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THE FEATURES OF DESIGN-PROJECTING OF CLOTHING COLLECTIONS ON THE PRINCIPLE OF ZERO WASTE

Abstract. *The basic principles of zero waste concept are defined, namely: avoiding the excessive use of clothes; reducing the use of raw materials in the production of the fashion industry products; reuse and repair of the fashion industry products; their processing (recycling, upcycling, freecycling, etc.); eco-friendly utilization. The modern tendencies of sustainable fashion in the collections of world-famous and Ukrainian designers are analyzed. The features of the process of designing of zero waste clothing on the example of the author`s collection of the women`s clothing named “Panther” with the use of the zero waste principle and a bionic source are considered.*

Keywords: *zero waste production, zero waste cutting, eco-friendly clothing, sustainable fashion, development of the collection, textile waste.*

Introduction. The state of the environment is a global problem of our days, the solution of which is of concern to the world community. One of the issues that need to be addressed first is the reduction of waste and its recycling. According to the United States Environmental Protection Agency, the share of textile waste landfilled throughout the country is about 8 % of total solid waste and is amounted to 11.2 million tons per year [10]. In China, it exceeds 20 million tons. The acceleration of the process of supplying fashion products to the stores and the change of the consumers` attitude to the clothes as such that are “of one use” – both factors contribute to the waste generation. To reduce the negative impact of clothing production, enterprises of the fashion industry began to green their processes. The introduction and implementation of zero waste production technologies are one of such directions.

The purpose of the work is to analyze the features of design-projecting of the collections of women`s eco-friendly clothing on the principle of zero waste production.

Analysis of previous research. The analysis of design of the women`s clothing on the principle of zero waste production is provided in papers [1-4]; the features of the design of the collections of women`s clothing with the use of environmental technologies are considered by the authors in [5-6].

In the article [1], the authors consider the principles of *zero waste* design of the clothes, the advantages of which are presented on the example of the developed model of the dress, describe the principles of environmentally friendly production, and the principles of zero waste production.

The authors of the article [2] consider the principles of *zero waste* design of the clothing and present a model of a women`s dress designed using the principles of zero waste production.

In the article [3], the principles of eco-friendly design in the light industry are described, the design of trousers without cabbages based on zero waste production according to the *zero waste* principle of using the entire area of textile material is developed, and the advantages of such principle are identified.

The authors of the article [4] consider the use of the principle of zero waste production as one of the modern directions of development of the fashion industry; on its basis, the design of coats without cabbages is developed. It is proved that the technology of zero waste production is one of the promising directions of light industry development at the present stage, the main task of which is to gradually improve the environment through the development and implementation of cost-effective and environmentally significant projects.

In the article [5], the results of artistic design of the collection of women`s clothing in eco-style are presented, and the main stages of the technique of manual decoration of products – stamping – are described.

The authors of the article [6] have conducted a study of the factors that affect the formation of the concept of development of universal forms of modern costume, considering aesthetic, design, and technological features of the eco-friendly architecture. The basic principles of ecological architecture are systematized for further use in the process of the creation of forms of modern clothing.

The conducted analysis has shown that in their works, various authors considered design-projecting of women`s eco-friendly clothing on the principle of zero waste production on the example of products and collections of different assortment; nevertheless, the design-projecting of the collection of women`s clothing on the principle of zero waste production still requires further research.

The purpose of the publication is to improve the process of designing clothes on the principle of zero waste.

The results of the research. Zero waste is an eco-friendly lifestyle that becomes more and more popular in the world. Its supporters seek to generate as little waste as possible and send everything that is generated for reuse or recycling. In the fashion industry, the zero waste approach can be applied in different ways: as a principle of designing and preventing of waste generation at the stage of product designing and production; to use in ready-made clothes that have expired by one consumer, but instead of getting to waste, such clothes begin to be used by the new consumer; or to the products that were not sold and thus handed over for altering or reuse instead of been landfilled or burned in the furnace [7].

