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KURARAY POVAL™ Singapore and Japan origin

Technical data sheet

Characteristics

KURARAY POVAL™ offers polyvinyl alcohol (PVOH) grades with varying degrees of polymerization and hydrolysis.

Recommended Uses

- Modification of emulsion adhesives.
- Protective colloid in emulsion polymerization.
- Raw material for the production of sizes and textile finishes.
- Production of paper adhesives and remoistenable adhesives.
- Binder in the surface finishing of paper.
- For regulating the processing characteristics of all types of coatings.

Form Supplied: Granules, unless specified otherwise.

Specifications

The data are determined by our quality control for each lot prior to release.

Available for any region in the Americas.

	NEW grade name	Old grade name	Viscosity [mPa•s]	Degree of hydrolysis (saponification) [mol-%]	Ash content[3] max. [%w/w %]
Partially hydrolysed	KURARAY POVAL™ 5-88	PVA-205	4.6 - 5.4	86.5 - 89.0	0.4
	KURARAY POVAL™ 5-88 S2[3]	PVA-205S[3]	4.6 - 5.4	86.5 - 89.0	0.4
	KURARAY POVAL™ 5-88 MB[3]	PVA-205MB[3]	4.6 - 5.4	86.5 - 89.0	0.4
	KURARAY POVAL™ 22-88	PVA-217	20.5 - 24.5	87.0 - 89.0	0.4
	KURARAY POVAL™ 22-88 S2[3]	PVA-217S[3]	20.5 - 24.5	87.0 - 89.0	0.4
	KURARAY POVAL™ 22-88 SB[3]	PVA-217SB[3]	20.5 - 24.5	87.0 - 89.0	0.4
	KURARAY POVAL™ 30-88	PVA-220	27.0 - 33.0	87.0 - 89.0	0.4
	KURARAY POVAL™ 30-88 SB[3]	PVA-220SB[3]	27.0 - 33.0	87.0 - 89.0	0.4
	KURARAY POVAL™ 44-88	PVA-224	40.0 - 48.0	87.0 - 89.0	0.4
	KURARAY POVAL™ 44-88 S2[3]	PVA-224S[3]	40.0 - 48.0	87.0 - 89.0	0.4
	KURARAY POVAL™ 44-88 SB[3]	PVA-224SB[3]	40.0 - 48.0	87.0 - 89.0	0.4
	KURARAY POVAL™ 49-88	PVA-225	45.0 - 52.0	86.5 - 89.0	0.4
Medium hydrolysed	KURARAY POVAL™ 27-96	PVA-CST	24.0 - 30.0[2]	95.5 - 96.5	0.4
Fully hydrolysed	KURARAY POVAL™ 5-98	PVA-105	5.2 - 6.0	98.0 - 99.0	0.7
	KURARAY POVAL™ 28-98	PVA-117	25.0 - 31.0	98.0 - 99.0	0.4
	KURARAY POVAL™ 28-98 S2	PVA-117S	25.0 - 31.0	98.0 - 99.0	0.4

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	NEW grade name	Old grade name	Viscosity [mPa•s]	Degree of hydrolysis (saponification) [mol-%]	Ash content[3] max. [%w/w]
High MW	KURARAY POVAL™ 100-88	PVA-236	90 - 110	87.0 - 89.0	0.4
Low hydrolysed	KURARAY POVAL™ 32-80	PVA-420H	4.0 - 5.0[1]	79.0 - 81.0	0.7
	KURARAY POVAL™ 48-80	PVA-424H	29.0 - 35.0	79.0 - 81.5	0.2
	KURARAY POVAL™ 40-80 E	PVA-420	37.0 - 45.0	79.0 - 81.0	0.4
	KURARAY POVAL™ 3-80	PVA-403	2.8 - 3.3	78.5 - 81.5	0.4
	KURARAY POVAL™ 5-82	PVA-405	4.5 - 5.2	80.0 - 83.0	0.4
	KURARAY POVAL™ 5-74	PVA-505	4.2 - 5.0	72.5 - 74.5	0.4

Available for only Canada, Central and South America.

	NEW grade name	Old grade name	Viscosity [mPa•s]	Degree of hydrolysis (saponification) [mol-%]	Ash content[3] max. [%w/w]
Partially hydrolysed	KURARAY POVAL™ 3-88	PVA-203	3.2 - 3.6	87.0 - 89.0	0.4
Medium hydrolysed	KURARAY POVAL™ 17-94	PVA-613	14.5 - 18.5	92.5 - 94.5	0.4
Fully hydrolysed	KURARAY POVAL™ 3-98	PVA-103	3.2 - 3.8	98.0 - 99.0	0.7
	KURARAY POVAL™ 5-98 DB[3]	PVA-105K[3]	5.2 - 6.0	98.0 - 99.0	0.7
	KURARAY POVAL™ 11-98	PVA-110	10.2 - 11.8	98.0 - 99.0	0.7
	KURARAY POVAL™ 28-98 DB[3]	PVA-117K[3]	25.0 - 31.0	98.0 - 99.0	0.4
	KURARAY POVAL™ 60-98	PVA-124	54.0 - 66.0	98.0 - 99.0	0.4

