Application of chemical structure analysis methods to cyanobacterial toxins and synthesized biologically active compounds

Doctoral (PhD) dissertation
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SUMMARY

Summarizing our results we conclude that culturing of the cyanobacterium *Cylindrospermopsis raciborskii* (BGSD 266) isolated from Lake Balaton can be succesfully performed under laboratory circumstances.

From *C. raciborskii* we have isolated a new plant growth inhibitor, named to cylindrospermopsicyclin using chromatographic techniques. The purification method involves silica gel and the thin-layer chromatography introduced by us has significantly increased the efficiency of the isolation.

The chemical structure of cylindrospermopsicyclin has been identified using structure determination methods (NMR and IR spectroscopy and MS). The newly isolated molecule has molecular mass of 413 Da. The chemical name of cylindrospermopsicyclin is: 4-amino-5,10-dihydroxy-9-(hydroxymethyl)-13-imino-11-methoxy-6-methyl-5,6,7a,9,10,11,11a,13-octahydropyrano[2,3-*j*]pyrimido[4,5-*e*][1,9,3]dioxaazacyclo-undecin-2(3*H*)-one. For trivial name *cylindrospermopsicyclin* (CYC) was chosen.

Experiments showed that the isolated metabolite inhibits the growth of the mustard plant with the IC_{50} value of 600 μg/ml. By the protein gelelectrophoretic studies it can be concluded that the purified cyanotoxin induces new proteins. The cyanotoxin decreases the activity of the ssDNase and acidic protease of the mustard.

Nutrient starvation (deprivation of phosphorous or sulfur) of the strain *C. raciborskii* induces fall-off in the growth of the culture. The amount of cyanotoxin produced by the culture (determined by thin-layer chromatography) also decreased under nutrient starvation conditions.

In a seperate study we have isolated four microcystins ([Dha^7]MCYST-FR, MCYST-HilR, MCYST-LY and [D-Ser^7]MCYST-EE(OMe)) from the organism *Microcystis aeruginosa* isolated in 2001 from Kis-Balaton Reservoir. The structures of these microcystins have been identified by mass spectrometry.

We have succesfully synthesized seven deuterated analogues of pterocarpan. By mass spectrometric studies the fragmentation pathway of the natural compound has been mapped.