

Metso[®] Sodium Metasilicate

A Soluble Silicate for
Institutional and Industrial Cleaning

Introduction

PQ Corporation is a leading producer of specialty inorganic chemicals, catalysts and engineered glass products. The Company conducts operations through three principal businesses, the Performance Chemicals division, which develops, manufactures and sells high performance silicate-based specialty chemicals, the Catalyst division, a leading producer of catalysts and the Potters division, which manufactures and sells highly engineered solid and hollow glass spheres. PQ Corporation operates worldwide with more than 60 plants in about 20 countries and has one of the most comprehensive global manufacturing and distribution networks serving a large variety of industries with a broad range of environment friendly products.

The Metso® range of Sodium Metasilicate Pentahydrate

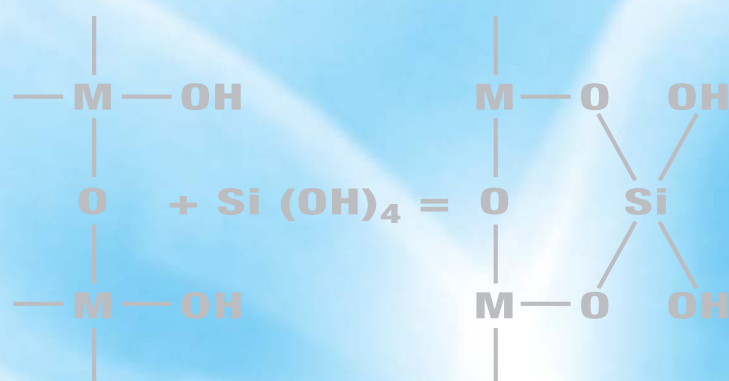
Sodium Metasilicate has been used for a long time in alkaline cleaning agents for the household and industrial sectors. Sodium Metasilicate provides both silica and alkalinity in a molar ratio of 1:1 between silica and sodium oxide, which makes it especially suitable for hard surface cleaning. Its multifunctional cleaning properties enhance the removal of fatty and particulate soil in both soft and hard water. The corrosion inhibiting properties of Sodium Metasilicate help protect both metal and non-metal surfaces.

Metso Sodium Metasilicate Pentahydrate granules are white and free-flowing. The product is characterized by:

- high dissolution rate, even in cold water
- negligible insoluble residue
- high mechanical strength
- low dust content
- available as fine and medium sized granules.

Metso Sodium Metasilicate Pentahydrate is available in different grades:

Product name	Metso 510	Metso 520	Metso 530	Metso 500
Product form	Fine granular	Medium granular	Coarse granular	Powder
SiO ₂ , %	28,5	28,5	28,5	28,5
Na ₂ O, %	28,7	28,7	28,7	28,7
LOI, 800°C, %	43,0	43,0	43,0	43,0
Bulk density, g/l	900	900	900	700
Mean particle size, µm	775	1075	>1000	90



Product Properties



Solubility

The maximum solubility of Metso Sodium Metasilicate Pentahydrate in water is dependent on the following:

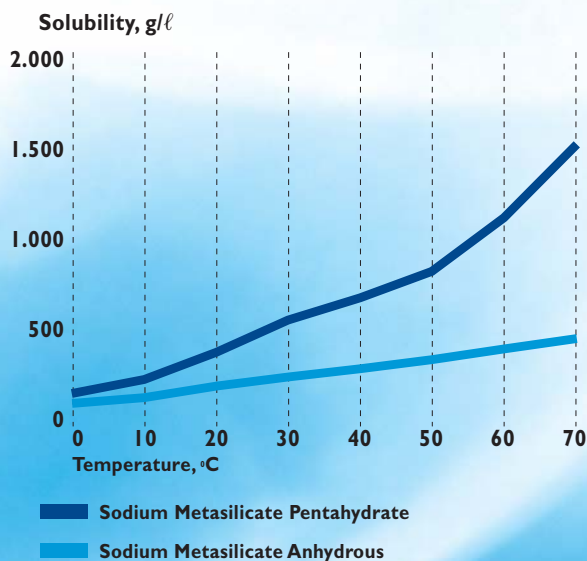
- The temperature.
When making solutions at maximum concentration, it is important to maintain the temperature above the solubility point in order to avoid recrystallization.
- The ion strength.
The solubility decreases with increased ionic strength but this is more significant in saturated solutions.