Standard production of clothes requires 10 – 20 % of excess material to compensate for the differences in patterns or defects of fabrics and up to 15 % for cutting cases [11]. All of this is potentially textile waste, much of which can be avoided by setting the appropriate goals at the stage of the product design.

There are five basic principles of zero waste concept, namely: avoiding the excessive use of clothes; reducing the use of raw materials in the production of the

fashion industry products; reuse and repair of the fashion industry products; their processing (recycling, upcycling, freecycling, etc.); eco-friendly utilization.

The zero waste principle of design is characterized by the minimal amount or complete absence of textile waste in the process of clothes production. The zero waste cutting is not a new concept – kimono, sari, chiton, and many other traditional folk clothes are examples of such an approach. Its main idea is that the patterns should be placed like puzzles, occupying the entire area of the material [8]. In such a way, zero waste design eliminates or minimizes the generation of textile waste, which is generated at the production stage but does not relate to waste generated during the use of ready-made clothes. For many modern designers, the use of the zero waste principle of cutting is not only a demonstration of an environmentally friendly position but also an opportunity to experiment with the shape and content of the product, for example, **Timo Rissanen**, a teacher, artist, and designer. His portfolio includes research, teaching, and artistic practice in the field of fashion, art and sustainable development [12]; **Zero Waste Daniel**, a fashion designer from New York and discoverer of zero waste lifestyle, who uses waste intended for the consumers of the New York garment industry, as well as other materials that are difficult to recycle, to create unisex clothing and accessories; **Farrah Floyd**, a brand of the women's clothing in Belgium. In the production of the clothes, the designer uses the principle of zero waste production; clothes are designed only from certified, environmentally friendly materials [13].

The standard process of making clothes can begin with the development of sketches of the clothes; then design and patterns for the most efficient use of fabric are developed; then the details of the clothes are cut out and the finished cut is sewn into a product, which is then packaged and transported to retail outlets [13].

The designers who have used such approach or approaches to zero waste cutting, which are related to zero waste direction of eco-friendly design, are **Bageeya Eco-clothing**, an Indian brand of the clothes that offers an assortment of the clothes made of natural fabrics, dyed with natural dyes. Prints and textures on each product are formed using real leaves and flowers; **Zandra Rhodes**, a designer from England, who creates her ecological textiles on the principle of upcycling; **Emroce**, an Italian brand, specializing in swimming underwear on the principle of *zero waste*; **Siddhartha Upadhyaya**, the founder of the *August* and *AIGHT* brands of stable clothing; **Yeohlee Teng**, an American designer, who creates clothes on the principle of *zero waste* [14], etc.



Fig. 1. The examples of the collections of clothing on the principle of zero waste production, presented by the designers: a – Timo Rissanen; b – Farrah Floyd; c – Yeohlee Teng



Fig. 2. The examples of the collections of products from a piece of fabric and knitted clothes: a – DaRouso; b – Vanessa Montoro; c – Issey Miyake

Also, some modern designers and companies create products using zero waste technology by knitting the whole clothes or products from a whole piece of fabric, for example, **Alabama Chanin**, an American fashion designer, who creates clothes from a whole piece of fabric using only natural raw materials; **Issey Miyake**, a Japanese fashion designer, who offers extraordinary, avant-garde products of complex cutting from a whole piece of fabric [17]; **DaRouso**, a Greek brand of the clothes that creates limited clothing of a simple cut, printed by the artist's drawings [15]; **Vanessa Montoro**, a Brazilian designer, who creates one-piece knitted clothing from silk threads [16], etc (Fig. 2)..

In Ukraine, the following designers produce their clothes using eco-friendly technologies: **Sofia Rousinovich**, the founder of ROUSSIN brand, who introduces the principle of recycling into the production, turning plastic bags and film into backpacks, bags, and shoes of various shapes [19]; **RCR Khomenko**, a Ukrainian brand of stable clothing on the principle of upcycling [18]; **Ksenia Schneider**, a well-known Ukrainian brand of clothes of Ksenia and Anton Schneider, who give new life to used jeans products[17]; **Azava, Remade**, a Ukrainian brand of accessories that recycles products made from used leather (backpacks, bags, belts, etc.).



