

Using Silicones in Topical Products

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I. INTRODUCTION

A. What Are Silicones?

The term *silicone* refers to a class of synthetic polymers that are based on alternating silicon-oxygen, or siloxane (-Si-O-) units. The silicones that are most commonly used in topical products are polydiorganosiloxanes in which two organic groups are bonded to each silicon atom. For commercial polydiorganosiloxanes, the organic groups are nearly always methyl groups, and such materials are referred to as *polydimethylsiloxanes* (PDMS). Other types of silicones that are used in topical products can be thought of as derivatives of PDMS in which some of the methyl groups have been replaced with other organic groups.

Polymethylsiloxanes are produced in one of two forms: linear or cyclic. Both are widely used in topical formulations and together account for most of the volume of silicones used in these applications. Linear PDMS is a colorless, odorless oil that is available in a wide range of viscosities. The viscosity of linear PDMS is directly related to molecular weight, and can range from less than 1 centistoke to over 1 million centistokes (cs). Cyclic PDMS is an odorless, colorless, low-viscosity, volatile oil. Commercially produced cyclic PDMS is available in a fairly narrow range of molecular weights, corresponding to the cyclic species with four, five, or six dimethylsiloxane units in the ring. As expected, volatility of cyclic PDMS is inversely related to molecular weight. Unlike linear PDMS, cyclic PDMS is a fairly good solvent, and this is one reason for its popularity among formulators.