Dissolution rate

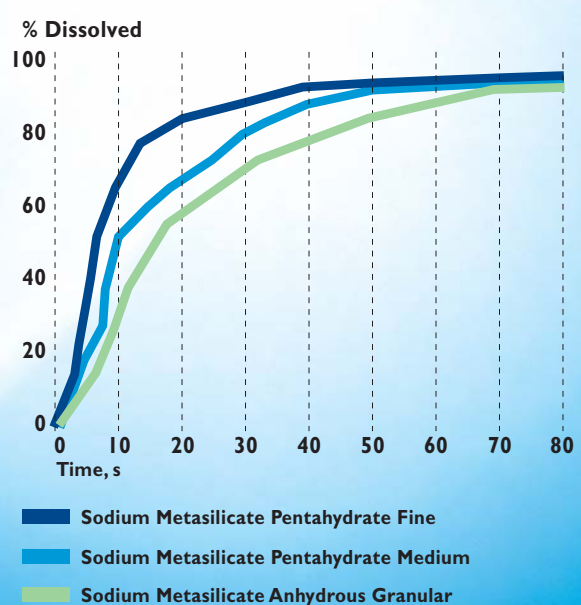
The dissolution rate, like the solubility, is dependent on the temperature. Other factors that influence the dissolution rate are:

- The particle size. Smaller particles dissolve faster than larger particles.
- The particle characteristics. The lower the mechanical strength and the higher the porosity, the higher the dissolution rate.
- The degree of hydration. Metso Sodium Metasilicate Pentahydrate dissolves faster than Sodium Metasilicate Anhydrous.

Solubility of Sodium Metasilicate



Dissolution rate of different Sodium Metasilicate grades



Alkalinity

The alkalinity provided by Metso Sodium Metasilicate Pentahydrate saponifies fatty soil which makes them readily dissolvable.

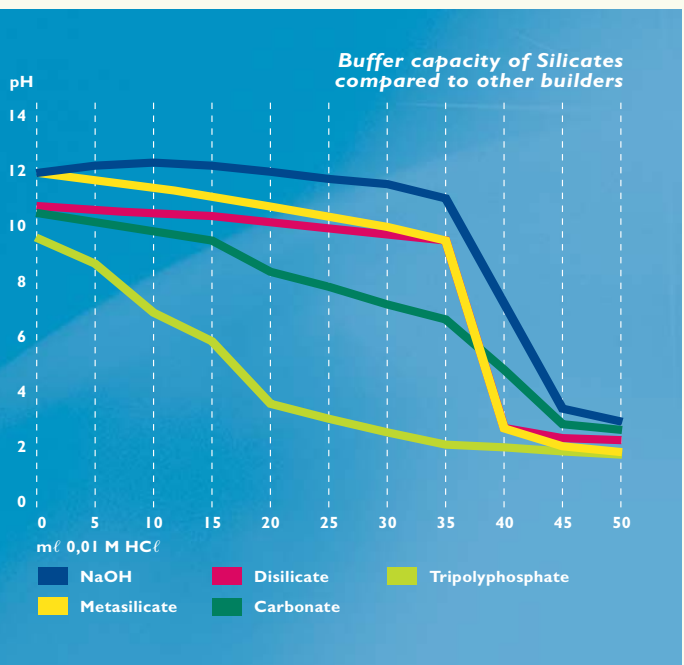
The saponified fatty soil acts as a soap and contributes to the emulsification and removal of oily and greasy soil. The alkalinity also neutralizes acid soils, and breaks down protein and starch. The high active alkali and minimum inactive alkali content makes Metso Sodium Metasilicate Pentahydrate an economical choice for cleaning applications. The table shows the active and inactive alkali content for common industrial alkalies.

