Toxicity of organic matter originated from Microcystis aeruginosa

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Nowadays, the eutrophication of surface water results in a massive increase in algal and cyanobacterial growth associated with the occurrence of water blooms. Due to the decomposition of the biomass, the concentrations of algal organic matter (AOM) including cyanobacterial toxins also increase in water reservoirs which are frequently used as a source of drinking water. The main problem arises during the drinking water treatment processes because the majority of dissolved organic compounds serve as precursors for the formation of potentially toxic disinfection by-products (DBPs) in drinking water. The mentioned compounds (e.g. cyanotoxins, DBPs) are currently considered to be a threat to drinking water quality due to their adverse effect on human health.

A method employing liquid chromatography with tandem mass detection (LC-MS/MS) has been developed and optimized for the determination of selected types of cyanobacterial toxins such as microcystins (MCs), anatoxin, cylindrospermopsin, nodularin. The fully optimized method has been used for the detection of cyanotoxins in a sample containing dissolved organic carbon (DOC) of cyanobacterium Microcystis aeruginosa. Cyanotoxins detected in the sample were: anatoxin (0.02 μg/mg of DOC), MC-RR (0.78 μg/mg of DOC), MC-YR (0.22 μg/mg of DOC), MC-LR (0.74 μg/mg of DOC), MC-LY (0.02 μg/mg of DOC) MC-LW (0.69 μg/mg of DOC) and MC-LF (0.02 μg/mg of DOC).

Moreover, toxic properties of the studied AOM-containing sample have also been established using Thamnotokit F with the crustacean Thamnocephalus platyurus for which LC50 was determined at 20.2 mg/l of DOC. Furthermore, IC50 for root growth inhibition of plant Lepidium sativum was established at 180.3 mg/L of DOC. The growth of other tested organisms (Saccharomyces cerevisiae, Bacillus subtilis, Escherichia coli) was not affected by the exposure to organic matter originated from M. aeruginosa and the growth of alga Desmodesmus subspicatus was even stimulated.

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Aromatase activity in the presence of penconazole and essential metals

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Triazoles are agrochemicals or pharmaceuticals used for protection of crop or skin against fungi or mildew. The mechanism of their action lies in the inhibition of sterols biosynthesis [1]. It is known that essential metals significantly influence the behaviour of azoles in the manner of (i) complexes creation with them [2], (ii) changes of redox behaviour [3] and (iii) degradation pathways [4]. It is not clear how the cocktail effect of other present biological active chemicals modifies the inhibitory effect of azoles (penconazole) to aromatase. We provide the experiments in the gas phase to clarify the reaction mechanisms modifications as an effect of essential metals presence.

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Migration of pesticide of the derivative class of phenoxyacetic acids in soil-water system

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Introduction: Study of the migration of phenoxyacetic acid class pesticide in soil water system.

Materials and methods: Derivative of the phenoxyacetic acid class (IUPAC name (4-chloro-2-methylphenoxy)acetic acid) is a broad-spectrum herbicide. According to hygienic classification of pesticides by degree of danger, it is a highly hazardous compound due to its carcinogenic effect (hazard class 2C in Russian Federation), according to the classification of the IARC – hazard class 2B. Substance in form of aqueous solution was introduced into the upper 20 cm layer of soil filtration columns. (Figure 1) in triplicate in concentrations: maximum recommended application rate in agriculture is 0.52 mg/kg; 10 times lower of the maximum rate - 0.052 mg/kg; 10 times higher of the maximum rate of 5.2 mg/kg. The experiments carried out in the most extreme conditions, using a model of soil standard. The determination of the substance in water carried out by LC/MS equipment consisted 1290 Infinity LC system with triple quadrupoles mass spectrometer Triple Quad 6460 (Agilent Technologies, USA) with negative ESI MRM mode, LLOQ - 0.0025 mg/L (Figure 2). Samples were taken daily 5 times a week for a month (until the content of substance in water decreases at the level of its maximum permissible concentration (MCP) into water bodies (0.003 mg/L).

Research results: It was established, that the maximum migration of a substance from soil to water was observed on the 9th day. (Figure 3). The content of the substance in water was at: 0.052 mg/kg of soil - 0.075 mg/L of water; at 0.52 mg/kg - 0.49 mg/L; at 5.2 mg/kg - >100 MPC mg/L, respectively. A strong correlation was found between the content of substance in the soil and in the water. The correlation coefficient is r = 0.997. Based on the regression equation there was established a threshold value of 0.0026 mg/kg of soil.

Conclusions: 1. Established a strong correlation relationship between the concentration of the substance in the soil and in the water filtrate. 2. The threshold value by the migration-water hazard indicator at the level of 0.0026 mg/kg of soil.