Tkachuk N.V., Associate Professor of the Department of Biology, Candidate of Biological Sciences, Associate Professor
T.H. Shevchenko National University "Chernihiv Colehium", nataliia.smykun@gmail.com
Hrytsenko O.M., 2nd year master's student
T.H. Shevchenko National University "Chernihiv Colehium", zayets.sasha1992@gmail.com

ECOLOGICAL AND MEDICAL-BIOLOGICAL RISKS OF USING ANTIBACTERIAL WET WIPES

Antibacterial wet wipes are a hygienic product used in everyday life and medicine. Wet wipes consist of a base material and a moisturizing solution. Consumers note the convenience, accessibility and pleasure of using them. However, there are questions about the safety of wet wipes that contain antibacterial preservatives for the environment and human health. The aim of this study was to analyze the environmental and biomedical risks of using antibacterial wet wipes.

During a laboratory study using a growth test with watercress seeds, the toxic properties of antibacterial wet wipes produced in Ukraine were assessed. The control was filter paper moistened with distilled water. The results were statistically processed.

It was found that the most toxic properties according to the results of biotesting were demonstrated by wipes in option 2 (the seeds of the test plant did not germinate), and the least toxicity was exhibited by wet wipes in option 5, although a statistically significant decrease in test indicators was observed compared to the control (Table 1).

Table 1

Test indicators of watercress during germination on antibacterial wet wipes

Research option	Germination energy, %	Germination, %	Root length, mm	The length of the aerial part, mm
Control	66.7±6.7	73.3±3.3	56.2±9.2	24.4±3.7
Option 2	0	0	0	0
Option 3	20.0±0.0*	20.0±0.0*	1.0±0.0*	2.3±0.6*
Option 4	36.7±3.3*	36.7±3.3*	1.4±0.2*	3.6±0.5*
Option 5	66.7±3.3	66.7±3.3	6.8±1.3*	8.9±2.1*
Option 6	46.7±3.3*	50.0±5.8*	3.3±0.6*	4.3±0.6*

Note: "0" - seeds did not germinate; "*" - significantly compared to the control at $p \leq 0.05$

Since the base material of the antibacterial wet wipes under study is non-woven fabric, often containing plastic, a number of environmental problems arise, which are associated with the accumulation of this agent in the environment; increased greenhouse gas emissions; water and soil pollution, in particular, due to the increase in the amount of microplastics in the environment. The wetting solution of wet wipes contains a number of compounds with surface-active properties and may exhibit toxic properties according to biotesting with plants. Preservatives are compounds with antimicrobial properties and are added to the solutions to prevent the development of microorganisms. In particular, the following preservatives were used in the tested antibacterial wipes: Dehydroacetic Acid, Benzoic Acid, Phenoxyethanol (options 2, 3 and 6), Benzalkonium Chloride (options 2, 3, 5 and 6), Silver Citrate (option 3), Ethylparaben, 2-Bromo-2-Nitropropane-1,3-Diol (Bronopol), Cetrimonium Bromide (option 4), Methylisothiazolinone, Benzyl Alcohol (option 5). It should be noted that methylisothiazolinone, which is listed in the moisturizing composition of antibacterial wet wipes option 5, is a pesticide used to control slime-forming bacteria, fungi, algae in pulp and paper mills, water cooling systems, oilfield operations, industrial process waters and air purification systems and is included in adhesives, coatings, fuels, metalworking fluids, resin emulsions, paints and various other specialty industrial products. It is a compound used to control mold growth on wood products. In studies using laboratory animals, methylisothiazolinone has been found to exhibit moderate acute toxicity by the oral and inhalation routes; it has high acute toxicity when applied to the skin or eyes. In subchronic studies, the most significant toxicological effect was microscopic damage to the nasal turbinates due to inhalation exposure. Developmental and chronic feeding/carcinogenicity studies in rats did not show significant effects, and the U.S. Environmental Protection Agency classified methylisothiazolinone as a Group D chemical, not classifiable as to human carcinogenicity. However, mutagenicity studies were inconclusive. Other biocides mentioned are known to be oral, inhalation, or dermal toxicants and may cause allergies.

Overall, the results of the study indicate that the tested antibacterial wipes exhibit toxicity in the watercress growth test. Release of such products into the environment may have negative environmental consequences. In addition, the presence of antimicrobial compounds with potential effects on human health requires manufacturers to be responsible in selecting the component composition and developing safe formulations.