

# WET WIPES AS A CAUSE OF ENVIRONMENTAL PROBLEMS: A MINI REVIEW

Nataliia Tkachuk<sup>1\*</sup>, Liubov Zelena<sup>2</sup>, Yaroslav Novikov<sup>1</sup>

<sup>1</sup>T.H. Shevchenko National University “Chernihiv Colehium”, Chernihiv, Ukraine

<sup>2</sup>Danylo Zabolotny Institute Microbiology and Virology, NAS of Ukraine, Kyiv, Ukraine

\*Corresponding author: [nataliia.smykun@gmail.com](mailto:nataliia.smykun@gmail.com)

*Our everyday life cannot be imagined without using various hygiene and cleansing products, wet wipes in particular, that protect us from undesirable pollution and contamination, and even could be used as a medical treatment. Besides all these positive aspects wet wipes can be very harmful for the different natural environments. The aim of this study was to analyze and summarize data from literary sources regarding wet wipes as a cause of environmental problems. According to the theoretical analysis, it was established that in the countries of the European Union, the use of individual wet wipes was 68 billion (by 2017, reference year) that equates to 511,000 tons of waste per year. In China, waste wet wipes make up 0.2% of all household waste. In Ukraine, according to 2015 data, the market share of wet wipes was 23%. The global market for wet wipes has a growing trend and is expected to increase its production from 2023 to 2030 by 3.8%. Wet wipes pose a threat to the environment because they contain toxic compounds (surfactants, plastic) and have low biodegradability. As a result, a number of environmental problems arise: 1) accumulation of wet wipes in the environment; 2) increase in greenhouse gas emissions; 3) pollution of water, soil, groundwater; 4) an increase in microplastics in the environment. To eliminate the environmental problems associated with wet wipes while maintaining the functionality of the products, it is suggested, first of all, to use eco-safe, biodegradable base fabric materials and non-toxic solutions for wetting. In addition, an important place is occupied by the formation of a conscious attitude of consumers of wet wipes to their disposal.*

*Keywords: biodegradation of materials, environmental problems, wet wipes*

---

DOI: 10.24263/EDSD-2024-6-12

Received 28.04.2024

Received in revised form 21.10.2024

Accepted 12.11.2024

---

## Introduction

Nowadays society produces and uses wet wipes in large quantities, and there is a trend towards an increase in their production volume and it is expected strong growth of their volume on the market in the future (IMARC, n.d.; Kyrychenko et al., 2020; Ramya & Amutha, 2021). Wet wipes go into the trash immediately after use, and mostly consist of plastic – a material that is difficult to degrade in the environment, and the problem of environmental pollution with wet wipes is identical to plastic pollution (Environmental and economic costs..., n.d.). The wet wipes can be used for various purposes including needs of cleansing, hygiene, disinfectant and medical care, in particular the tremendous number of different types of wet wipes was utilized during COVID-19 pandemic. These drove attention to the manufacture of eco-friendly and biodegradable wet wipes suggesting production from other than synthetic materials, such as cellulose. The new biodegradable and flushable products were developed and became popular. But according to the publications such wet

wipes do not fully biodegradable under natural environmental conditions (Shruti et al., 2021) and flushable ones do not break down easily (Allison et al., 2023). Wet wipes, on the one hand, facilitate the life of a modern person, but on the other hand, they cause a number of environmental problems. Therefore, the aim of this study was to analyze and summarize data from literary sources regarding wet wipes as a cause of environmental problems.

### **Materials and Methods**

The research used methods of theoretical research of available information, analysis of scientific and methodical sources on this problem, empirical method of accumulating facts, method of argumentation for proving own judgments.

### **Results and Discussion**

#### *Production volumes of wet wipes in the world and in Ukraine*

Wet wipes make up a significant share of the paper sanitary-hygienic products market. In 2018, the global market for baby wipes reached USD 4.1 billion; 16,830 million USD in 2020 and is expected to reach 17,980 million USD in 2026 at a CAGR of 6.3% during 2021-2026 (Ramya & Amutha, 2021). Over the last decade the raising of wet wipes consumption was observed worldwide. The global wet wipes market size was estimated at USD 27.07 billion in 2022 and is projected to grow at a compound annual growth rate (CAGR) of 3.8% from 2023 to 2030 (Grand View Research, n.d.). *It is expected that by 2032 their volume on the market will increase (IMARC, n.d.).*

