Technical Information

TI/ES 1151 e
July 1992 (DFC)

Supersedes TI/P 3037 e dated May 1988

Sokalan® PA types

Sokalan PA 13 PN
Sokalan PA 15
Sokalan PA 20 PN
Sokalan PA 20
Sokalan PA 25 PN
Sokalan PA 25 PN Granules
Sokalan PA 30
Sokalan PA 30 CL
Sokalan PA 40
Sokalan PA 40 Powder
Sokalan PA 50
Sokalan PA 70 PN
Sokalan PA 80 S
Sokalan PA 110 S

Additives for low-phosphate and phosphate-free detergents and cleaners.

Dispersing agents for organic and inorganic solids in water-treatment processes, etc.

Specialty Chemicals

BASF

Sokalan PA types

Chemical nature

The Sokalan PA types are polyacrylates. Their average K value, which is a guide to their molar mass, is indicated by the numeric code.

The alphabetic suffix indicates the following.

PN = Partially neutralized
S = Free acid

All products without a suffix are neutralized with sodium hydroxide before they are dispatched.

Properties

The Sokalan PA types are clear or slightly cloudy, yellowish liquids. Sokalan PA 40 is also supplied as powder and Sokalan PA 25 PN in granular form.

The most important properties of the Sokalan PA types are listed in the following table. All figures are averages for a representative sample of batches.

Properties of the Sokalan PA types

Sokalan	Unit	PA 13 PN	PA 15	PA 20 PN	PA 20	PA 25 PN	PA 25 PN Granules	PA 30
Physical form		Liquid	Liquid	Liquid	Liquid	Liquid	Granules	Liquid
Concentration* (Dried at 150 °C until mass remains constant)	%	ca. 54	ca. 45	ca. 54	ca. 45	ca. 54	ca. 92	ca. 45
Average molar mass Mw	g/mol	1000	1200	2500	2500	4000	4000	8000
K value		13	15	20	20	25	25	30
Water content (ISO 3373)	%	ca. 46	ca. 55	ca. 46	ca. 55	ca. 46	ca. 7	ca. 55
pH (10 % active		ca. 4	ca. 8	ca. 4	ca. 8	ca. 4	ca. 4	ca. 8
Density (23 °C)	g/cm^3	ca. 1.24	ca. 1.32	ca. 1.24	ca. 1.32	ca. 1.26	–	ca. 1.34
Bulk density (ISO 697)	g/l	–	–	–	–	–	ca. 650	–
Viskosity (23 °C, Brookfield, 60 rpm)	mPa·s	ca. 300	ca. 250	ca. 700	ca. 400	ca. 1700	–	ca. 1400
Calcium carbonate dispersing capacity								
at 23 °C, pH 11	mg $CaCO_3$/g	ca. 95	ca. 80	ca. 125	ca. 100	ca. 135	ca. 135	ca. 120
at 60 °C, pH 11	mg $CaCO_3$/g		ca. 45	ca. 65	ca. 55	ca. 70	ca. 70	ca. 75

* Drying time
– Liquids: 2 hours
– Powders: 16 hours

	PA 30 CL	PA 40	PA 40 Powder	PA 50	PA 70 PN	PA 80 S	PA 110 S
	Liquid	Liquid	Powder	Liquid	Liquid	Liquid	Liquid
	ca. 45	ca. 35	ca. 92	ca. 40	ca. 30	ca. 35	ca. 35
	8000	15000	15000	30000	70000	100000	250000
	30	40	40	50	70	80	110
	ca. 55	ca. 65	ca. 8	ca. 60	ca. 70	ca. 65	ca. 65
	ca. 8	ca. 7	ca. 7	ca. 8	ca. 5	ca. 2	ca. 2
	ca. 1.34	ca. 1.25	–	ca. 1.29	ca. 1.17	ca. 1.14	ca. 1.14
	–	–	ca. 450	–	–	–	–
	ca. 1000	ca. 250	–	ca. 1500	ca. 200	ca. 1000	ca. 5000
	ca. 120 ca. 75	ca. 120 ca. 80	ca. 120 ca. 80	ca. 130 ca. 80	ca. 145 ca. 130	ca. 170 ca. 120	ca. 170 ca. 150

Molar mass

Molar mass was determined by gel permeation chromatography (GPC) with aqueous eluents. The columns were calibrated with samples of sodium polyacrylates with a very wide molar mass distribution. Their molar masses were measured by a combined GPC/laser-light-scattering method, calculating the area under the curve. The calibration method described by M.J. R. Cantow (J. Polym. Sci. A-1, 5 (1967), 1391–1394) was used, but the concentration correction recommended by Cantow was not employed.

K value

The K value* of a polymer is an indicator of its intrinsic viscosity, and is thus a guide to its degree of polymerization and molar mass.

The K values of 1%-active aqueous solutions were measured. Products with a pH of less than 7 were neutralized with sodium hydroxide.

Calcium carbonate dispersing capacity

The ability of the Sokalan PA types to inhibit incrustation is the result of their being able to disperse sparingly soluble solids. A method derived from the Hampshire test, which was developed specifically for chelating agents, can be used to test the effectiveness of dispersing agents in detergents (F. Richter and E.W. Winkler, Tenside Detergents **24,** Vol. 4, 1987, 213–216). The method consists of titrating a solution of dispersing agents against calcium acetate in the presence of an excess of carbonate ions until the solution becomes cloudy.

