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Raw Chemical Components for the Production of Cosmetics in Russia: Production, Market and Forecast

Sample PDF

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Annotation

The **purpose of research** is to assess the potential of localization in Russia of production of imported raw chemical materials for the cosmetic industry.

The **objects of study** are: silicone emulsions, cyclomethicones, dimethicones, antiperspirant salts, propylene glycol butyl ether, alkyl benzoate, zinc pyrithione, and carbopols.

This work is a **desk research**. As **information sources**, data of Rosstat, Federal Customs Service of Russia; materials of the sector and regional press, as well as websites of enterprises of the chemical industry were employed.

The **chronological scope of the study**: 2008-2012.

The **geography of research**: Russian Federation - a comprehensive analysis of markets.

The report consists of 7 Sections, contains 60 pages, including 9 figures and 21 tables.

The **first-sixth chapters of the report** examine the characteristics of the investigated products, raw materials and methods for their preparation, analyze volumes, geography and structure of imports by companies-producers and consumers, present the dynamics of import prices, assess the possibility of creating domestic productions, present contact information of companies with similar technological processes.

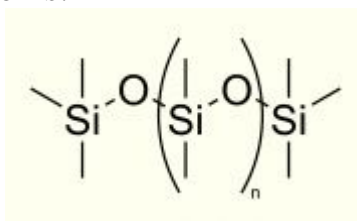
The **seventh chapter** presents a SWOT-analysis of creating a production of import substitution of cosmetics ingredients.

1. Dimethicones, cyclomethicones, silicone emulsions

Silicones began to be actively used in the personal care products and decorative cosmetics in the 70-s. Combination of silicones with natural oils allows creating a cosmetic, which is both helpful (biologically active at the expense of natural oils) and pleasant to use (easier, "dry") and less comedogenic (i.e., it will not clog pores due to silicones).

Currently silicones are part of antiperspirants and deodorants, makeups, conditioners, shampoos and hair dyes, products for shaving, tanning, hair styling, skin and body care.

Silicones are the inorganic silicon-oxygen chains with side organic groups, which are attached to silicon atoms:



In some cases, organic side groups can join together two or more silicone chains. By varying the length of the main silicone chain, side groups and cross-linking bonds, silicones can be synthesized with different properties.

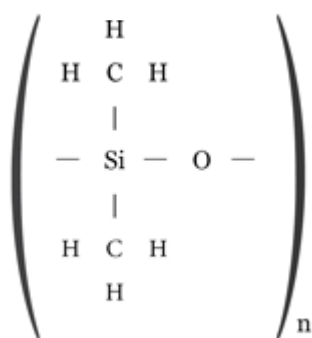
Silicones are divided into three groups, depending on the molecular weight, degree of crosslinking, kinds and amounts of organic groups on the silicon atoms:

- silicone fluids - at least 3,000 siloxane units;
- silicone elastomers – 3,000-10,000 siloxane units;
- silicone resins - over 10,000 siloxane units and a high degree of crosslinking.

Most silicones are insoluble in water and therefore are formulated as *emulsions*.

The most widely used in the manufacture of cosmetic products are dimethicones and cyclomethicones, representing chemically inert transparent silicone odorless fluids. They mix well with mineral oils, are thermally stable, resistant to UV radiation, and are not food for the fungus and bacteria.

The chemical formula of **Dimethicone** or **polydimethylsiloxane**:

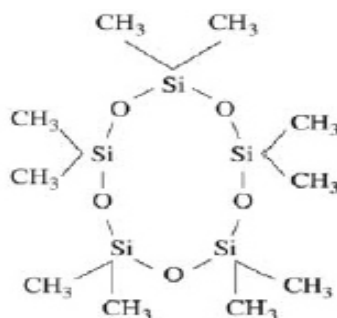


The substance is optically transparent, considered to be inert, non-toxic and non-flammable. In cosmetics for hair Dimethicone protects the skin, inhibits foam formation and has a conditioning effect on hair, adds shine and silkiness. In creams the substance has a calming effect on the skin and can protect it from irritation caused by aggressive cleaning components (e.g., Sodium Lauryl Sulfate). Therefore, it is often added to cosmetic formulations with irritating ingredients.