By 2017 (reference year), about 68 billion wet wipes (equates to 511,000 tons of waste per year) were used in the 28 EU member states (Environmental and economic costs..., n.d.). In China, waste wet wipes make up 0.2% of all household waste (Zhang et al., 2022). In Ukraine, in 2015, the market share of wet wipes was 23% (Kyrychenko et al., 2020). Types of wet wipes on the Ukrainian market are: universal, for personal hygiene, medical, household wipes, etc. The authors note that universal wet wipes are in the greatest demand on the world market - 45%. Baby wipes occupy 29% of the market share, wipes for removing make-up and masks - 10%, wipes for intimate hygiene - 5%, deodorant wipes - 1% (Kyrychenko et al., 2020). In the market of Ukraine, the total volume of sales is: universal wet wipes - 78%, children's wet wipes - 14%, antibacterial wipes - 5%, makeup remover wipes - 4%, intimate hygiene wipes - 1% (Kyrychenko et al., 2020). In 2018, there was a significant increase in sales of wet wipes in Ukraine. However, wet wipes are a man-made product, and despite their ease of use, they lead to a number of environmental problems.

#### *Toxicity of wet wipes*

Wet wipes are impregnated with a solution, the ingredients of which are water, surfactants, preservatives, pH adjustment, Skin benefit agents (Rodriguez et al., 2020). Among these compounds, those that are known to harm human health and are subjects of intensive public discussions deserve special attention (Siegert, 2011). These compounds include (Siegert, 2011):

- **Formaldehyde/Formaldehyde-donors** (DMDMH, imidazolidinyl urea, diazolidinyl urea) – suspected of carcinogenic potential;
- **Organic Halogen Compounds** (Isothiazolinones, methyl dibromo glutaronitrile, IPBC) – sensitisation potential;
- **Bronopol** (avoid nitrosamine formation);

- **Parabens** (Methyl-, propyl-, ethyl-, butyl-, isobutylparabens) – pseudo-oestrogenic and androgenic potential; association with breast-cancer; association with skin aging (methylparaben);
- **Benzyl Alcohol** – perfume “allergen”;
- **Phenoxyethanol** – glycol ether under discussion in France.

The study of the phytotoxicity of wet wipes produced in Ukraine, Turkey, and Great Britain using a growth test with *Lepidium sativum* L. showed their high and extreme toxicity, which, according to the authors, is caused by the content of toxic substances (in particular, surfactants) (Tkachuk & Zelena, 2023). Since wet wipes are toxic to the test plant, their effect on water and soil microorganisms is also expected, especially considering antibacterial compounds used as disinfectants in the content of wipes (Siegert, 2011; Yayla et al., 2021). Therefore, it is advisable to direct future research to determine the influence of the composition of the lotion for impregnation, the material of wet wipes on the formation of biofilms, the number of microorganisms on the surface of the material of the wipes during their exposure in water and soil, which will determine the biodegradability of this product.

#### *The base material of wet wipes*

Wet wipes, along with other disposable hygiene products (feminine hygiene products, baby diapers), are products that go into the trash immediately after use, and are mostly made of plastic (Environmental and economic costs..., n.d.). In Europe, such items usually end up in landfills (87%), resulting in waste, or incinerated (13%), resulting in a waste of resources. As a result, there is a negative impact on the environment - the need for land resources, soil and groundwater pollution, greenhouse gas emissions, etc. In EU countries, the amount of waste from disposable feminine hygiene products, diapers and wet wipes is 7,832,000 tons (approximately 15.3 kg per person per year), which is 3% of the total amount of solid household waste and 4% of the total volume of mixed municipal waste (Environmental and economic costs..., n.d.).

Material that enters the environment is subject to degradation, in particular, biodegradation by microorganisms (Tkachuk & Zelena, 2021). Biodegradability of a material is determined by its composition. Typically, wet wipe fabric is made from fibers such as cotton and viscose, as well as plastic resins such as polyester, polyethylene and polypropylene (Environmental and economic costs..., n.d.). The most expensive napkins are made of two types of material - spunlace and airlaid. Cheaper napkins are made from cloths of thin bonded fibers - spunbond, chemicalbond and thermobond (Kyrychenko et al., 2020). However, an increase in the resistance to disintegration of wet wipes from nonwovens (bleached pulp, unbleached pulp and low-yield dissolving pulp) with deionized water was shown, and their tensile strength and disintegration energy remained unchanged (Harter et al., 2022). Sölar and Keçeci (2021) noted that nonwovens from regenerated cellulose and nonwovens from PET have a significant difference in degradation under the same experimental conditions. The PET fiber content slows biodegradation in the soil, and the decomposition behavior is similar to the PET fiber content in the fabric structure. The authors report that with an increase in the content of PET, degradation decreases, and with an increase in the content of cellulose fiber, the level of degradation increases (Sölar & Keçeci, 2021). Under the conditions of UV degradation of six variants of nonwoven materials suitable for wet wipes (100% Tencel, 70/30% Tencel/CV, 50/50% PET/CV, 60/40% PET/CV, 80/20% PET/ CV, 100% PET) within four months certain changes in the

