Over the last twenty years, cosmetology, which combines cosmetics and care with medical cosmetology, has become one of the biological studies that takes into account the aspects of skin physiology as the tool which integrates the human being with the surrounding world of external stimuli. Contemporary cosmetology is a subject of interest for specialists from many scientific fields: doctors, pharmacists, biophysicists, chemists and biochemists, pharmacologists, molecular biologists, as well as geneticists and many others. Cosmetology has become an interdisciplinary science.

Making an effort to meet the consumer’s demands – and in accordance with the new European Union regulations – the cosmetics’ manufacturers are obliged to perform thorough efficacy tests of a pharmaceutical. This effectiveness has been and, unfortunately, still is, often assessed solely in terms of theoretical premises (which usually specify the effectiveness of individual components).

Nowadays, an enormous amount of active substances is used in care products. Their origin varies substantially – they are, among other things, synthetic products taken from pharmacy (e.g. ichthyol, flavonoids – diosmin and hesperidin), plant extracts used in natural medicine (aloe, flax, Alchemilla, Siberian Pine nuts, lime, Maidenhair tree), or substances recommended by dieticians – like vitamins and microelements. After many years of improvements, attempts and tests, each of them celebrates a success in cosmetology.

In vitro

In vitro tests play a fundamental role in developing a cosmetic. They are popular in studies of other scientific fields; unfortunately, their use in the world when developing cosmetics is still rare, while among Polish manufacturers they constitute almost an exception. The term in vitro (Latin for “in glass”) is used to denote studies of biological process under artificial conditions, outside the living organism.

Tests of cosmetic materials (active substances) are performed on isolated skin cells. This first test phase evaluates the usefulness of the component in cosmetics. Cells growing in layers or in a suspension (the simplest model) enable to observe the skin cells’ behavior under the influence of active substances or their complexes in laboratory conditions.

It is extremely important to test whether a combination of a few components into a complex will prove to be useful for skin physiology, or will the outcome prove to be quite the opposite. If the death of cells is observed already at very low concentrations of a theoretically-based complex whose components include a few singular, effective and tested active substances – then this suggests an improper behavior of their combinations, and not those of medical substances. In vitro tests allow determining the negative impact of certain combinations of cosmetic components on cells. They may also help in assessing which of the components may work synergically, without damaging the skin cells. The term synergism denotes the phenomenon of combining a few substances into a complex which provides a better result, i.e. one that is not only the sum of the individual components’ effectiveness. Such complexes are very valuable and sought after active substances of cosmetics. However, their development is extremely difficult.

Depending on the needs, the cultivation of selected skin cells is carried out. The effectiveness of components which brighten up hyperpigmentations, as well as of protective agents is assessed based on pigment (melanocytes) and epidermal cells (keratinocytes). The effectiveness of slimming agents may be observed on fat cell cultures (adipocytes). Dermis fibroblasts constitute a good model for studying anti-wrinkle and aging-preventing components. Furthermore, skin cells in vitro cultures are used for testing the level of damage done to the cell structures (including DNA) under the influence of stress factors (e.g. UV or free radicals).

Specific active substances have different working mechanisms. Some of them impact all cells; others influence only older or damaged ones.

In vitro tests include also the studies of cosmetics materials’ cytotoxicity, the level of synthesis and cell activity of enzymatic proteins, growth agents and various types of compounds influencing skin aging processes. Very often, the impact of various cosmetic substances on the level of cell apoptosis (programmed death) is determined.

More complicated experiments are performed on skin models. In the histological analysis, the artificial skin (apart from the lack of glands) does not differ morphologically from the skin collected from the patient. These model types are used in testing the effectiveness of cosmetics, as well as in developing medical products in the pharmaceutical industry.

Epidermis models are extremely important in evaluating the irritating properties of ready cosmetics. After a specified period of the product’s contact with the epidermis, its survival rate and the level of pro-inflammatory agents’ (interleukin) synthesis are assessed. It is extremely important that the safety potential of a cosmetic be examined in laboratory conditions before it is determined at the dermatologist’s.

Artificial skin models are currently invaluable in testing the permeability of the active substances through the skin. Almost all users of cosmetics inquire about this. More and more often, active substances are enclosed in special media equipped with a marker that may be used to check the substance’s penetration depth, as well as to what part of the cell the substance has permeated. This is extremely important with regard to the component responsible for supporting corrective systems of nucleic acids; it must reach the nucleus – the main resource of genetic information.