Fig. 3. The examples of works of Ukrainian designers in eco-friendly direction: a – Ksenia Schneider; b – RCR Khomenko; c – Sofia Rousinovich

Table 1. Eco-raw materials used in eco-design

Name	Characteristics and method of manufacture
Hemp	It requires little water, pesticides and chemicals.
Linen	Breathable, resistant to microorganisms.
Organic cotton	The plant is grown in fields that have not been treated with chemical fertilizers or pesticides for at least three years.
Jute	From a plant of the same name make a rough cloth with homogeneous weaving.
Rami	Created from nettles.
Cork	It is extracted from a special species of trees - cork oak
Used canvas	Dense fabric impregnated with a waterproof solution is made of linen, semi-linen or cotton raw materials.
Lyocell	Produced from eucalyptus pulp.
Palm leaves	Produced from the leaves of the palm tree. For the manufacture of cloth leaves are soaked in bio- solution. Elastic and durable palm leather is suitable for clothes, shoes and accessories.
Pineapples	After harvesting the fruit, excess raw materials are discarded. Strong fibers are extracted from pineapple leaves by keeping them in closed tanks. Pinatex is used for the production of bags and shoes.
Oranges	Residues from oranges are pressed, twisted and pulp is extracted. This fabric is called Orange Fiber .
Milk	Fermentation of the product is accompanied by the release of casein protein, to which natural components are added and fiber is obtained.

The recommended fabric for making a collection of women's clothing on a zero waste principle is organic cotton. Having analyzed the modern fashion trends and *zero*

waste eco-approach, a collection of women's eco-friendly clothes has been developed according to the zero waste principle (Fig. 4).



Fig. 4. The author's collection of women's eco-friendly clothing named "Panther": a – model 1; b – model 2; c – model 3; d – model 4; e – model 5 (by David Petrosyan)

The zero waste principle and a bionic object have become the source of inspiration for the development of the author's collection. The image of the panther is used, which symbolizes the strength of the female character in combination with elegance, sophistication, and grace (Fig. 5). The developed collection is presented at the Redress Design Awards 2020 competition (Hong Kong, China) [21].



Fig. 5. Source of inspiration for the development of the collection of women's eco-friendly clothing named "Panther"

