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Amino acids as possible alternative nitrogen source for growth of Euglena gracilisZ in life support systems

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Abstract

In recent times Euglena gracilisZ was employed as primary producer in closed environmental life-support system (CELSS), e.g. in space research. The photosynthetic unicellular flagellate is not capable of utilizing nitrate, nitrite, and urea as nitrogen source. Therefore, ammonium is supplied as an N-source in the lab (provided as diammonium-dihydrogenphosphate,(NH4)2HPO4)to E. graciliscultures.

While nitrate exerts low toxicity to organisms, ammonium is harmful for many aquatic organisms especially, at high pH-values, which causes the ionic NH4+(low -toxicity) to be partially transformed into the highly toxic ammonia, NH3. In earlier reports, Euglena graciliswas described to grow with various amino acids as sole N source.

Our aim was to investigate alternatives for (NH4)2HPO4as N-source with lower toxicity for organisms co-cultivated with Euglenain a CELSS. The growth kineticsof Euglena graciliscultures was determined in the presence of different amino acids (glycine, glutamine, glutamic acid, leucine, and threonine). In addition, uptake of those amino acids by the cells was measured. Cell growth in the presence of glycine and glutamine was quite comparable to the growth in (NH4)2HPO4containing cultures while a delay in growth was observed in the presence of leucine and threonine.

Unlike, aforementioned amino acids glutamate consumption was very poor. Cell density and glutamate concentration were almost unaltered throughout the .experiment and the culture reached the stationary phase within 8 days.

The data are compared with earlier studies in which utilization of amino acids in Euglena graciliswas investigated. All tested amino acids (glutamate with limitations) were found to have the potential of being an alternative N-source for Euglena gracilis. Hence, these amino acids can be used as a non-toxic surrogate for (NH4)2HPO4.

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