color of the material were noted, which indicated the beginning of their degradation. At the same time, the authors note that despite a significant exposure time (4 months), the maximum weight loss was 20%, and degradation would obviously take more time, although the weight and thickness of the fabric are too low compared to classic textile fabrics. Moistened non-woven materials did not show significant differences from dry ones. After sonic degradation, degradation was observed within the time used in the study (30 hours), indicating the use of ultrasound to degrade wet wipes as a promising method for further research (Sülar & Keçeci, 2022).

As a result of disposal of sanitary and hygienic products, including wet wipes, through the sewage system, contamination of the water environment with microplastics is increasing (Ó Briain et al., 2020). Given this, as well as the global spread and projected growth of the nonwoven textile industry, there is a risk of environmental contamination from microplastics generated from wet wipes and a need to raise public awareness of alternatives (Ó Briain et al., 2020). Today, the use of microplastics, which are intentionally added to products, is restricted in Europe (Commission Regulation (EU) 2023/2055, 2023). Microplastics, which are formed during the degradation of materials, are addressed by the documents: A European Strategy for Plastics in a Circular Economy (European Commission, 2018), Waste Framework Directive (Directive 2008/98/EC..., 2008), Marine Strategy Framework Directive (Directive 2008/56/EC..., 2008). At the same time, it is advisable to comprehensively consider the issue of including wet wipes as sources of microplastics.

#### *Ways to solve the problem*

To solve the environmental problems caused by the use of wet wipes, it is proposed radically - the rejection of those containing plastic, as it was announced in Great Britain (Wet wipes could face..., 2018). There is an urgent need to use eco-safe material for the production of wet wipes. In particular, it is proposed to introduce an environmentally friendly product - wet wipes made of natural sugarcane fibers using sugarcane pulp (*Saccharum officinarum*) and *Acalypha indica* leaf powder (Eshvintha et al., 2023).

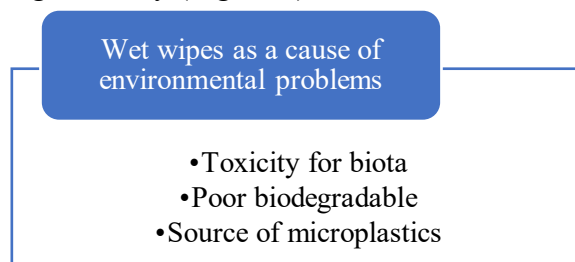
As an alternative to wet wipes, it is suggested to use (Kazarova, n.d.):

- homemade wet wipes, the recipes of which are available on the Internet. The advantage is that safe substances are used for impregnation, and paper towels or natural textiles are used as the base material, which are easily biodegradable.
- soap and water, which are available in toilets in almost all public places.
- environmental disinfectants produced by industry or self-made.
- a handkerchief that does not take up much space, is made of natural materials and can be used repeatedly after washing.
- cotton pads to remove makeup that are reusable.
- biodegradable wet wipes (Manufacturer of Professional Cleaning Wipes, 2024).

#### **Conclusions**

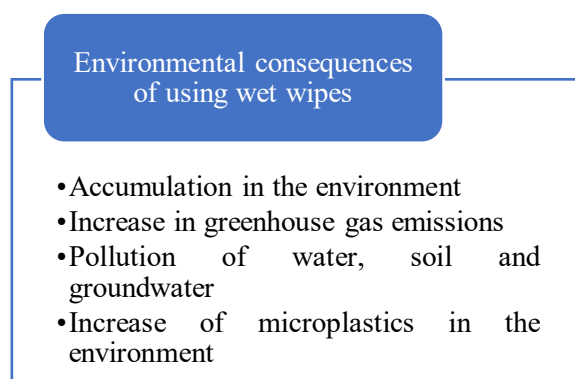
Therefore, in the countries of the European Union, the use of individual wet wipes was 68 billion (by 2017, reference year) that equates to 511,000 tons of waste per year. In China, waste wet wipes make up 0.2% of all household waste. In Ukraine, according to 2015 data, the market share of wet wipes was 23%. The global market for wet wipes has a growing trend and is expected to increase its production from 2023 to 2030 by 3.8%.