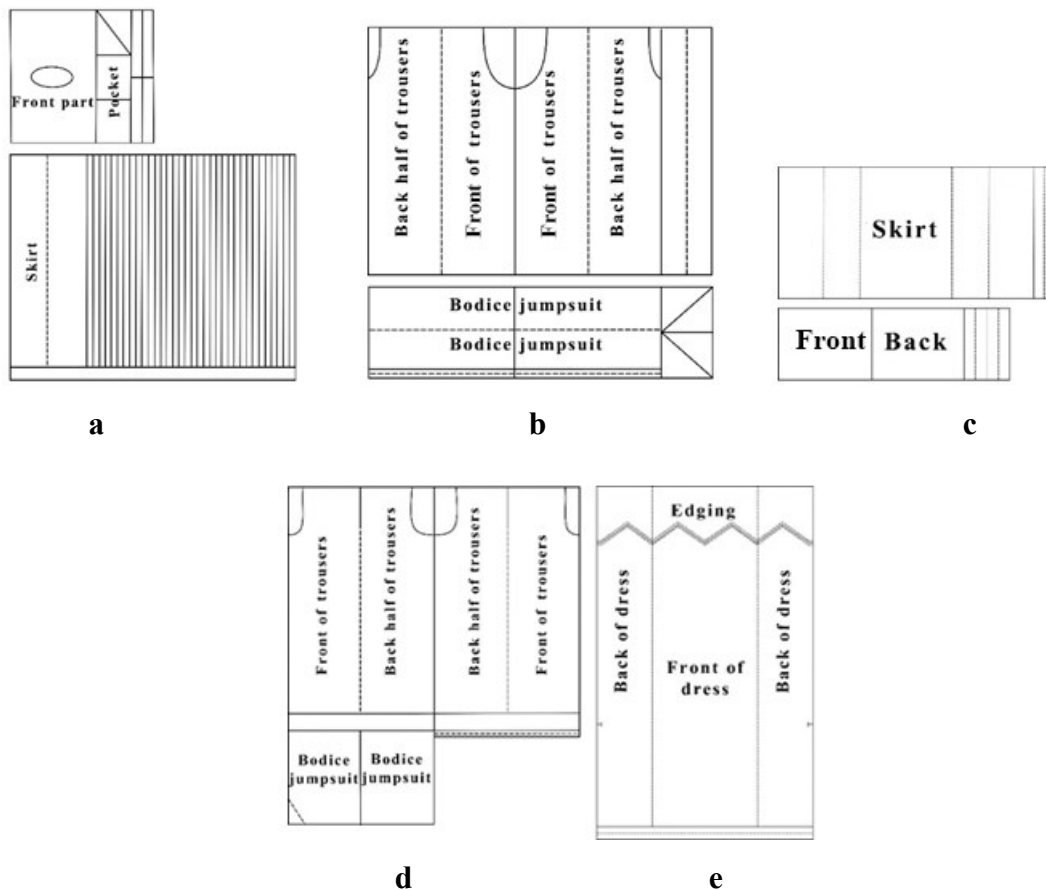


Fig. 6. Details of models of the collection of the clothes on the principle of *zero waste*: a – model 1 (sleeveless and skirt); b – model 2 (sleeveless and trousers); c – model 3 (sleeveless and skirt); d – model 4 (overalls); e – model 5 (dress)

Conclusions. The basic principles of *zero waste* concept are defined, the modern tendencies of sustainable fashion in the collections of world-famous and Ukrainian designers are analyzed. The features of the process of designing of zero waste clothing are considered. Considering the *zero waste* principles and using the bionic analog, an author's collection of modern women's clothing has been developed.

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ОСОБЛИВОСТІ ДИЗАЙН ПРОЕКТУВАННЯ КОЛЕКЦІЙ ОДЯГУ ЗА ПРИНЦИПОМ ZERO WASTE

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Анотація. Досліджено метод проектування безвідходного одягу «Zero waste»; визначено основні принципи концепції «Zero waste»: відмова від надмірного споживання одягу; зменшення вживання сировини для виготовлення товарів фешн індустрії; повторне використання і ремонт виробів фешн індустрії; переробка, ресайклінг, апсайклінг, фрісайклінг; екологічна утилізація. Проаналізовано інноваційні рівні еко дизайну та висвітлено шляхи вирішення еко-завдань на різних етапах виробництва, а саме проектування, виготовлення, споживання та утилізація. Проведено аналіз сировини та матеріалів, які використовують у еко дизайні, створено їх класифікацію. Розглянуто етапи виробництва та властивості еко-матеріалів. Проведений аналіз творчості українських та зарубіжних еко-брендів та визначено, що все більше брендів приділяють увагу екологічності одягу, взуття та аксесуарів. В межах тижнів моди влаштовують окремі секції для показів екологічних колекцій, виробники прагнуть скоротити кількість текстильних відходів, відмовляються від хутра і шкіри та використовують природні матеріали. Розглянуто особливості процесу проектування безвідходного одягу на прикладі: тона, спідниці, комбінезона, брюк та сукні. Керуючись принципами «Zero waste» і біоморфним аналогом пантери розроблено авторську колекцію сучасного жіночого одягу «Panther».

Ключові слова: безвідхідне виробництво, безвідхідний крій, еко-одяг, стійка мода, розробка колекції, текстильні відходи.