PQ CORPORATION

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PQ Corporation, recently acquired by JPMorgan Partners, is a leading producer of silicate, zeolite, and other performance materials serving the detergent, pulp and paper, chemical, petroleum, catalyst, water treatment, construction, and beverage markets. It is a global enterprise, operating in 19 countries on five continents, and along with its chemical businesses, includes Potters Industries, a wholly owned subsidiary, which is a leading producer of engineered glass materials serving the highway safety, polymer additive, metal finishing, and conductive particle markets.

Bulletin 17-18

PQ® Soluble Silicates for Textile Processing

INTRODUCTION

In the textile industry PQ's sodium and potassium silicates are used for a variety of functions, including:

- Hydrogen peroxide bleach stabilization
- Detergency
- Pad-batch dyeing
- Corrosion inhibition
- Water treatment

Sodium silicates are supplied as aqueous solutions at different weight ratios of SiO_2 to Na_2O. Depending upon their ratio, the liquid sodium silicates provide a wide range of chemical and physical properties.

KASIL® potassium silicates are manufactured much like the sodium silicates except that K_2O is the alkali component. These products are generally used as substitutes for sodium silicate in areas where higher solubility is required, or the potassium is preferred to the sodium ion in solution.

PQ's METSO® product line contains the crystalline sodium silicates at a 1:1 SiO_2/Na_2O ratio. Because of their unique detergency properties, they are able to remove light or heavy grease and soil in either hard or soft water.

TABLE 1. PQ® SILICATES USED IN TEXTILE PROCESSING
The properties shown are typical values, not manufacturing specifications

LIQUID SODIUM SILICATES

PRODUCT	WT. RATIO SiO_2/Na_2O	COMPOSITION		DENSITY			VISCOSITY AT 68°F (20°C) (Centipoises)
		% Na_2O	% SiO_2	°Be	lb./gal	g/cm³	
O®	3.22	9.2	29.5	42.2	11.8	1.41	400
N®	3.22	8.9	28.7	41.0	11.6	1.38	180
N® CLEAR	3.22	8.9	28.7	41.0	11.6	1.38	180
E®	3.22	8.6	27.7	40.0	11.5	1.37	100
STAR®	2.50	10.6	26.5	42.0	11.7	1.40	60
D®	2.00	14.7	29.4	50.5	12.8	1.53	400
B-W®	1.60	19.7	31.5	58.5	14.0	1.67	7,000

LIQUID POTASSIUM SILICATES

PRODUCT	WT. RATIO SiO_2/Na_2O	COMPOSITION		DENSITY			VISCOSITY AT 68°F (20°C) (Centipoises)
		% K_2O	% SiO_2	°Be	lb./gal	g/cm³	
KASIL® #1	2.50	8.3	20.8	29.8	10.5	1.26	40
KASIL® #6	2.10	12.6	26.5	40.3	11.5	1.38	1050
KASIL® 2130	2.10	9.5	20.0	30.9	10.6	1.27	10

NOTE: When ordering liquid silicates it is important to specify both the density AND ratio. Some grades, e.g. O® and STAR®, have similar densities but their ratios and physical and chemical properties are very different.

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CRYSTALLINE SODIUM ALKALI SILICATES							
PRODUCT	MOLE RATIO $Na_2O:SiO_2$	COMPOSITION			DENSITY		Approximate Sizing Tyler Screen
		% Na_2O	% SiO_2	% H_2O	lb/ft^3	g/cm^3	
METSO PENTABEAD® 20	1:1	29.3	28.4	41.6	55	0.88	Between 20 & 48 mesh
METSO BEADS® 2048	1:1	51.0	47.0	—	68	1.09	Between 20 & 65 mesh

BLEACHING

The decomposition of peroxide solutions is accelerated by the catalytic action of some common metals such as copper, iron and manganese. Sodium silicate blocks this catalytic reaction and stabilizes the peroxide. As a result, the amount of hydrogen peroxide consumed per pound of goods bleached is reduced, thus lowering the bleaching cost. Silicates can also increase the ceiling brightness threshold resulting in a brighter final product.

Continuous Bleaching. In J-Box operations, the cloth is put through the caustic saturator, passes into a steam tube, and then enters the J-Box where the caustic acts on the cellulosic material. Silicate is introduced in both the caustic saturator operation and in the peroxide saturator sequence.

