

Silicones for Personal Care. 2nd Edition

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The book highlights the various steps on the synthesis of silicone compounds construction, functionalization and derivitization, giving the possibility to the reader to understand their performances and activities on the human body and the environment.

Reporting the actual technologies and future perspectives of the derivatives of silicon (silicium), it should be interesting to remember how this mineral is important for our skin also. Silicon plays in fact, an important metabolic role in connective tissue, being a fundamental component of the skin's *ground substance*. Thus, structural role for this mineral has been proposed mainly supported by the finding that it is a component of human glycosaminoglycans and their protein complexes.

In the connective tissue, silicon essential element of the human body, contributes to the structural framework by forming links or bridges within and between individual polysaccharide chains, and perhaps by linking polysaccharide chains to proteins. In this way, silicon may aid in the development of the architecture of the fibrous elements of the connective tissue and may contribute to its structural integrity by providing strength and resilience. For all these reasons we must become to consider not only silicon but *silicone also* as natural component of our skin and not only as component of mineral quartz. Silicon is the primary element linked with polysaccharides, while silicone is referred to materials in which silicon is bonded to oxygen. But oxygen is one of the primary elements necessary for the life of our cells!

In my opinion, the silicone chemistry described in this book by 25 chapters has to be considered as important as the natural polysaccharides chemistry, having the two chemical families a positive impact on the environment and on the body, also considering that the natural decreased concentration of silicon with ageing leads to skin tissue destruction. Moreover, it is important to remember not only the difference between silicon and silicone, but also the difference between silicone and silane to have the possibility to better understand the metabolic pathways of their relative derivatives.

A silicone compound has a Si-O-S_i bond, while the silane has only one Si atom. However, in the living organisms, silicium is probably in the form of silicic acid Si(OH)₄ thus linked with oxygen. Considering silicium as an integral component of mucopolysaccharide-protein complexes of the connective tissue, the relative organic derivatives have been considered to formulate anti-ageing cosmetics as skin restructuring compounds. This inorganic element is very important, in fact, in the embryonic mesenchyme, and decreases with age in all the connective tissue. Disturbance, ageing and sclerose appear with a fall of silicium rate in the body, because the intestinal absorption capacity decreases gradually with age.

Acting as an anti-cross-linking agent, silicium may contribute to structural integrity of connective tissue, thus entering the construction of skin macromolecules such as elastin, collagen, proteoglycans

and structure glycoproteins.

From that, the large use of silanols, compounds carrying Si-OH groups, which are important since certain multihydroxy materials can complex by hydrogen bonds with bio-actives making them-bio-available. Thus, specific silanol derivatives can efficiently protect the skin from external aggressions, aging and dysfunction of the cell metabolism. They can provide multiple activities such as restructuring effects, prevention, protection and metabolism stimulation with an excellent skin tolerance, being non-toxic and non-allergenic.

In conclusion, it has been observed that the biological activity of silicon atoms, combined in an organic form, can be modified and oriented by the nature of the molecules bonded to these atoms. Thus, the action of an organic complex of silanol is itself the more physiological, and closer to the natural action of silicon in living cell, since it is bonded to a natural molecule. Therefore, as said above, the new silicium-compounds may be compared with the activity of the natural polyglycosides.

But the manufacturers of personal care products have to formulate also topical compositions that provide superior film properties on keratinous surface with exceptional aesthetic appeal, a silicon derivatives have from all these reasons the incredible large numbers of patents, ranging up 6000 in USA from 2004 to 2006 in the field of silicon chemistry !

As silicone technology advanced, new materials emerged giving incredible feel and performance properties on skin and hair. Among the most used new silicon components is the dimethicone crosspolymer elastomer, comprised of repeating siloxane units (-Si-O-Si-O-) with hydroxycarbon side chain groups, crosslinked internally with a carbon based on moiety.

Selective silicon and silicone compounds have therefore to be considered not only interesting ingredients to ameliorate the feeling sensation when applied on the skin, but also natural compounds capable to effectively help the reconstruction and reparation of the skin connective tissue, stimulating also the cell proliferation and the production of collagen. This may happen because for the high similarity with the extracellular matrix (ECM), the derivatives of silicium are capable of carrying the eventual bounds substance radical into the epidermis and even into the dermis.

Moreover, according with some recent studies it has been also shown as some silicium compounds may positively influence the inter-cellular communications thus acting by the "NICE" approach, which contemporary involves the Nervous, Immune, Cutaneous and Endocrine systems. Naturally for the biological use of all the silicium derivatives it will be necessary to conduct strict *in vitro* and *in vivo* tests to evaluate their efficacy and their bio and eco-compatibility.

In accordance with my friend Tony O'Lenick new cosmetic and medical markers based upon specialty applications, new biological studies and the formulators' creativity will continue to be developed. The efficient product development, based on synergistic blends of dimethicone copolyol compounds with traditional fatty compounds or other organic ingredients, and a better knowledge of the skin functions, connected with the new "NICE" approach, will represent the future of mind-body innovative skin care.

This interesting book, giving all the necessary information to really understand not only the chemistry of the silicon compounds, but also their use to formulate more active and safe personal care products, represents a basic key for all the Cosmetic Chemists and/or Medical Doctors who really wish to understand the skin activity of this interesting family of natural-oriented chemicals.

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