Silicones having a cyclic structure are called **Cyclomethicones**. Cyclic silicones have a low molecular weight and are easy to evaporate from the surface. Their high fluidity and rapid distribution on the skin and hair makes them excellent ingredients of cosmetics.

Cyclomethicones include a group of compounds which differ in the content of silicon and oxygen atoms. There are cyclotrisiloxane (D3), cyclotetrasiloxane (D4), cyclopentasiloxane (D5), cyclohexasiloxane (D6) and cycloheptasiloxane (D7). These substances may be used either in pure form or as mixtures.

The most common cyclomethicone for the cosmetics industry is *Cyclopentasiloxane*. Synonyms: decamethylcyclopentasiloxane, cyclomethicone pentamer, and volatile silicone. Chemical name is decamethylcyclopentasiloxane. Chemical formula:



The substance is a colorless transparent liquid, practically odorless, non-fat, of low viscosity, similar in appearance to water. Its physical characteristics:

- Density at 25°C - 0.95-0.96 g/ml;
- Viscosity at 25°C - 4 mm²/s;
- Flash point - 77°C;
- Freezing temperature - below -50°C.
- Soluble in water, glycerol, insoluble in ethanol;

- Is miscible with fatty alcohols, bees wax (by heating and melting), stearic acid, essential oils (e.g., almond oil, jojoba, soybean, sunflower, but not with the castor oil, partially miscible with hardened oils), mineral oils, synthetic esters (emollients), and other silicones.

As part of care products for skin, just like natural oils, it acts as an emollient, i.e. softening/superfating supplements. In comparison with oils it has several advantages:

- It is inert, does not penetrate deep into the skin and does not interfere with the physiological processes occurring, i.e. is a neutral component;

- Does not enter into any chemical reactions with other ingredients, thus active substances are preserved in their original form;

- Resistant to oxidation and deterioration, stable in the product;

- Completely evaporates from the surface of the skin without creating an occlusive layer;

- Non-comedogenic.

Having a low skin irritation potential, cyclomethicone is used in products for sensitive skin. It is ideal for an oily skin (the input into the formulation at the temperature below 50°C). A recommended dosage:

- Children's cosmetics - up to 10%,

- Creams or gels for the face after shaving, the cleaning compositions - up to 20%, more typically 1-5%,

- Waterless skin care means - up to 50-70%,

- Massage Oil - up to 10-15%,

- Hair conditioners - up to 8-10%,

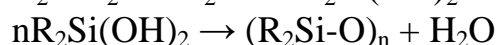
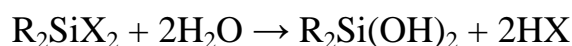
- Hair sprays - up to 99%,

- Dry perfume: 15-85%.

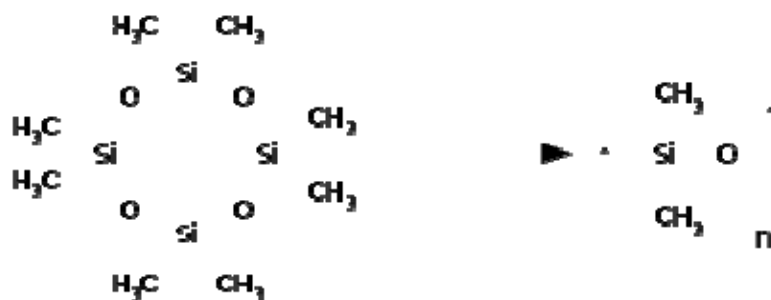
Besides classical silicones (such as the already mentioned dimethicones, cyclomethicones D5, D6, D7, and phenyl trimethicones and alkyl silicones), the formulations of makeup products often use **dimethicone copolyols** due to their excellent emulsifying properties, as well as crosslinked and branched **polysiloxanes** and **silsesquioxanes**.

In general, organopolysiloxanes are synthesized by conventional methods of the polymer chemistry, including polycondensation and polymerization.

One of the most common methods is the hydrolytic polycondensation of functionalized diorganosilanes - dichlorosilanes, dialkoxy- and diacyloxy- and diaminosilanes. The method is based on the hydrolysis of the functional groups leading to the formation of unstable diorganosilanes that oligomerize to form cyclosiloxanes:



Cyclosiloxanes, formed in the reaction mixture, then are polymerized under the ionic or cationic mechanism:



By changing the polymerization conditions, molecules of different lengths can be obtained, which will have different physical properties. Thus, polymers with short chains - liquids - are excellent lubricants, preserving useful properties in a very wide temperature range (-100 to 300°C).

