 cells/ml suspension in all experiment variants. The ambient temperature varied between 21-25^o C.

The initial culture of *Chlorella vulgaris* Beij. was obtained from the Plant Physiology Laboratory of Institute of Biology from Bucharest.

The magnetic fluid with water (50 G) was introduced in the culture medium before inoculation. Three concentrations of the magnetic fluid solutions 0.25‰, 0.5‰ and 1‰ were used.

The growth of algae was observed within the culture cycle with a "Cecil 1020" spectrophotometer at $\lambda = 676$ nm. For every concentration of magnetic fluid, at the sampling time, the absorbance of the blank sample was subtracted from the sample absorbance in order to obtain the absorbance of the algal suspension (Fig. 1). The blank samples consisted of Arnon medium (without *Chlorella* cells) and the quantity of magnetic fluid required to obtain one of the three used concentrations.

The number of algal cells was counted with a Thoma haemocytometric mount.

Results and discussions

The obtained data showed a small rate of growth in the first days, followed by an increase of the growth rate (Fig. 2).

For the algal cultures grown in a nutritive medium with a concentration of the magnetic fluid of 1‰, the beginning of the intense growth phase occurred with a delay of two days.

In the first 4 days of experimentation, the growth rate was grater in the control than in the concentrations of 0.5‰ and 1‰.

In the same time a small stimulation may be noticed for the 0.25‰ concentration, but the differences were not significant.

For the concentrations of 0.25‰ and 0.5‰ the number of *Chlorella* cells/ml reached a maximum in the 10th day of the experiment and after this day the number of cells per volume unit from these two treatments decreased continuously till the end of the experiment (the 15th day).

For the concentration of 1‰, the maximal number of cells per volume unit was recorded in the 14th day of the experiment when it was almost equal with the control.

The control culture showed an obviously decrease of the growing rate after the 11th day, but it remained positive.

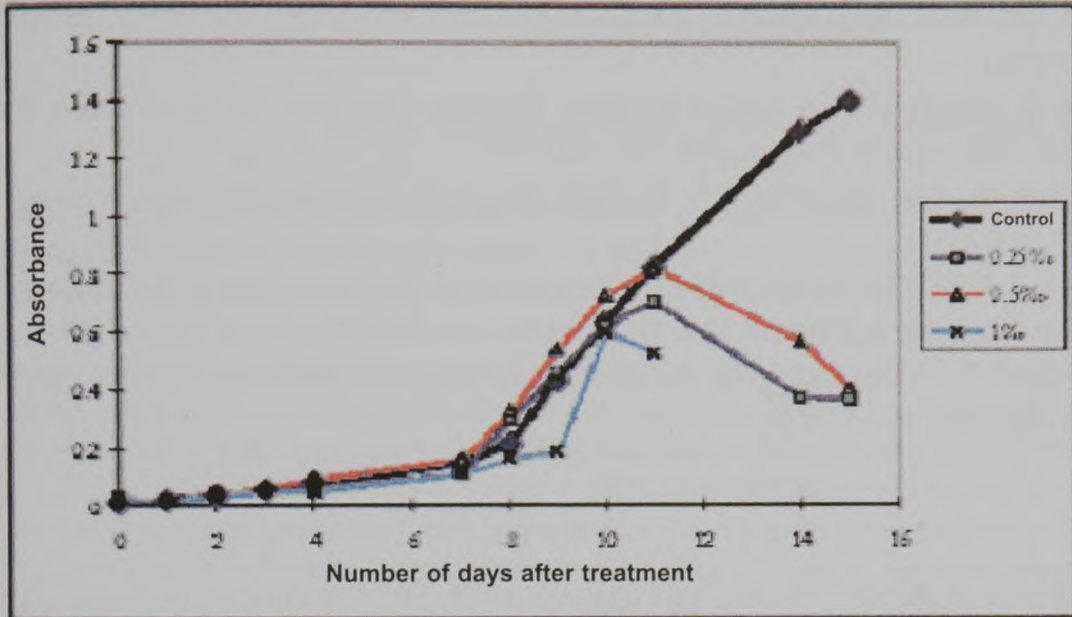


Fig. 1 Variation of absorbance of *Chlorella vulgaris* cultures treated with different concentrations of magnetic fluid

