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Decreasing toxic and mutagenic activity of soils through the application of humic substances

I. Gorova Alla (), 2. Pavlichenko Artem (), and 3. Klimkina Iryna ()

(1) Professor, Head of Ecology Department, National Mining University, 49005, Karl Marx avenue, 19, Dnipropetrovsk, Ukraine; fax +38(056) 744-62-12, phone +38(0562) 46-90-16, (2) Associate professor, Department of Ecology, National Mining University, 49005, Karl Marx avenue, 19, Dnipropetrovsk, Ukraine; fax +38(056) 744-62-12, phone +38(0562) 46-90-16, (3) Associate professor, Department of Ecology, National Mining University, 49005, Karl Marx avenue, 19, Dnipropetrovsk, Ukraine; fax +38(056) 744-62-12, phone +38(0562) 46-90-16; (irina_klimkina@ukr.net)

Based on an example of conditions on mining industry land adjacent to the Dnepr River in the Dnepropetrovsk Region (Ukraine), the ecological quality of the soils was evaluated by cytogenetic methods and, in parallel, the efficiency of using humates obtained from brown coal of the Alexandria deposit was also researched.
During an ecological monitoring programme from 1997 to 2007, the genetic characteristics of soils at 12 locations in Dnepropetrovsk, and at 33 locations in four other industrial mining areas in the region, was studied. A theoretical basis for the use of humic substances for blocking the migration paths of ecological toxic-matter within a soil-to-plant system was reasoned, namely that introducing natrium humate into the soil would promote a normalization of the cell division processes and a reduction in the chromosome aberration rate in the root meristem of the biological indicators.
Laboratory tests involved growing seeds of an indicator plant (Pisum sativum L.) in the different soils, to some of which humic substances had been added. The data showed evidence that the soils of the region display a rather patchy picture in terms of toxic and mutagen features. This was obvious from the variety of levels on the mitotic index, as well as from the increase of 5 to 24 times the frequency of aberrant chromosomes.
Introducing 0.01per cent of a Christecol water solution into a substratum for growing the indicator plant apparently reduced ($P<0,01$) the level of the chromosome aberrations in the meristem cells of the test material.
The mutagenic rates of the soils during the test was reduced by 1.5 to 4 times and, at the same time, a reduction of the soil toxic rates was also observed. The reduction in chromosome aberration levels in the cells of the tested materials for the soils in the different city districts, varied from 2.9 to 12.4 times. Importantly, a reliable reduction in the genetic damage under the influence of humic substances was observed in all test variants. The tests showed that there is good potential for achieving significant improvements in the key ecological characteristics of these types of damaged soils and so raises the prospect of an increase in relevant crop production.