Wet wipes pose a threat to the environment, as they contain toxic compounds (surfactants, plastic) and have a low biodegradability (Figure 1).



**Figure 1. Causes of environmental problems associated with wet wipes**

As a result, a number of environmental problems arise: 1) accumulation of wet wipes in the environment; 2) increase in greenhouse gas emissions; 3) pollution of water, soil, groundwater; 4) an increase in microplastics in the environment (Figure 2).



**Figure 2. Environmental problems associated with the use of wet wipes**

To eliminate the environmental problems associated with wet wipes while maintaining the functionality of the products, it is suggested, first of all, to use eco-safe, biodegradable base fabric materials and non-toxic solutions for wetting. In addition, an important place is occupied by the formation of a conscious attitude of consumers of wet wipes to their disposal.

### **Conflict of interest**

The authors state no conflict of interest.

### **References**

- Allison, T., Ward, B. D., Harbottle, M., & Durance, I. (2023). Do flushed biodegradable wet wipes really degrade? *Science of the Total Environment*, 164912.
- Commission Regulation (EU) 2023/2055 (2023, October 17). Restriction of microplastics intentionally added to products. Available at [https://single-market-economy.ec.europa.eu/commission-regulation-eu-20232055-restriction-microplastics-intentionally-added-products\\_en](https://single-market-economy.ec.europa.eu/commission-regulation-eu-20232055-restriction-microplastics-intentionally-added-products_en). Retrieved 10 April 2024.
- Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy. (2008). Marine Strategy Framework Directive. Document 32008L0056. *Official Journal of the European*

- Union*. Available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0056>. Retrieved 11 April 2024.
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. (2008). Document 32008L0098. *Official Journal of the European Union*. Available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098>. Retrieved 11 April 2024.
- Environmental and economic costs of disposable wet wipes, menstrual products and baby diaper. (n.d.). Available at [https://zerowastelviv.org.ua/wp-content/uploads/2021/06/ua\\_doslidzhennya-pidguzky.pdf](https://zerowastelviv.org.ua/wp-content/uploads/2021/06/ua_doslidzhennya-pidguzky.pdf). Retrieved 10 April 2024. (in Ukrainian).
- Eshvintha, N. A., Indumathi, T. R., Phil M. (2023). Development of eco friendly microfibril wet wipes. *International Journal of Creative Research Thoughts (IJCRT)*, 11(3), 179-188.
- European Commission (2018). *A European Strategy for Plastics in a Circular Economy*. Available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN>. Retrieved 11 April 2024.
- Grand View Research (n.d.). *Wet Wipes Market Size, Share & Trends Analysis Report By Product (Household Wipes, Baby Wipes, Intimate Wipes), By Material (Non-Woven, Woven), By Distribution Channel, By Region, And Segment Forecasts, 2023 - 2030*. Available at <https://www.grandviewresearch.com/industry-analysis/wet-wipes-market-report/methodology> Retrieved 16 April 2024
- Harter, T., Steiner, H., Hirn, U. (2022). Investigating mechanisms deteriorating the dispersibility of biodegradable and flushable wet wipes. *Cellulose*, 29, 8827–8842. <https://doi.org/10.1007/s10570-022-04816-y>
- IMARC (n.d.). *Baby Wipes Market Report by Technology (Spunlace, Airlaid, Coform, Needle-punch, Composite, and Others), Product Type (Dry Wipes, Wet Wipes), Distribution Channel (Supermarkets and Hypermarkets, Pharmacies, Convenience Stores, Online Stores, and Others), and Region 2024-2032*. Available at <https://www.imarcgroup.com/baby-wipes-market>. Retrieved 10 April 2024.
- Kazarova, R. A. (n.d.). Why “convenient” does not mean “useful”. Available at <https://college.nuph.edu.ua/wp-content/uploads/2021/04/%D0%9A%D0%B0%D0%B7%D0%B0%D1%80%D0%BE%D0%B2%D0%B0-%D0%A0-%D0%90-%D0%A7%D0%9E%D0%9C%D0%A3-%D0%97%D0%A0%D0%A3%D0%A7%D0%9D%D0%9E-%D0%9D%D0%95-%D0%9E%D0%97%D0%9D%D0%90%D0%A7%D0%90%D0%84-%D0%9A%D0%9E%D0%A0%D0%98%D0%A1%D0%9D%D0%9E.pdf>. Retrieved 10 April 2024. (in Ukrainian).
- Kyrychenko, O. V., Hniti, N. V., Bidna, K. A. (2020). Market of wet wipes in Ukraine. *Proceedings of the VII International Scientific and Practical Internet Conference “Modern Materials Science and Commodity Science: Theory, Practice, Education” (Poltava, Ukraine, 12–13 March 2020)*. Available at <https://core.ac.uk/download/pdf/326487599.pdf>. Retrieved 10 April 2024. (in Ukrainian).
- Manufacturer of Professional Cleaning Wipes. (2024, February 23). *Biodegradable Wet Wipes: Eco-Friendly Solutions for Sustainable Hygiene*. [Thumbnail with link attached] [Post].