Average alkali content of industrial alkalies

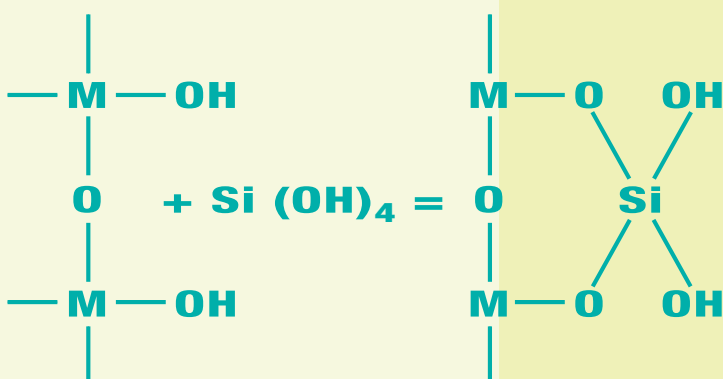
PRODUCT	ACTIVE ALKALI % Na ₂ O	INACTIVE ALKALI % Na ₂ O	TOTAL ALKALI % Na ₂ O	PH OF 1% SOLUTION AT 20°C
Sodium Metasilicate Pentahydrate	28	0,7	28,7	12,5
Sodium Metasilicate Anhydrous	49	2,0	51	12,6
Sodium Hydroxide	76,0	-	76,0	13,1
Sodium Carbonate	29,0	29,0	58,0	11,4
Sodium Sequicarbonate	13,8	27,5	41,3	9,8
Sodium Bicarbonate	-	36,9	36,9	8,4
Tri Sodium Phosphate	10,0	8,0	18,8	12,1
Tetra Sodium Pyrophosphate	6,7	16,2	22,9	10,2
Sodium Tripolyphosphate	1,6	15,3	16,9	9,4

Buffering action

It is very important to keep the pH at a high and constant level throughout the cleaning process. Acidic soils lower the pH of the cleaning solutions below that required for optimum cleaning by the surfactants and other ingredients. Metso Sodium Metasilicate Pentahydrate is an excellent buffer and the effect of acid soil is minimized. Compared to other alkalis, with the exception of sodium hydroxide, Metso Sodium Metasilicate Pentahydrate keeps the cleaning solution at constant pH over an extensive loading of acidic soil, see figure below. A constant pH level contributes to the effectiveness of the silicate in cleaning functions involving emulsification of oils and grease and suspension of particulate soils. A declining pH will lead to a reduction of the overall performance of the cleaning solution.



Deposition of Silica on metal surface



Corrosion inhibition

By forming a protective barrier, the soluble silica content of Metso Sodium Metasilicate Pentahydrate acts as a corrosion inhibitor and protects metal, glass and ceramic surfaces against alkaline attack from other detergent ingredients such as phosphates, synthetic detergents and other alkalis. The mechanism of corrosion inhibition on metal is shown in the figure left. The monomeric species of silica are negatively charged and will adsorb onto the metal surface and form a thin monomolecular film, which will inhibit corrosion. The film does not build on itself and will not form excessive scale. The film is an electrical insulator and blocks the electrochemical reactions of corrosion, yet is thin enough that it does not obstruct water flow.

The detergency properties of Metso® Sodium Metasilicate Pentahydrate

Detergency

The cleaning process involves removing the soil from the surface, dispersing the soil in the solution and preventing redeposition of the soil on the surface. The soil is usually classified as particulate, oily, proteinaceous, starchy or fatty. The cleaning process is dependent on the following factors:

- the type and amount of soil
- the amount of water used
- the type of surface
- the water hardness
- the time of the cleaning cycle
- the composition of the detergent
- the temperature.

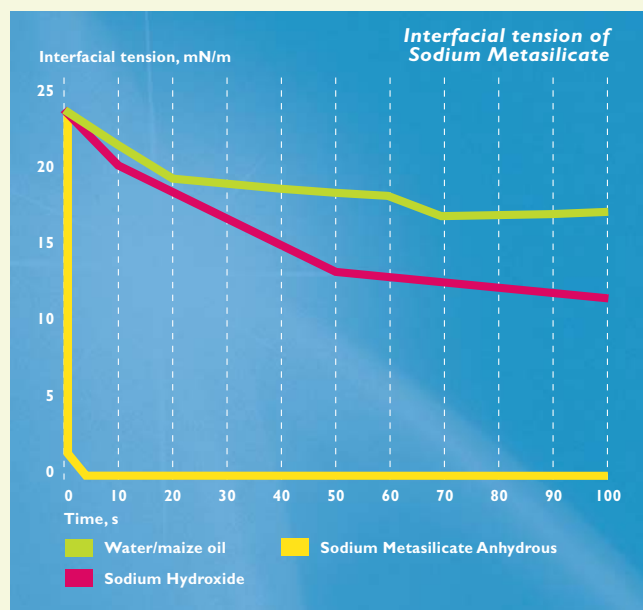
Metso Sodium Metasilicate Pentahydrate contains an optimum proportion of alkali and soluble silica for heavy duty cleaning, which involves removal of high loading of fatty and oily soils and particulate soils. The grease and dirt deposits are scattered into small suspended particles that are rinsed away without redepositing on freshly washed surfaces.

