

A new concept for skin protection

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A skin protection concept against the effects of frequently used materials at the workplace on the basis of saturated phosphatidylcholine (PC) is presented. PC and base creams with PC perfectly stabilize the skin barrier.

The acceptance of skin protection and skin care especially designed for activities in humid conditions (e.g. metal industry, construction industry, hairdressers) and workplaces where oils are used (e.g. oil industry, automotive industry, mechanical engineering) among the individuals affected is rather low. Especially in those fields where not really corrosive and acutely irritating or sensitizing materials are used but rather "everyday" substances, a large number of skin diseases has been diagnosed according to the statistics of the professional associations¹⁾. Cooling lubricants are among the "everyday" substances used in metalworking. What "homemaker's hands" are for homemakers, applies to the hands of the "tough guys" in the factories. In both cases the skin barrier layers are chronically disturbed and react with increased roughness, cracks and eczema. Exogenous noxae as e.g. sensitizing substances, germs and their metabolism products but also micro-fillings may easily penetrate into the skin and cause allergic contact eczema and infections^{2,3)}. In the recently published technical regulations TRGS 531 "Risks of skin disorders caused by working in humid conditions"⁴⁾ it is explicitly stated that a "long-term and constantly repeated contact with water, especially with a simultaneous effect of cleansing substances, disinfectants, solvents, alkalis and acids, damages the epidermal barrier and the skin layer underneath". Optimal skin protection needs appropriate protective products and non-irritant materials at the workplace^{5,6)}.

A new skin protection concept

Besides skin protection also skin care belongs to a skin protection concept, i.e. skin care preparations which are able to restore the skin barriers without disturbing the regeneration process of the skin. The focus here is on products with a barrier affinity which are able to restore the skin barrier. Alternatively, this can also be realized by a "second protection layer" (occlusive principle). Similar to gloves, this principle generally leads to an increased

endogenous swelling and a reduced regeneration capacity of the skin⁷⁾.

It would be very welcome to stabilize the natural skin barrier. From the standpoint of metrology, the stabilization of the barrier means the maintenance of the "normal" transepidermal water loss (TEWL), this also applies for the contact with materials at the workplace. A further measuring parameter is the skin hydration. The skin hydration should also be kept at a stable level.

Skin protection substances

The composition of the sebum⁸⁾ provides very little protection against materials like cooling lubricants. Though fatty acids, cholesterol and ceramides of the natural barrier layers^{9,10)} are more resistant, they will finally also be attacked due to the emulsifying properties and the pH of 8-9, which frequently is linked to a high buffer capacity.

Ceramides are well-known for their very high barrier effects. Together with other barrier substances they form in vitro liposomes¹¹⁾. Liposomes have the same bilayer structure as the barrier bilayers. Hence it can be concluded, that substances which are able to form bilayers have perfect prerequisites for skin protection formulations.

Phosphatidylcholine (PC) is the main component of the plasma membranes. The physical properties of saturated PC are very similar to the properties of the ceramides but it also has the advantage to be easier penetrated into the skin.

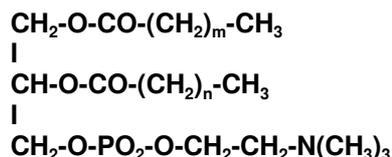


Fig. 1: Saturated phosphatidylcholine (m, n = 14,16)

Saturated PC is effectively used in form of finished base cream products¹²⁾. The DMS-base creams (DMS = Derma Membrane Structure) correspond to the concept of a

"skin-identical composition". Table 1 shows the qualitative structural composition.

Horny layer	DMS-base creams	remarks
glycerides	triglycerides	the skin contains a mixture of di- and triglycerides
cholesterol	phytosterols	components of neurodermatitis creams
squalene	squalane	squalane is less sensitive to oxidation than squalene
fatty acids	not included	saturated PC contains palmitic and stearic acid
PC	saturated PC	saturated PC also is very well tolerated by sensitive skin ^{13,14)}

Table 1: Structural composition of DMS-base creams

Skin protection and skin care formulations

Saturated PC respectively DMS-base creams as components in new skin protection formulations provide excellent preconditions for a stabilization and regeneration of the skin barrier. Measurements of the TEWL, the skin hydration, and the skin smoothness within the scope of an experiment design which was adapted to the situation at the workplace, proved the desired barrier-stabilizing effects for skin contacts with cooling lubricants¹⁵⁾. The formulations do without silicones and high-molecular mineral oil products like Vaseline; in the metal industry, the substances mentioned leave annoying fingerprints when touching the work pieces.

Additional measuring results of the base creams

Measurements of pure DMS-base creams in comparison to high-quality conventional skin care creams clearly show that the increase of skin hydration and skin smoothness still is verifiable up to 72 hours after the treatment was discontinued. This also indicates a high barrier affinity and a relatively low "wash-out"-effect.

Multi-functionality of skin protection preparations

Skin protection represents the sum of the different single functions of a formulation (Table 2).

function	effect
penetration	avoiding oily films on the skin
transport vehicle	assimilation of hydrophilic and lipophilic active agents
barrier compatibility	stabilizing the "normal" TEWL
corneocyte affinity	adhesion to biological surfaces, minimizing the "wash-out effect"
additive	stabilizing the emulsion without strain on the skin
low CMC of the components	a low critical micelle concentration (CMC) is the precondition for a high skin tolerance
active agent effects	increase of skin hydration, skin smoothness, anti-inflammatory effects
conditioning	preparing the horny layer for a lipophilic or hydrophilic attack of exogenous substances
spreading	appropriate spreading is an important precondition for acceptance

Table 2: Multi-functionality of skin protection preparations

General set-up in the industrial field is the refusal of preservatives and perfumes on the part of the consumers, the work doctors and the professional association.

However, no skin protection preparation may guarantee the protection against all the possible materials and substances at the workplace. Neither does the addition of astringents or micro-fine solids. In these cases only a change of procedures, encasing or impermeable gloves in connection with the well-known disadvantages will help.

Skin protection in the future

It makes sense to use similar skin protection concepts also for private use. "Skin care creams" also are supposed to protect the skin against environmental influences. Further-

more, sun protection products may be prepared by adding UV-filters to DMS-base creams. An advantage here is the high water resistance. An interesting field for the use of barrier-active formulations also is dermatology where pathologically disturbed barriers have to be preventively protected or restored.

Finally, besides optimizing the skin protection and skin care as well as the further development of working materials an essential point is the competent use of skin protection products. An appropriate training in this field may still improve the situation in the future.

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