

Powders, gels, creams & sticks – Routes of administration

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Cosmetic products often have rather imaginative names and sometimes even propose riddles to the consumers. In other words, a so-called gel may prove to be no gel at all in the technological sense of the term. The main characteristics of the different routes of administration are described in the following.

The first cosmetic products mainly originated from oils, balms and pigments from natural sources. Only gradually, people started to mix different substances and refine components. In the course of time, more complex forms of products for various different applications evolved on the basis of these first products. The skin care substances and active agents were then complemented with a large variety of additives that allowed new manufacturing techniques and the creation of new products. Characteristics like spreadability, consistency, easy application, tolerance and shelf life were significant in this context. Today the following types of preparations are known in particular:

Ampoules

Ampoules may consist of different materials and are designed for one way use. Glass ampoules are generally sterilized at the manufacturers hence they do not require any preservatives. They usually contain aqueous solutions.

Bath tablets

Bath tablets consist of calcined soda (sodium hydrogen carbonate), citric or tartaric acid as well as perfumes and dyes, each of the ingredients in dry and crystalline form. If the tablets get in contact with water, the acid contained releases carbon dioxide from the calcined soda – in other words, it bubbles.

Balms

Balms are high-viscosity plant secretions. The resinous and non-aqueous liquids as e.g. benjamin (benzoin resin), frankincense, myrrh and balsam of Peru contain essential oils, free acids and aromatic esters of cinnamic and benzoic acid as well as aromatic aldehydes. The term balm is frequently used for ointments, oleogels and creams which however is not correct in this context.

Base creams

These creams serve as basic modules to be

adapted to the individual skin with the help of specific active agents. They are also used as basic modules for medical prescriptions in order to be combined with pharmaceutical active agents.

Base gels

In analogy to the above-mentioned base creams, the gels serve as bases for modular gel formulations. Frequently, non-fat and water-clear hydrogels are used for this purpose.

Butters

Butters are pure lipid substances as for instance shea butter, cocoa butter or mixtures of triglycerides of long-chained acids like glyceryl tripalmitate (palmitin). Frequently, they serve as components of oleogels and are used in the same way.

Cold creams

Due to their natural sterol content (vegetable sterols: phytosterols; animal sterols: lanolin alcohols), the semisolid waxes like beeswax, lanolin (wool wax) and shea butter can absorb and retain a certain amount of water. In this process, they lose consistency, soften and hence spread more easily. The evaporating water has cooling effects on the skin. The watery phase of the original cold creams also contained borax (sodium borate) which is a sodium salt of the boric acid.

Creams

Creams are white, semisolid emulsions for the care of the skin. Depending on their composition, they also have cleansing, toning and, if containing dispersive abrasive bodies, exfoliating effects.

Creams with Derma Membrane Structure

Characteristic for these creams are their layered double membranes (bilayers) that can only be detected when magnified with the electron microscope. The structuring elements of the emulsifier free creams are phosphatidyl-

choline (component of cell membranes) and ceramides (component of the skin barrier).

Emulsions

Emulsions consist of a watery and a fatty or oily phase (lipid phase). The lipids either are dispersed in the form of tiny droplets (O/W emulsions) or in a lamellar (Derma Membrane Structures) or transparent (microemulsions) form. They are stabilized with the help of emulsifiers (exceptions are DMS products or oily hydrogels). O/W emulsions contain lipid droplets the size of 1-20 µm. In reverse, the watery phase in W/O emulsions is dispersed in the form of tiny droplets in the lipid phase. Semi-solid emulsions are called creams; liquid emulsions pertain to the lotions.

If an emulsion sample applied on a dry filter paper shows an evaporating fringe of water we are dealing with an O/W emulsion, if a fatty spot remains, we are talking of a W/O emulsion. Besides O/W and W/O emulsions also multiple W/O/W and O/W/O emulsions are used for cosmetic purposes.

Essential oils

Essential oils are fluid, water-immiscible and volatile substances. They have cooling, warming, refreshing, calming or stimulating effects.

Foundations

Foundations are used as makeup or toning bases and consist of creams that contain a fair quantity of pigments. They provide a basic colouring of the skin and cover up skin impurities. Intensely covering foundations based on lipid-wax-compounds (oleogels) are called camouflages.

Gels

In contrast to bi-phase emulsions, gels are single-phase systems whose liquid components are solidified by adding gelling agents (consistency agents). A distinction is made between water-clear hydrogels with water-soluble components and lipogels (oleogels) consisting of water-insoluble waxes, oils and fats. In appearance, oleogels free from water often are difficult to distinguish from creams (W/O emulsions).

Granulates

Granulates are grainy, either mostly salt-like or dry extract containing preparations (e.g. bath supplements) that quickly dissolve in water. Freeze-dried plant components like tea leaves in granule form are suitable for fresh infusions that can be mixed into masks or packs.

