

Humectants (Moisturizing Agents)

Traditionally, moisturization was believed to inhibit transepidermal water loss by occlusion. Water originates in the deeper epidermal layers and moves upward to hydrate cells in the upper layer of the skin (stratum corneum), eventually being lost to evaporation. Research suggests that the stratum corneum acts as an active membrane consisting of intercellular lipids (i.e. ceramides, cholesterol and fatty acids), thereby forming a water-barrier function. In addition, the stratum corneum contains a natural mixture of amino acids, lactates, urea and electrolytes, which also help retain water.

Dry skin is noted when the moisture content is less than 10%, and there is loss of continuity of the stratum corneum. Scientifically, the moisturizing treatment involves a 4-step process:

4 Steps of Moisturizing Treatment

- Repairing the skin barrier
- Increasing water content
- Reducing transepidermal water loss
- Restoring the lipid's water barrier function

Occlusives

Occlusives are substances that physically block transepidermal water loss in the stratum corneum. Petrolatum in a minimum concentration of 5% is the most effective occlusive followed by lanolin, mineral oil, and silicones such as dimethicone. Petrolatum is widely used as a classic moisturizer. Lanolin is also widely used and quite effective although it has been shown to induce contact dermatitis in some cases.

Humectants

Humectants attract water when applied to the skin and theoretically improve hydration of the stratum corneum. However, the water that is drawn to the skin is transepidermal water, not atmospheric water. Continued evaporation from the skin can actually exacerbate dryness.

Chemically, all humectants have something in common: hydroxyl groups. These groups allow them to partake in the association process known as hydrogen bonding. In other words: they attract water (Latin: humectare = moisten).

Humectants include glycerin, sorbitol, propylene glycol, hexylene and butylene glycol, MP Diol, urea, alpha hydroxy acids (i.e., lactic acid) and other sugars.

Glycerin: glycerin is by far the most popular of all humectants used in personal care products. While it is a very good compound when it comes to moisturization, and its natural connotation is a real positive, when used at concentrations above 5% it can leave the skin with a sticky, unpleasant feel.

Sorbitol: Sorbitol, available as powder or a 70% aqueous solution, is typically used in toothpastes and many other personal care products.

Propylene Glycol: propylene glycol is less commonly seen in personal care products. While it is less sticky than glycerin, there have been concerns regarding its safety when used at high concentrations above 7.5%.

Hexylene and Butylene Glycol: both compounds are often used in emulsions designed for facial applications due to their non-sticky skin feel. When employed in makeup emulsions, they can reduce

streaking which is often seen in this product type. Their relatively high cost has limited their usage. MP Diol: MP diol has properties similar to hexylene and butylene glycol but is less expensive (similar to propylene glycol).

It is of note that all glycol-type humectants can additionally improve the effect of preservatives (e.g. paraben) since they take away the water from the bacteria (needed for their growth) and improve the solubility of parabens. Urea & alpha-hydroxy acids (AHA's): In addition to their humectant properties, urea and AHA's (e.g. lactic acid) are keratolytic. Urea is a humectant in lower concentrations (10%), but in higher concentrations (20-30%) it is mildly keratolytic by disrupting hydrogen bonds or epidermal proteins. AHA's, such as lactic acid or glycolic acid, appear to increase cohesion of the stratum corneum cells, thereby reducing roughness and scaling.

Emollients and Proteins

Emollients smooth skin by filling spaces between skin flakes with droplets of oil, and are not usually occlusive unless applied heavily. When combined with an emulsifier, they may help hold oil and water in the stratum corneum. Examples of emollients include mineral oil, lanolin, fatty acids, cholesterol, squalene, and structural lipids.

Fatty acids: fatty acids and fatty alcohols exert their benefits through effects on the skin barrier. Examples include stearic, linoleic, linolenic, oleic, and lauric acids, which can be found, for example, in palm oil, coconut oil, and grapeseed oil.

Ceramides: Structural lipids as ceramides which are located between skin cells, are also felt to play a considerable role in the water-holding potential of the stratum corneum. Ceramide is a major skin cell component and plays a major role in generating multilamellae architecture. Natural ceramides themselves are at present too expensive to make commercially available. However, synthetic ceramides (e.g. lacto-ceramide encapsulated in liposomes) are now available and have been clinically shown to be effective in preventing and improving dry skin.

Proteins: like emollients, protein shrink on the skin leaving a film that smoothes the skin, stretches out some of the fine wrinkles, and avoids water loss.

Sources:
Klein K. Humectants: more than meets the eye (or skin). *Cosmetics & Toiletries* 2005; 120(2): 30
Lynde CW. Moisturizers: what they are and how they work. *Skin Therapy Letters* 2001; 6(13): 3

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Moisturizing Compounds and their Mode of Action

Class	Mode of Action	Compounds	Comments
Occlusives	Physically block transepidermal water loss	Petrolatum, lanolin, mineral oil, silicones, zinc oxide	May be comedogenic, contact dermatitis (lanolin)
Humectants	Attract water to stratum corneum	Glycerin, propylene glycol, sorbitol, hexylene glycol, butylene glycol, urea, alpha-hydroxy acids (AHA's)	May be irritant at high concentrations (AHA's), Glycols also increase effect of preservatives
Emollients	Smooth skin by filling spaces between skin flakes with droplets of oil	Plant oils, polyisobutene, squalene, fatty acids, ceramide (e.g. lacto-ceramide)	
Proteins	Replenish proteins in stratum corneum	Collagen, keratin, elastin, protein mixtures (e.g. wheat protein)	