Longer siloxane molecules form rubbers, which unlike conventional rubbers retain elasticity over a wide temperature range.

The easiest hydrolytic polycondensation process occurs with dichlorosilanes, but in this case hydrogen chloride is released, which is unacceptable in some cases, such as the synthesis of polymers for medical devices. In these cases, diacetoxysilanes are used (prepared by acetylation of chlorosilanes with potassium acetate). In the course of the hydrolytic polycondensation nontoxic acetic acid is formed, but the process proceeds much slower.

Currently, in the industry for producing organosilicon monomers (methylchlorosilanes, ethylchlorosilanes, phenyltrichlorosilanes) usually hydrogen chloride and commercial silicon alloys with copper are used.

Currently in Russia in total slightly more than 2.1 thousand tons of silicone polymers (silicones) in primary forms is produced. Of these, about 0.5 thousand tons are accounted for rubbers (JSC "Kazan Synthetic Rubber Plant"), 0.2 thousand tons - for plastics and polymer coatings, synthetic resins (JSC "Zhilevsky Plant of Polymeric Materials" - Moscow region, CJSC "Huntsman-NMG" - Kaluga region). Silicone fluids for the production of lubricants, rubber products, etc. are released by JSC "Silan" (Dankov, Lipetsk region), JSC "Altaikhimprom" (Altai Territory).

The Russia's largest manufacturer of monomers for the production of silicones (including for use in the cosmetics industry) is "Khimprom" (Novocheboksarsk, Chuvashia). The total amount of release of Novocheboksarsk organosilicone products exceed 1.1 thousand tons per year. Specifically, the company produces: trichlorosilane (TU 2437-443-05763441-2004), phenyltrichlorosilane technical (OST 6-02-100-73) and improved (TU 2437-538-05763441-2012).

Silicone emulsions, used in the cosmetic industry, are produced by:

- **CJSC "Sofex-Silicone" (Moscow).** Silicone polymers for the cosmetics industry are produced under the brand SOFEXIL (TU 6-05-42942526-96) and represent a mixture of polymethylsiloxane oligomers of linear and cyclic structures, water-oil emulsions of polydimethylsiloxane.

Contact info:

CJSC "Sofex-Silicone"
111141, Moscow, 2-nd proezd Perova Poly, 9.
Phone/fax: +7 (495) 741-02-85
E-mail: mail@sofex-silicone.ru
<http://www.sofex-silicone.ru/>

- **LLC "Penta Volga" (Togliatti, Samara region)** is a part of the group of companies "Penta" - ventures for the production of silicone compounds, silicone fluids for various purposes, organosilicone compounds, etc. Since April 2012 a group of companies "Penta" is part of ITW Performance Polymers & Fluids (USA). For the cosmetics industry the company produces polymethylsilicone and polyethylsiloxane liquids (oils).

Contact info:

LLC "Penta Volga"
445043, Samara region, Togliatti, Kommunalnaya st., 33
Phone: (8482) 62-12-54
Phone/fax: (8482) 39-21-61
E-mail: penta@penta-volga.ru
<http://www.penta-volga.ru>
<http://www.penta-volga.ru/cosmetics.html>

- **SSC RF FSUE "GNIKhTEOS"** - State Scientific Center of the Russian Federation State Research Institute of Chemistry and Technology of Organoelement Compounds (Moscow). It releases, among other compounds, silicone products for the construction, rubber-technical and other industries. The range of products includes a variety of silicone-based defoamers, as well as cosmetics, developed jointly with CJSC "Astera", presented in the form of multi-component emulsions based on organosilicon and organogermanic compounds.

Contact info:

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111123, Moscow, Entuziastov shosse, 38
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<http://www.eos.su/>
CJSC "Astera"
Phone: (495) 673-79-55, (495) 673-71-67
E-mail: astera98@mail.ru

However, the Russian production of silicone emulsions for the cosmetic industry is small (by assessment of "InfoMine" it does not exceed 200-300 tons per year). Besides, the quality of Russian products can not compete with foreign counterparts.

