

# Silicones – Beneficial and Safe

Silicones have been used in the personal care industry since the 1970's.

## BENEFITS OF SILICONES

Silicones prevent water loss and create a hydrating barrier. They also make products softer, silkier and more spreadable. Silicones are used extensively in skincare, baby care, medical formulations and sensitive skin products due to their inert and non-irritating characteristics [1,2]. Silicones are indeed one of the most innocuous and gentle ingredients known to man, evidenced by nearly 70 years of research and consumer use history [3,4].

Contrary to what the popular press may communicate, silicones are not occlusive. Instead, silicones are actually breathable and non-comedogenic because of their long bond lengths and wide bond angles. This is one reason that they are used for wound care and acne products [5,6].

## STRUCTURE OF SILICONES

Silicones are synthetic polymers made up of silicon and oxygen, combined with carbon, hydrogen and sometimes other elements. Silicon makes up 27.7 percent of Earth's crust (eg. quartz is silicon dioxide) and is the second most abundant element in the crust after oxygen [7].

## SILICONES ARE SAFE

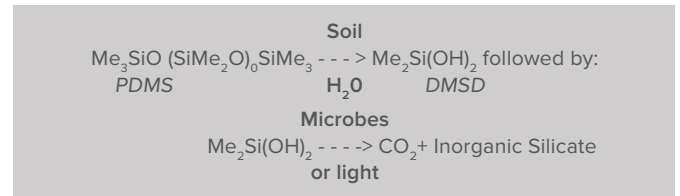
Silicones are large molecules that do not penetrate the skin. Major health agencies have concluded that cyclomethicones and dimethicone are extremely safe for topical human use:

- European Commission's Scientific Committee on Consumer Safety
- UK Environment Agency
- Health Canada
- Cosmetic Ingredient Review Expert Panel (CIR)
- Australian Inventory Multi-tiered Assessment and Prioritization

Silicones are sustainable, never animal derived and, therefore, approved by vegans as cruelty free materials. They are not related to palm and RSPO issues and are certified as GMO free. Finally, silicones are colorless, odorless and have no oxidation issues.

## TYPES OF SILICONES

1. Volatile silicones – used in leave-on skin and hair products because they easily evaporate for a weightless finish. Eg. cyclomethicone, cyclopentasiloxane
2. Silicone fluids [polydimethylsiloxane (PDMS) fluids] – used for their silky emolliency. Eg. dimethicone
3. Amodimethicone blends – micro-emulsifications of silicone for easy incorporation into water-based formulas. Eg. 100's of different materials with amodimethicones
4. Silicone gums, gels and polymers – boosts viscosity, cushiony feel, immediate "blurring effect" for fine lines Eg. dimethiconol
5. Ethoxylated or propoxylated silicones – makes silicone more water-loving and functional (emulsifying properties). Eg. PEG- or PPG- in INCI name with silicone name
6. Silicone film formers – can make a product extended wear or water resistant. Eg. INCI name includes words like siloxymethacrylate and copolymer.



## SILICONES AND THE ENVIRONMENT

Scientific studies have shown that silicones are safe and degrade in the environment into common products such as water, carbon dioxide and minerals found in the earth's crust.

There has been extensive research on dimethicone, which is part of a group of silicone fluids known as polydimethylsiloxane (PDMS) fluids. PDMS is not an environmental contaminant and it does not adversely affect wastewater treatment operations. If PDMS enters an aquatic environment, it attaches to particulates and is removed by natural sedimentation. PDMS fluids degrade naturally in soil from polymers into monomers within days. Once in monomeric form, they will undergo microbial degradation (biodegradation) into silica, water and carbon dioxide [8,9,10].

## D4 AND D5 REGULATORY ISSUES

Two cyclomethicones, D4 (octamethylcyclotetrasiloxane or cyclotetrasiloxane) and D5 (decamethylcyclopentasiloxane or cyclopentasiloxane), were added to the REACH Annex XVII restricted substances list by the EU on January 2018 due to environmental concerns, specifically persistence and bioaccumulation. D4 and D5 will not be in wash-off cosmetic products in a concentration equal to or greater than 0.1% of either substance by January 2020 since they may go down the drain and enter lakes, rivers and oceans [11].

However, a recent US industry-funded study suggests that D4 poses a negligible risk to the environment, based on data collected under an EPA (Environmental Protection Agency) enforceable consent order. The U.S. (Cosmetic Ingredient Review), Health Canada and Australian regulatory bodies have concluded that D4, D5 and D6 do not pose any risk or environmental concern and are extremely safe for human use. On April 2, 2018 representatives of the European and U.S. silicon industry associations began a legal action against the EU Commission. They argue that the criteria for SVHC (substance of very high concern) defined in Annex XIII of REACH regulation are inappropriate to describe the properties of siloxanes correctly. In addition, according to the Institute of Personal Care Science, cyclomethicones are not even used in wash-off products anyway.



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