- LinkedIn. Available at <https://www.linkedin.com/pulse/biodegradable-wet-wipes-eco-friendly-solutions-sustainable-hygiene-hoxdc/>. Retrieved 10 April 2024.
- Ó Briain, O., Marques Mendes, A. R., McCarron, S., Healy, M.G., Morrison, L. (2020). The role of wet wipes and sanitary towels as a source of white microplastic fibers in the marine environment. *Water Res.*, 182, 116021. <https://doi.org/10.1016/j.watres.2020.116021>.
- Ramya, K., Amutha, K. (2021). Eco-friendly wet wipes - A review. *Proceedings of the International Conference on Advances in Technical Textiles (Sathyamangalam, Tamilnadu, India, October 2021)*. Available at <https://5.imimg.com/data5/SELLER/Doc/2023/9/343153030/WV/GB/VZ/140877384/baby-wet-wipes.pdf>. Retrieved 11 April 2024.
- Rodriguez, K. J., Cunningham, C., Foxenberg, R., Hoffman, D., Vongsa, R. (2020). The science behind wet wipes for infant skin: Ingredient review, safety, and efficacy. *Pediatr. Dermatol.*, 37, 447–454.
- Shruti, V. C., Pérez-Guevara, F., & Kutralam-Muniasamy, G. (2021). Wet wipes contribution to microfiber contamination under COVID-19 era: An important but overlooked problem. *Environmental Challenges*, 5, 100267.
- Siegert, W. (2011). Preservative Trends in Wet Wipes. *SOFW-J.*, 137, 44–51.
- Sülar, V., Keçeci, B. (2021). Degradation of nonwoven fabrics suitable for wet wipes buried in soil. *Proceedings of the International Conference on Textiles and Connected R & D Domains "TexTen X" (Bucharest, Romania, October 21-22, 2021)*. <https://doi.org/10.35530/TT.2021.53>.
- Sülar, V., Keçeci, B. (2022). UV and sonic degradation of nonwoven fabrics used as wet wipes. *Proceedings of The 18th Romanian Textiles and Leather Conference "CORTEP 2022 IASI-RO" (Iasi, Romania, November 17-19, 2022)*, 296-300. <https://doi.org/10.2478/9788367405133-045>.
- Tkachuk, N., Zelena, L. (2021). The impact of bacteria of the genus *Bacillus* upon the biodamage/biodegradation of some metals and extensively used petroleum-based plastics. *Corros. Mater. Degrad.*, 2, 531–553. <https://doi.org/10.3390/cmd2040028>.
- Tkachuk, N., Zelena, L. (2023). Evaluation of the toxicity of wet wipes based on the growth test with *Lepidium sativum* L. *Eng. Proc.*, 56, 5. <https://doi.org/10.3390/ASEC2023-15495>.
- Wet wipes could face wipe-out in plastic clean-up. (2018, May 8). BBC. Available at <https://www.bbc.com/news/44034025>. Retrieved 10 April 2024.
- Yayla O., Özgeç M., Ay E., Gençtürk Ü., İnce A. (2021). Application of anti-bacterial feature to wet wipes made of cellulosic fibre based. *Biological and Chemical Research*, 8, 80-96. Available at <https://www.ss-pub.org/wp-content/uploads/2021/07/BCR2021032901.pdf>. Retrieved 11 April 2024.
- Zhang Yu., Wen Z., Hu Yu., Zhang T. (2022). Waste flow of wet wipes and decision-making mechanism for consumers' discarding behaviors. *Journal of Cleaner Production*, 364, 132684. <https://doi.org/10.1016/j.jclepro.2022.132684>.