Builder action

Metso Sodium Metasilicate Pentahydrate acts as a buffer and keeps the pH at an optimum level for detergency. It also sequesters water hardness ions in order to ensure maximum cleaning performance of the surfactant system in hard water.

Interfacial tension

The figure below shows the interfacial tension between oil and water. The combination of soluble silica and alkali in Metso Sodium Metasilicate Pentahydrate reduces the interfacial tension more than alkali alone. This means that the cleaning performance of the surfactant system is enhanced and that oily and fatty soils are easier removed. Metso Sodium Metasilicate Pentahydrate also contributes to the wetting action of the cleaning solution.



Emulsification

Emulsification is the process of removing and suspending oily soils in water. Metso Sodium Metasilicate Pentahydrate provides alkali that saponifies fatty and oily soils to soap contributing to the emulsification of fatty and oily soils.

Deflocculation and suspension of soils

Metso Sodium Metasilicate Pentahydrate removes particulate soil like clay by charging both the soil and the surface with negative charges, see figure below. The soil is broken into fine particles, making them easier to remove and easier to suspend in the washing solution. The negative charge of Metso Sodium Metasilicate Pentahydrate has an additive effect on the negative charge of the particulate soil. The repelling forces keep the particles apart and prevent them from agglomerating and forming larger particles.

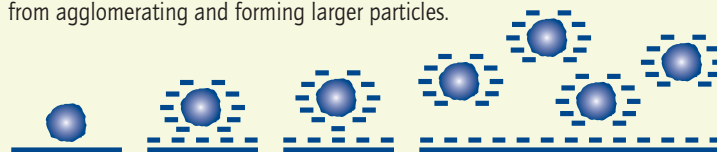


Illustration of deflocculation

Prevention of redeposition

The ability of Metso Sodium Metasilicate Pentahydrate to keep emulsified soils and particulate soils suspended in solution contributes to the prevention of soil redeposition onto cleaned surfaces.

Metso Sodium Metasilicate Pentahydrate in detergent Formulations

Metso Sodium Metasilicate Pentahydrate is mainly used in Industrial and Institutional detergents. The unique combination of silica and alkalinity in the Metso range of Sodium Metasilicates ensures effective cleaning across the wide range of I&I powder, tablet, liquid and block detergents.

Metso Sodium Metasilicate Pentahydrate provides:

- Alkalinity that saponifies fatty soils and make them easy to dissolve. The saponified fatty soil contributes to the cleaning process.
- Silica that disperses the soil in the solution and prevents it from redepositing on the surface.
- Excellent buffering capacity which means that the pH is kept constant throughout the process.
- Sequestration of calcium and magnesium ions in order to soften the water.
- Protection against corrosion on metal, china and glass surfaces.
- Stabilization of the bleaching agent during the washing process.

Other applications of Metso Sodium Metasilicate Pentahydrate

- Lithographic process
- Enhanced oil recovery
- Refractory and acid resistant cement
- Waste treatment
- Scouring of textiles
- Paper coatings
- Ore flotation
- Refining of natural oils

Certificates

To assure our customers of a product with a constant quality which complies with their requirements we have certified our system according ISO 9001. In future we will continue to make every effort to meet the wishes of customers.

By certifying our Environmental Management System in accordance with the requirements of the environmental standard ISO 14001 we assure that our environmental performance not only meets, but will continue to meet, legislative and policy requirements.

Packaging and handling

Packaging

Metso Sodium Metasilicate Pentahydrate is available in bags, net weight 25 kg, big bags, and bulk.

Storage

Dry sodium silicates are hygroscopic products and adsorb water from the ambient air. Metso Sodium Metasilicate Pentahydrate should be stored in a cool and dry warehouse in its original package protected against moisture. When delivered in bulk to a silo, Metso Sodium Metasilicate Pentahydrate must be protected against moisture.

Handling and safety

Metso Sodium Metasilicate Pentahydrate is a strongly alkaline product and should be handled with care in order to prevent injuries.

The Material Safety Data Sheet provides more detailed information about handling, safety and labelling.



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