

# Technical Tuesdays

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## Organo- Modification of Silicones for Textile Applications

History of the Textile industry is very rich and starts with history of ancient India. Our ancestors were expert in fibre, fabric and garment technology. Over a period of time, the encyclopedia of Indian textile was kept updated with various cultures and traditions that associated only with India since Indus Valley Civilization. Many finishing chemicals were known and used effectively to get the optimum results starting from Vegetable, animal fats, waxes and other fatty derivatives like amides. Their products were so famous world wide and along with other natural resources, it attracted many foreigners of different time to trade with and ultimately lured them to invade the nature's own country.

The use of Silicone as textile finishing agents started way back in late forties in the 20<sup>th</sup> century immediately after Rochow's invention of direct synthesis of chlorosilane which led to the commercial success of coveted first inorganic polymer on the globe.

### Why Finishing is required?

Cotton fibers undergo various mechanical, chemical processes starting from its spinning, sizing, desizing, mercerizing, dyeing etc., on the way to become a fabric/garment. Cotton loses its nature and becomes harsh to touch or feel, as the chemicals are some times strong alkali or strongly reacting with cotton molecules. Thus it becomes necessary to add reasonable long lasting feel or smoothness to the fabrics/Garment, which forms outermost layer of human skin in the modern era. Organic softeners provide adequate softness but with their own limitations of poor durability. Silicone serves the exact purpose here, it meets all the requirements as a finishing chemical with excellent durability, softness and its molecular versatility helps processors to meet different tastes of customer by providing smooth, buttery, silky, limpy, wet, leathery, etc., finishes.

### First Generation Silicone Softeners

Immediately after commercial production of silicones in the late 1940s, there were many attempts to use silicone polymers for the textile industries.

The first polymer attempted was PolydimethylSiloxane with the following structure:

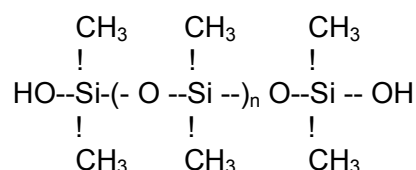


PDMS

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The polymer PDMS is non-reactive in nature, as the terminal methyl groups (CH<sub>3</sub>) do not allow the polymer either to propagate its chain length or to cross-link. These polymers when treated onto a fabric surface offered dry hand feel with body and fullness with poor wash durability to home laundering and failed as a fabric softener. However, the long fatty like backbone confers good lubricity for cotton and synthetic yarns and is widely used as yarn lubricant in its macro emulsion form.

In a next attempt to improve the wash durability, the methyl terminal groups are replaced with hydroxyl (-OH) groups, which are capable of cross-linking with itself and can, form a physical entanglement matrix with cotton fibers and can withstand wash cycles.



## SILANOL

However, here too the softness obtained was inferior and not upto the industrial standard, though bouncy effect could be achieved due to crosslinkability of the - OH groups. Silanol along with methyl hydrogen polysiloxane, in a macro emulsion form, found some commercial success in hydrophobic coating for cotton and cotton rich blended fabrics.

### Limitations of first generation Silicones:

- Poor Exhaustion
- Inferior Softness with dry feel
- Poor wash durability
- Cannot be emulsified into micro emulsion
- Risk of spotting is very high due to poor stability of the macro emulsions

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