Therefore, currently the bulk of considered cosmetic ingredients are purchased from foreign manufacturers.

The analysis of foreign trade operations with silicone emulsions, dimethicones and cyclomethicones was carried out by the HS codes 3910 "Silicones in primary forms", 2931 "Other organo-inorganic compounds" and "Prepared binders for foundry molds or cores; chemical products and preparations of the chemical or allied industries (including those consisting of mixtures of natural products), not elsewhere specified or included". Data sampling was performed manually by line.

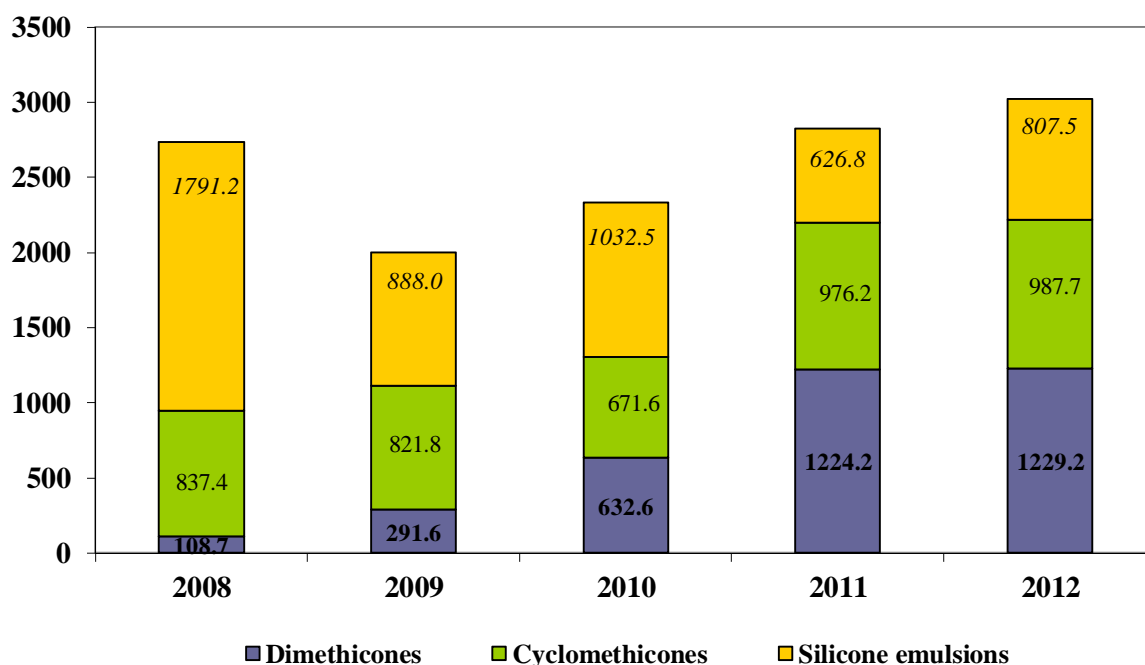
Russian **imports** of silicones for the cosmetic industry in 2008-2012 generally had an upward trend. The share of imports of dimethicones and cyclomethicones in total amount of silicones increased (Figure 1).

During the reporting period the imports of silicone emulsions, dimethicones and cyclodimethicones increased by 10.5% (from 2.74 thousand tons in 2008 to 3.02 thousand tons in 2012).

The largest Russian importers of *silicone emulsions* of the brand XIAMETR of the company DOW CORNING are manufacturers of cosmetics LLC "Unilever Rus" and CJSC "L'Oreal", as well as trade and logistics company LLC "Russo Logistics".

It should be noted that these amounts of specific types of considered products are quite approximate, because they are not separated in customs declarations (one line may list several brands of emulsions, as well as many items that can not be identified).

Figure 1. Volumes of imports of silicones for the cosmetic industry (by type) in Russia in 2008-2012, tons



Source: "InfoMine" based on the analysis of customs statistics of the Russian Federation

In addition, the logistics companies (LLC "Russo Logistics" and LLC "Momentive Performance Materials RUS") purchase siloxanes and silicone emulsion not only for the cosmetic, but also for the textile, rubber-technical and other industries. And products for use in various industries may also be listed in one line indicating the total supply volume. The same applies to products that are in different states of aggregation (liquids, emulsions, solids), etc.