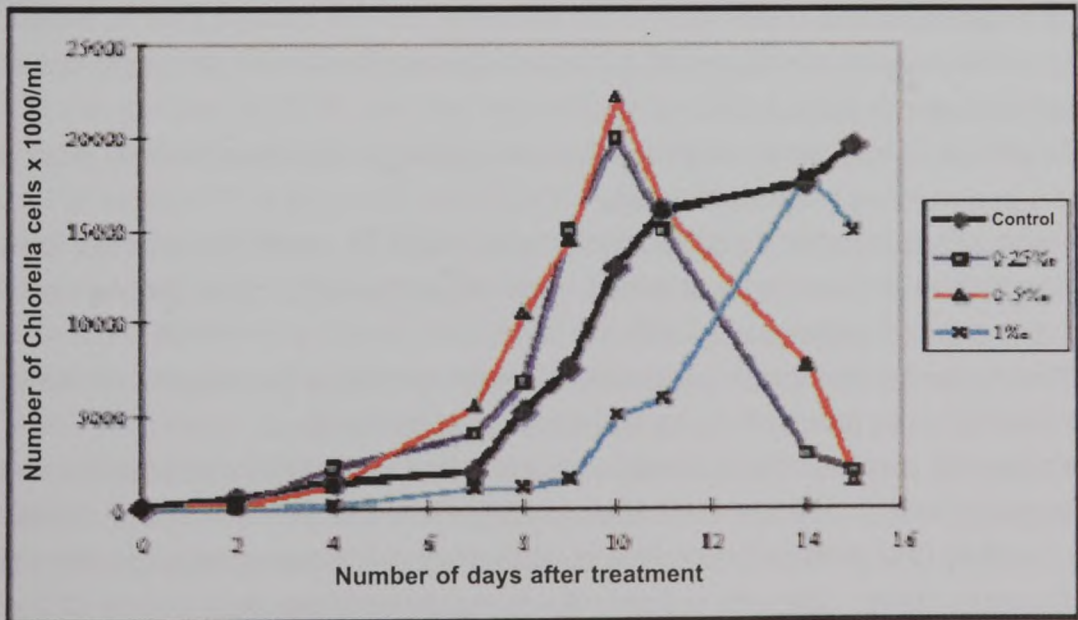


Fig. 2 Dynamics of the number of *Chlorella vulgaris* cells from cultures treated with different concentrations of magnetic fluid

Conclusions

Transitory stimulation effects were observed for the concentrations of magnetic fluid of 0.25‰ and 0.5‰, but at the end of the experience the number of *Chlorella* cells per volume unit for all treatments were lower than in control.

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INFLUENȚA FLUIDELOR MAGNETICE ASUPRA CREȘTERII CELULELOR ALGALE DIN GENUL CHLORELLA

Rezumat: s-au urmărit dinamica absorbantelor și a numărului de celule de *Chlorella vulgaris* Beij./ml de mediu nutritiv tratate cu fluid magnetic pe bază de apă (50 G), pe parcursul unui ciclu de cultură (15 zile).

Lichidul magnetic a fost adăugat în mediul nutritiv Arnon al suspensiei algale în concentrații crescânde, de la 0,25‰ la 1‰.

În primele 7 zile ale ciclului de cultură s-a observat o creștere lentă, după care s-a înregistrat o perioadă de creștere intensă.

Pentru concentrațiile de 0,25‰ și 0,5‰, numărul de celule de *Chlorella* pe unitatea de volum a atins un maximum în a zecea zi de experimentare, după care a continuat să scadă până la sfârșitul experienței, în ziua a 15-a.

Pentru concentrația de 1‰, numărul maxim de celule pe unitatea de volum a fost atins în a 14-a zi, când practic a ajuns la același nivel cu martorul.

Creșterea celulelor de *Chlorella vulgaris* a fost inhibată în cazul tuturor variantelor cu fluid magnetic, din a 11-a zi a ciclului de cultură, iar la sfârșitul celor două săptămâni de cultivare, numărul de celule din variantele cu fluid magnetic a fost depășit de către martor.

Cuvinte cheie: *Chlorella vulgaris*, fluide magnetice, creștere