1) of a 4% polymer solution at 20°C, determined by Brookfield synchronised-motor rotary-type viscometer (JIS K6726)
2) calculated as Na_2O
3) MB, SB, DB: anti-foaming/defoaming grade; S2: finer powder grade

Additional data, valid for all KURARAY POVAL™ grades

Volatile Matter Content - 5% max. (as measured during packaging)

The viscosity of the 4% aqueous solution at 20°C is a relative measurement of the molar mass of the PVOH at the stated degree of hydrolysis of the polyvinyl acetate from which the PVOH grade is derived.
PVOH is classified by degree of hydrolysis as follows:

- Partially hydrolysed
- Medium hydrolysed
- Fully hydrolysed

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Properties and uses

Polyvinyl alcohols are water-soluble polymers manufactured by alcoholysis of polyvinyl acetate. The properties of the various grades are mainly governed by the molecular weight and the remaining content of acetyl groups. As PVOHs have such good cohesion and good adhesion to fibres, fillers and pigments, all KURARAY POVAL™ grades are notable for their good bonding strength and pigment binding capacity. The latter intensifies with increasing molecular weight. This, together with the adhesive/ cohesive strength and with a number of other specific properties, allows the manufacture of unfilled to highly filled systems for a variety of uses.

Properties of KURARAY POVAL™ films

The properties of KURARAY POVAL™ films are governed mainly by the grade of KURARAY POVAL™ used. The water resistance of dried KURARAY POVAL™-based films increases with increasing molecular weight and degree of hydrolysis. It can be improved still further by heat-treating the dried film at a temperature of, for instance, 120 °C. Another possible way of improving the water resistance of KURARAY POVAL™ films is to add acids such as orthophosphoric acid or salts such as ammonium chloride to the KURARAY POVAL™ solution in a quantity of 5% by weight, relative to KURARAY POVAL™. Other products that can be used to increase the water resistance are aldehydes such as formaldehyde or glyoxal, and also urea-formaldehyde resins and melamine-formaldehyde resins in quantities of 10-20% by weight, relative to KURARAY POVAL. Ultraviolet radiation on the dried KURARAY POVAL™ film also enhances water.

Plasticizers for KURARAY POVAL™ are polyhydric alcohols e.g. glycerol, neopentyl glycol, trimethylol propane, ethylene glycol, di- and tri-ethylene glycol and polyethylene- ne glycols up to a molecular weight of approximately 400 and in quantities of up to 30% by weight, relative to KURARAY POVAL™.

KURARAY POVAL™ as an adhesive raw material is used in a similar manner as natural products such as casein as well as starch and its degraded derivatives (for example dextrins) as raw material for the production of aqueous adhesive solutions. Compared to dextrins and casein KURARAY POVAL™ has the advantage of a more uniform chemical structure and greater adhesion, being obtained with minimum raw material requirements.

Raw Material for Adhesive

PVOH in a similar manner to the natural products such as casein and starch (and degraded derivatives such as dextrin) is used as raw material for the production of aqueous adhesive solutions. Compared to dextrin and casein, PVOH has a more uniform chemical structure and greater adhesion.

Water-Activated Adhesives

Remoistenable adhesives including the gumming of paper on the reverse side (e.g. Postage stamps and labels), application of gum to the flaps of envelopes and Jiffy®-type bags. Partially hydrolyzed PVOH grades with low to medium viscosity, e.g. KURARAY POVAL™ 5-88 are particularly suitable for this function. Adhesives are produced with up to 30% PVOH solution and applied according to the viscosity requirements. The addition of a preservative is recommended.

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Drying of the adhesive can be accelerated by the addition of alcohols. The drying temperature must be as low as possible. Note that at temperatures higher than 130 °C the gummed surface may be more difficult to activate. The open time of the adhesive depends on the grade of PVOH employed. Increasing viscosity of a 4% PVOH solution is generally accompanied by decreasing the open time. Applying 10g of solid KURARAY POVAL™ 5-88 per m^2 allows the production of coatings has the following advantages:

- Good remoistening properties.
- High degree of flatness during storage under fluctuating air humidity.
- Colorless, flexible coatings.
- Minimal blocking tendency even at high air humidity.
- Fast setting after reactivation.

