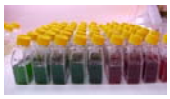
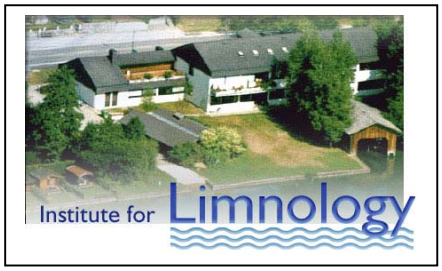



Use of Cyanobacteria for the production of ethanol and natural products research



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Cyanobacteria (blue-green algae) constitute the oldest and most primitive plant-like organisms on Earth and show a wide tolerance to environmental conditions. Cyanobacteria thrive in arid and semiarid regions, in the free water zone of oceans and lakes, as well as on rocks of the littoral zone of aquatic and terrestrial ecosystems. They often live in environments that become at least periodically anoxic, for example in lake sediments, in microbial mats of the littoral zone, or during symbiosis in the rhizosphere of higher plants.

The filamentous cyanobacterium *Oscillatoria* sp. growing on lake sediments of the Ossiacher See (Carinthia), 200 fold magnification.

This broad ecological amplitude of cyanobacteria is only possible due to various physiological adaptations to their environment. For example the ability of plant-like photosynthesis and the possibility to fix nitrogen from the atmosphere allows for the colonization of most pristine habitats and also makes cyanobacteria valuable symbionts in higher plants. Cyanobacteria are also able to survive and grow in dark for considerable time.

For example it is known that the filamentous cyanobacterium *Planktothrix* that occurs frequently in lakes in the Alps can grow in the dark at the same rate as in the light when cultivated under a light and dark cycle by respiration of glycogen. Other cyanobacteria are able to gain energy from various substrates such as glucose, fructose or sucrose under dark and anoxygenic conditions.

Cyanobacteria are extremely rich in the production of secondary metabolites with interesting properties, for example the UV-sunscreen compound scytonemin. Scytonemin is produced by cyanobacteria and

absorbs sunlight in the wavelength from 325-425 nm. It is responsible for the black colour of the so-called “Tintenstriche” on the rocks in the Alps. Cyanobacteria also produce various extracellular polysaccharides that are used for sequestration of nutrients, protection against grazers, and resistance to desiccation. Other cyanobacteria contain various sugar binding proteins, for example cyanovirin-N that is under development as an antiviral agent due to its activity against HIV (http://aidsinfo.nih.gov/DrugsNew/DrugDetailNT.aspx?int_id=0395prod)

Cultures of cyanobacteria isolated from the Salzkammergut Area and cultivated at the Institute of Limnology in Mondsee

Selection of cyanobacterial clones on nitrocellulose membranes using various selective agents

Ethanol is currently one of the most promising alternative energy sources to gasoline and has up to date been produced via fermentation mainly from corn, sugar cane and other agricultural plants (Marris 2006, see also http://ngm.nationalgeographic.com/ngm/2007-10/biofuels/biofuels.html). While the photosynthetic assimilation products of cyanobacteria and other photosynthetic microorganisms can be processed into ethanol, the yield of ethanol compared to traditional plant feed stocks is higher because faster growth under optimal conditions can be achieved. In the present project a large number of cyanobacteria will be investigated for photosynthetic capacity and further physiological parameters as well as stress tolerances relevant for large scale processes. Cyanobacteria have been isolated from various habitats both from freshwater and marine systems. Since cyanobacteria show an impressive variation in physiological properties a collection of cyanobacteria from various habitats also provides an excellent platform for the experimental selection of suitable strains.

The research project “Use of cyanobacteria for the production of ethanol and natural products” is funded by CyanoBiofuels **(http://cyano-biofuels.com/),** while natural products research is funded by CyanoBiotech **(http://www.cyanobiotech.com/).**

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