Cosmetic tests using cell models are carried out by the biggest world-wide cosmetic companies. For ten years now they have also been conducted in Poland; unfortunately, up to now only by one Polish cosmetic company. Although their costs are high (every scientist knows this), they are worth bearing, having in mind that tests on cells are important alternatives to tests on animals. In accordance with the 7th amendment to the Cosmetic Directive, any tests of cosmetic substances on animals must stop in periods set by the EU.
Dermocosmetics

– specialist cosmetic preparations

In the last couple of years, the number of pharmacies in Poland has increased significantly. Their character is also changing. Pharmacies are becoming more and more modern – they change not only their traditional appearance, but also their sale system (to partially self-service) and they broaden their assortment by introducing an increasing number of OTC drugs, as well as – making an effort to meet customers’ needs – cosmetics. Market studies have proven that pharmacies are currently gaining increasingly more popularity among people looking for effective cosmetic products – especially those highly specialist.

Specialist cosmetic agents, referred to as dermocosmetics, which are accessible only in pharmacies, are aimed at people with complexion problems. This pertains to, among other things, allergic complexion, vascular complexion or a complexion with acne or hyperpigmentation, psoriatic skin or skin after irradiations used in radiotherapy. Lines of pharmaceuticals cater to various skin demands and needs and they enable a complex care, as well as facilitate the treatment of the most common skin troubles.

Specialist products are meant to be used for people with problematic complexion who generally have an increased sensitivity to environmental factors, including sensitivity to used cosmetics. Thus, experts, including dermatologists, must supervise the production process and cosmetic studies. Scientific studies are becoming one of the most significant fields of dermocosmetics’ production; they guarantee the safety of the manufactured pharmaceutical and provide knowledge about its effectiveness and about the factual impact on the skin. Thanks to this it is possible to offer an effective and safe care of the face and body skin.

Before the products reach the customer, each of them is carefully prepared and studied through very strict procedures. Studies accompany each stage of their manufacturing, and the cosmetic recipe goes through improvement stages in order to fulfill all the sophisticated requirements and expectations. Products should be manufactured in conditions similar to pharmaceutical production – with the use of modern machines and measuring devices, in a so-called protective atmosphere, i.e. in an environment with controlled parameters of humidity, temperature and biological cleanliness of air, as well as water used in production processes. Materials making up the composition of specialist cosmetics should be of the highest quality and should possess special properties. They include, e.g. mineral and thermal waters from biologically clean terrains, active plant extracts (e.g. the 

\[ \text{Asparagopsis armata} \]

brown alga and the

\[ \text{Ascophyllum nodosum} \]

red alga used in vascular complexion care) or particles synthesized in big research laboratories. Pharmacy dermocosmetics should be modern preparations manufactured with the use of very advanced technologies, maximally deprived of preservatives, odour-free or perfumed with special hypoallergenic compositions, i.e. lacking the most sensitizing allergenic substances.

Specialist cosmetic preparations constitute a prophylaxis, as well as a significant aid for the dermatologist in his every day work. In case of patients with early skin disease symptoms, i.e. acne rosacea or sebor-
Stage I – in vitro tests (on isolated skin cells and skin models)
- the impact and working mechanism on skin cells
- selection of active substances aimed at a skin problem
- innovative combinations of cosmetic agents
- searching new and previously unapplied components of cosmetics

Stage II – developing the cosmetic recipe
- use of new technologies
- tests of mass stability
- assessment of physical-chemical properties
- assessment of the coherence of the mass with the package

Stage III – microbiological tests
- microbiological purity of the cosmetic mass,
- loading (challenge) tests

Stage IV – toxicological assessment of the recipe
The toxicological assessment includes, among other things: the exposition path (skin), the surface onto which the cosmetic is applied, the contact time of the cosmetic with the skin, the frequency of using the cosmetic.

Stage V – ex vivo tests
- tests of components and ready cosmetics on human skin under laboratory conditions
- statements that active substances included in the cream in fact influence the skin physiology

Stage VI – dermatological studies via a contact test
- the tested pharmaceuticals are applied onto the skin with the use of special chambers fitted on a hypoallergenic tape,
- the skin reaction assessment is performed directly after taking off the tapes (after 48 hours) and during subsequent days – in the 72nd and 96th hour from the moment of contact with the skin.

Stage VII – ex vivo tests, most often in advanced research laboratories, clinics, hospitals
- selection of volunteers, taking into account especially the type of complexion (problematic complexion)
- safety of use
- apparatus assessment of the skin condition (instrumental tests)
- subjective assessment of usable and care properties of the evaluated product

The toxicological assessment includes, among other things: the exposure path (skin), the surface onto which the cosmetic is applied, the contact time of the cosmetic with the skin, the frequency of using the cosmetic.

Predictive dermatological tests involve:
- the impact and working mechanism on skin cells
- selection of active substances aimed at a skin problem
- innovative combinations of cosmetic agents
- searching new and previously unapplied components of cosmetics

Bibliography

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