The results obtained for dispersing agents by this method are significantly lower than those obtained in the Hampshire test, but the differences between individual dispersing agents are more pronounced. The results correlate well with those obtained by measuring residual ash in washing trials, but variations in the composition of detergents can have a marginal effect on results in practical tests.

Method

1.0 g of dispersing agent, expressed in terms of the active substance, is dissolved in 100 ml of distilled water and neutralized. 10 ml of 10% sodium carbonate solution is then added, and the pH is adjusted to 11. This solution is then titrated against a 0.25 mol/l calcium acetate solution. The pH and temperature are maintained at a constant level.

Applications

Detergents

Legislation has been passed in many countries, and voluntary agreements have been reached in others, to reduce the amounts of pentasodium triphosphate in laundry detergents. The result has been a reduction in detergency and an increase in incrustation, the severity of which depends on the composition of the detergent, the type of fabric, water hardness and temperature. Hard water is the main cause of incrustation.

Polymers such as our Sokalan PA, CP and HP types can provide a considerable reduction in incrustation. They also boost detergency and keep soil redeposition to a minimum. Their effectiveness depends on the formulation in question, but they generally have to be added at rates of 1–4 %.

The low-molar-mass Sokalan PA types improve the granular structure of powder detergents, making them more free-flowing. They are added at 0.5–1%, expressed as solids. They also help to homogenize detergent slurries, enabling them to flow more easily. The main function of the Sokalan PA types with a molar mass in the upper range is to inhibit incrustation and soil redeposition. They also make a contribution to detergency.

Dispersing finely divided solids

The Sokalan PA types are very effective dispersing agents, solubilizers and protective colloids for use in aqueous dispersions of sparingly soluble solids that are predominately inorganic in nature. They can be added before or after the solids have precipitated.

The medium-molar-mass Sokalan PA types' main applications are as dispersing agents and protective colloids, and in water treatment processes. Their high soil-dispersing capacity makes them useful ingredients for the builder systems of cleaners.

**See H. Fikentscher, Cellulosechemie, 13, 58, 1932.*

The pigments that can be dispersed with Sokalan PA include iron oxide, aluminium oxide, aluminium silicate, calcium sulfate, calcium carbonate, titanium dioxide and china clay. Pigments of this type are incorporated in cleaners, polishes, paints, lubricants, mould-release agents and a host of other products. In the chemical industry, Sokalan PA types can be used to prevent finely divided particulate solids formed by chemical reaction in aqueous media from reagglomerating. This ensures they are able to participate in further chemical reactions.

The dispersing effect of the medium-molar-mass Sokalan PA types is most pronounced if the solids to be dispersed are ground in the presence of the dispersing agent, rather than being dispersed afterwards in a separate operation, because the dispersing agent is then able to occupy the reactive sites on the particles immediately. The same applies to the solids generated by chemical reactions.

The levels at which the Sokalan PA types are added vary according to the type of solids to be dispersed. They are normally added at rates of between 0.1% and 5%, expressed as a proportion of the dispersed solids, They are compatible with ionic and nonionic surfactants from our Nekal®, Lutensit® and Lutensol® ranges, and they often give better results if they are used in combination with products of this type.

Water treatment

Hard-water salts tend to form deposits on the surfaces of heat exchangers, pipes and nozzles, etc., and coalesce to form a hard scale. The low-molar-mass Sokalan PA types, Sokalan PA 13 PN to Sokalan PA 40 inclusive, are particularly effective against this type of scale.

If any solids do precipitate, they settle out in the form of a loosely aggregated sludge consisting of fine flocs which can easily be collected and removed from the system.

Sokalan PA 13 PN to Sokalan PA 40 inclusive are usually added to water at rates of between 15 – 60 mg/l, and Sokalan PA 40 Powder at 5 – 20 mg/l. They tend to have a solubilizing effect on scale at higher concentrations, which is comparable to that of chelating agents such as polyphosphates or our Trilon® types. The Sokalan PA types are fully compatible with polyphosphates and the aminopolycarboxylic acids in our Trilon A, B, C and D ranges, and they often perform better if they are used in combination with substances of this type.

The Sokalan PA types can also be used to disperse the sparingly soluble solids that precipitate alongside hard-water salts in ore refining and other liquid-solid processes. The rate at which they are added depends on the particular process in question.

The low-molar-mass Sokalan types can also be used to formulate descalers for the sugar industry, usually in combination with Sokalan CP 10.

Active-chlorine cleaners

Another area of application for this range of products is in active-chlorine formulations such as commercial dishwasher detergents. Sokalan PA 30 CL performs very well in products of this type. Further details are given in the Technical Information leaflet on Sokalan PA 30 CL.

Processing

Polymers can precipitate out of solutions with high electrolyte contents. Attention should be paid to their stability in individual formulations.

Safety

We know of no ill effects that could have resulted from using the Sokalan PA types for the purpose for which they are intended and from processing them in accordance with current practice. According to the experience that we have gained over many years and other information at our disposal, the Sokalan PA types do not exert any harmful effects on health, provided that they are used properly, due attention is given to the precautions necessary for handling chemicals, and the information and advice given in our Safety Data Sheets are observed.

Handling

All contact with the eyes and prolonged contact with the skin should be avoided. Safety glasses should be worn when handling these products in their undiluted form.

Further details are given in our Safety Data Sheets.

Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, these data do not relieve processors of the responsibility of carrying out their own tests and experiments; neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

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