In a variation of this system, steam tubes are not used prior to the goods entering the J-Box, but instead steam is introduced at the bottom of each J-Box. After leaving the first “J,” the goods are washed and squeezed. A saturating bath of peroxide and silicate follows. Finally, the cloth travels from the second “J” to the washer, the squeezer, and then to the white room.

Successful continuous bleaching is often conducted at a 1:1 ratio of STAR® silicate to 50% hydrogen peroxide. However, some mills have increased the ratio to 2:1 silicate-to-H_2O_2 for heavier weight fabrics. Since plant equipment, materials, and individual requirements differ, the user should determine the optimum amount of silicate for each application prior to full scale use.

Silicate build up is minimized by regular rinsing of process equipment. Most build up is removed with warm water. Excessive build up may require use of hot water and/or a dilute solution of caustic soda. Normal precautions should be observed when working with caustic soda solutions.

PAD-BATCH DYEING

Pad-batch dyeing is a textile dyeing process which offers simplicity, versatility and flexibility without major capital investment in equipment. It can increase production and improve dyeing quality and reproducibility, while reducing processing costs. Both knitted and woven goods containing cellulosic fiber can take advantage of this process.

PQ sodium silicates are utilized as part of the fixation alkali, providing the necessary buffering to keep reactive dyes stable. Selection of the proper sodium silicate is critical for optimal dye yield and performance. When knitted greige goods are pad-batch dyed, the silicate helps to sequester knitting oils and saponify spinning waxes. The following ranges have been developed for pad-batch dyeing formulas for knitted greige goods:

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10-60 g/L. Cibacron* Type Reactive Dye
55g/L. O® Sodium Silicate
1.2-4 g/L. Caustic soda flakes

*Cibacron is a registered trademark of Ciba-Geigy Corp.

Specific formulations required to produce desired colors can be obtained from the Ciba-Geigy Corporation's Dyestuffs & Chemicals Division, Greensboro, NC 27419.

DETERGENCY OPERATIONS

In spite of good mill housekeeping, cloth becomes stained with oils, grease, and dirt as it travels from one operation to another. Such soil must be removed. Temporary sizings must also be removed. PQ's METSO sodium metasilicates are particularly suitable for these detergent operations.

The combination of high active alkali and soluble silica is responsible for the ability of METSO silicates to provide six important detergency functions: (1) wetting the soil; (2) neutralizing fatty acid soils; (3) saponification of triglycerides and greases; (4) deflocculating clay and dirts; (5) suspending soil; and (6) preventing soil redeposition.

Despite sudden loads of acidic soil, METSO detergents hold the cleaning solution at a sustained pH level. Because of this buffering action, initial supplies last longer in the detergent bath. Detergent solutions without buffered alkalies are soon exhausted by acid soil, resulting in a sharp drop-off of pH and consequent loss of cleaning action.

Textile scouring and other detergent operations require the complete rinsing of alkalies. METSO sodium metasilicates fulfill this demand because washing solutions do not cling to clean surfaces or leave sticky residues behind after rinsing.

METSO sodium metasilicates are well suited to the detergent operations of textile wet processing because they improve cleaning action when used alone or with soaps, syndets, phosphates, wetting agents or other alkalies. The cleaner the fiber, the more even the dye penetration, and hence, a more level color is obtained.

OTHER APPLICATIONS

Corrosion Inhibition. Corrosion in water lines, metal tanks, vats, and humidifying systems of textile mills is effectively and inexpensively controlled through the introduction of liquid sodium silicates. Active metals such as copper, brass and aluminum are particularly vulnerable to corrosion in the absence of silicate's protection. Treatment is particularly valuable in soft water which ordinarily attacks metal rapidly.

Water Treatment. Turbidity of raw water is of concern to textile mills because it affects the quality of the finished goods. PQ's N-SOL® processes for making activated silica sol provide both effective and economical coagulation performance for water treatment. When used in conjunction with alum, ferric salts or other coagulants in the treatment of raw water, activated silica sols increase the speed of floc formation the size density, and strength of the

floc. In addition, activated silica sols improve the clarity of the overflow from setting basins.

SAFETY INFORMATION

Depending on their degree of alkalinity, soluble silicates may irritate or burn the skin and eyes. Precautions for handling, provided on the labels of packages, should be observed. Material Safety Data Sheets are available for all products for further guidance.

APPLICATION ASSISTANCE

For additional information and/or further assistance, contact PQ's Industrial Chemicals Division. Our sales or technical service representatives will be happy to assist you in selecting and evaluating the proper PQ sodium silicate for your specific textile processing applications.

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