Nevertheless, it was found that the largest Russian buyer of imported *dimethicones* for the cosmetics industry in the last 3 years is LLC "Russo Logistics". The enterprise receives polydimethylsiloxane fluids produced by Dow Corning (Table 1).

The second largest purchaser of the products in question is LLC "Momentive Performance Materials RUS", the Russian representative of Momentive Performance Materials Inc. - the global developer and manufacturer of specialty chemicals and materials. The Russian representative office provides domestic consumers with polydimethylsiloxane Centistoke under the brand BAYSILONE, produced by plants in Germany, USA, etc.

Table 1. Largest Russian buyers of imported silicone emulsions, dimethicones and cyclomethicones for the cosmetic industry in 2008-2012, tons

Recipient enterprise, volume and a price of a cosmetic compound by companies-producers		2008	2009	2010	2011	2012
<i>Silicone emulsions XIAMETR MEM-7051HS, XIAMETR MEM-7134, XIAMETR MEM-7128, XIAMETR MEM-1788, XIAMETR MEM-1785, XIAMETR MEM-0949 (Belgium, USA, China and others)</i>						
LLC "Unilever Rus", Moscow, branch in St. Petersburg	volume, tons					
	price, \$/ton					
<i>Silicone emulsion XIAMETR MEM-1391 (USA)</i>						
LLC "Unilever Rus", Moscow, branch in St. Petersburg	volume, tons					
	price, \$/ton					
<i>Silicone emulsion DB-310 ANTIFOAM (Belgium)</i>						
LLC "Unilever Rus", Moscow, branch in St. Petersburg	volume, tons					
	price, \$/ton					
Other (LLC "Russo Logistics", LLC "Bio-Khim", JSC "Henkel Pemos")	volume, tons					
	price, \$/ton					
<i>Silicone emulsion DOW CORNING(R) 949 CATIONIC (Belgium)</i>						
LLC "Russo Logistics", St. Petersburg	volume, tons					
	price, \$/ton					
JSC "Arnest", Nevinnomyssk, Stavropol Territory	volume, tons					
	price, \$/ton					
<i>Dimethicones (polydimethylsiloxanes)</i>						
LLC "Russo Logistics", St. Petersburg	Dow Corning (United Kingdom, USA, Belgium), tons					
	price, \$/ton					
LLC "Momentiv Perfomans Materials RUS", Moscow	Momentive Performance Materials (Germany, USA, Japan, China), tons					
	price, \$/ton					
CJSC "L'Oreal", Moscow	Wacker (Germany), tons					
	price, \$/ton					
	MIRASIL DM, BELSIL DM (Spain), tons					
	price, \$/ton					

Recipient enterprise, volume and a price of a cosmetic compound by companies-producers		2008	2009	2010	2011	2012
	XIAMETER (United Kingdom, Belgium), tons					
	price, \$/ton					
	total, tons					
	average price, \$/ton					
LLC "Unilever Rus", Moscow, branch in St. Petersburg	XIAMETER (United Kingdom), tons					
	price, \$/ton					
Others (LLC "Chemical Service", LLC "Penta Silicone", etc.)	volume, tons					
	price, \$/ton					
Total dimethicones, tons						
Average price, \$/ton						
<i>Cyclomethicones (decamethylcyclopentasiloxane)</i>						
LLC "Unilever Rus", Moscow, branch in St. Petersburg	KCC Corporation (South Korea), tons					
	price, \$/ton					
	Dow Corning (United Kingdom), tons					
	price, \$/ton					
	Shin-Etsu Chemical, (Japan, Thailand), tons					
	price, \$/ton					
	Momentive Performance Materials (Germany), tons					
	price, \$/ton					
	total					
	average price, \$/ton					
LLC "Russo Logistics", St. Petersburg	Dow Corning (United Kingdom), tons					
	price, \$/ton					
Others (LLC "Momentiv Performance Materials RUS", LLC "Revada" and others)	Momentive Performance Materials (Germany) and others, tons					
	price, \$/ton					
Total cyclomethicones, tons						
Average price, \$/ton						