Hydrogels

Hydrogels are made of water and thickening

polyacrylates (carbomers), xanthan gum, chemically modified cellulose, CM-Glucan, hyaluronic acid etc. They have cooling effects. Hydrogels with high consistency allow a fine dispersion and stabilization of oils. Resulting from this particular process then are emulsifier free creams.

Compact powders

The main ingredients of spreadable powders are pigments and an adhering component like magnesium stearate. Compact powders (cake powder, pressed powder) additionally are pressed and solidified with the help of binding agents like waxes, long-chained alcohols, oils and fatty acid esters.

Liposomes

With their membrane bilayers and their specific composition, liposomes correspond to natural cells in which water-soluble active agents can be encapsulated. Their diameters range from 50 to 300 nanometres (nm). Liposomes form clear to opalescent, watery dispersions.

Solutions

Solutions are transparent watery or water-immiscible liquids. Water, alcohols or organic oils (essential resp. fatty oils) are used as base liquids. Depending on the specific type, they either contain water-soluble or fat-soluble active agents. Solutions are applied on the skin in the form of lotions or ampoule products. An example for hybrid forms here are perfumes as they simultaneously contain a certain amount of essential oils, alcohol (solubilizer) and water.

Lotions

Lotions are fluid emulsions or solutions which spread easily by means of a little sponge, a spraying system or manually. A difference is made between skin caring, skin cleansing or watery-alcoholic lotions (e.g. for shaving lotions). Liposome or nanoparticle dispersions can also be used for facial or body lotions.

Microemulsions

Transparent emulsions with a droplet size of 10-50 nm are called microemulsions. In a narrower sense, they are highly concentrated tenside systems in which watery and oily phase can no longer be distinguished, not even with the electron microscope. They are used for shampoos for instance.

Microcapsules

Nano or microcapsules consist of polymers (e.g. polypeptides) or solid waxes which comprise cosmetic or pharmaceutical active agents that are slowly released (extended-release applications) into the skin. Due to their small

particle size they provide a particularly large surface and hence allow a controlled release of the active agents from the polymer matrix. Microcapsules are added to gels and creams. Polymers and waxes remain on the skin surface.

Nanodispersions

Similar to liposome dispersions, nanodispersions also are water-based. The particles (nanoparticles) are about the same size – the difference however is that their shells contain monolayers (single membranes) instead of bilayers (double membranes). The shell material (phosphatidylcholine) is identical however it embraces an oily internal space to carry oil-soluble agents. Like liposomes, the opalescent to milky nanoparticle dispersions are biodegradable hence they are not subject to the stringent safety regulations that apply for solid, non-biodegradable nanoparticles.

Oils

Mineral or vegetable ("fatty") oils are liquid, water-immiscible transparent substance compounds that are either used as oil phases in emulsions, as oleogels for skin care purposes or applied in pure form as massage oils. Oils with defined composition (esters, PAO) are produced synthetically. Essential oils add characteristic scents to emulsions or are used in perfumery (solutions).

Oleogels

Similar to emulsions, oleogels (lipogels) are semisolid, white preparations however consist of one single phase only, like hydrogels. They are produced by solidifying liquid oils into gels with the help of gelling agents (consistency agents). Salts of long-chained fatty acids as well as long-chained triglycerides serve as gelling agents. Oleogels are used for the care of very dry skin, for massages or also in combination with pigments for mascara, camouflage and eye shadow products.

Facial and body powders

Besides colouring pigments, the powdery bases contain particular substances that increase the glidability, retain lipids or moisture and also improve the adhesiveness. Solid variants are called compact powders.

Other substances in powder form

Masks, enzyme peelings and healing earths belong to this substance group. They are mixed with water before application.

Ointments

The term "ointments" as a generic term refers to pharmaceutical creams and gels.

Foams

Non-durable foams are prepared on the basis of specifically formulated lotions which are bottled in containers with foaming caps. Saponin-containing lotions (e.g. with added horsetail-extracts) already foam if the containers are equipped with spray nozzles. Durable foams are prepared on the basis of emulsions bottled in pressure cylinders with propellant gas.

Shaking mixtures

Like emulsions, shaking mixtures consist of a watery and an oily phase. Since they do not contain any emulsifiers the phases separate and sediment during storage, hence it is required to shake well before application. Shaking mixtures are mostly used for pharmaceutical administrations.

Sprays

Similar to emulsion-based foams, sprays also need to be bottled in pressure containers with propellant gas (CO₂, propane, butane). Lotions or solutions can also be sprayed on the skin, if the caps of their containers are equipped with atomizer nozzles.

Sticks

Lip sticks or khol pencils consist of non-aqueous formulations with lipids and pigments. Their specific consistency and spreadability is adjusted with waxes, oils, esters and long-chained acids like stearic acid.

Suspensions

Suspensions are liquids in which finely dispersed and undissolved particles of colouring agents or pigments float in suspense. Mascara products often contain suspensions which are maintained in this form by means of consistency agents.

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