Wet Bonding

Fully hydrolyzed polyvinyl alcohol with high viscosity (e.g KURARAY POVAL™ 28-98) are preferred if the adhesive is intended for use in the production of bonds that are resistant to cold water. Fully hydrolyzed PVOH are used for such applications as the manufacture of special paper laminates (cardboard), spiral tubes and sealing materials for packaging. These PVOH grades normally possess higher “wet tack”. Aqueous adhesives based on PVOH can be also extended with fillers such as china clay. Even at loadings ratios of approx. 2 parts by weight of filler to 1 part by weight of PVOH, it is still possible to obtain firm bonds in the winding of spiral tubes or the plane-surface bonding of paper and cardboard.

Modification of Emulsion Adhesives

Aqueous solutions of PVOH can be added to polymer emulsions stabilized with PVOH. The post addition:

- Extends the open time
- Increases the setting speed
- Improves rheology

The open time is very important in such operations like the manual or the machine bonding of wood and paper. In a number of polymer emulsions the addition of PVOH solution increases the bonding speed considerably. Additions of up to 10 % of an approx. 15% solution of PVOH to the polymer emulsion have proved to be suitable for this purpose. The choice of PVOH grades is primarily dependent on the viscosity required in the ready-to-use adhesive.

Generally speaking, preference should be given to partially hydrolyzed PVOH grades on account of their faster solubility at lower temperatures. In emulsion adhesives suitable for application by dip wheel or roller on applicator machines, the addition of PVOH solutions, has the advantage of largely preventing skin formation during processing. Blending PVOH grades with cellulose-stabilized polyvinyl acetate emulsions is also possible, but the storage stability of each blend needs to be determined.

PVOH as Protective Colloid

PVOH grades, preferably partially hydrolyzed, are used as protective colloids in emulsion polymerization. Because of their ability to anchor to the surface of the polymer particles, they help to stabilize the polymer emulsion during

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and after polymerization. The use PVOH affects not only the particle size distribution, but also the application properties such as viscosity, stirring stability, freeze/thaw stability, pigment compatibility, electrolyte stability and the open time of the emulsion.

PVOH as Binder in Textile Sizes

The use of PVOH as a binder in textile sizes is based on its penetration capacity and adhesion properties on all types of fibrous material. The excellent film characteristics of PVOH including: high cohesion and toughness, low electrostatic charging and re-dissolving capacity of the dried film in water makes the polymer suitable for this purpose.

PVOH as a versatile auxiliary aid in paper applications

Due to its broad property profile PVOH is frequently used as a co-binder in paper coatings.
The suitability of PVOH in pigmented coatings is based on its -

- Outstanding carrier properties to optical brightening agents.
- Excellent colloidal protection - effective in high solids pigment formulations establishing a smooth viscosity profile.
- Good water retention in coating colors.
- High binding strength in paper coatings which can be related to polymer cohesion as well as to good adhesion to the fibre and to the pigment particles. PVOH possesses remarkable barrier properties. Due to its insolubility in most organic sol-vents, surfaces treated with PVOH repel hydrophobic products such as oil, grease and fat. PVOH displays excellent mechanical strength when applied as a film on paper or paperboard which makes it fit well as a surface sizing agent. Many special paper grades are produced using PVOH. Some examples of these special grades include:
- Banknote paper and grades with high folding endurance.
- Silicon base paper for use as a release paper for pressure sensitive adhesive (PSA) labels.
- Thermoreactive paper for bar code labels or facsimile machines.
- Film casting (release) paper.
- Ink-jet paper.

Preparation of PVOH Solutions

In the adhesives sector PVOH is processed as an aqueous solution as it is in most other fields of application. The solutions should be prepared in corrosion-resistant vessels. In case of Fully and Medium hydrolyzed PVOH, first the PVOH is sprinkled into cold water during stirring and heated to 90–95 °C in a water bath or by the use of live steam. In the case of Partially hydrolyzed PVOH, first the PVOH is sprinkled into cold water during stirring and heated to 70–95 °C in a water bath or by the use of live steam. The solution should be stirred during cooling in order to prevent skin formation.

The speed of dissolution increases with increasing temperature. For both partially and fully hydrolyzed PVOH grades the speed of dissolution decreases with increasing molecule size (i.e. increasing viscosity of the 4 % aqueous solution). The dissolving process is also made more difficult when there is a transition to higher concentrations. As a result, even more highly concentrated PVOH solution, (e.g. 30% solution of KURARAY POVAL™ 5-88), should be

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produced at temperatures of 90–95 °C. Polyvinyl alcohol solutions may produce foam during stirring or transporting in pipelines, but this can be largely prevented by using a suitable stirrer design such as a low-speed anchor stirrer or by avoiding steep downward gradients in the pipelines.

Suitable defoamers are offered by numerous suppliers such as Dow Corning, Air Products and Chemicals, Inc., Emerald Performance Materials, Munzing Chemie Gmbh etc. Please check regulatory compliance if the application requires such status.

Polyvinyl alcohol solutions which have been stored for lengthy periods may show increases in viscosity. This is especially true of fully hydrolysed grades in high concentrations and at low temperature. The original viscosity can be restored by heating and stirring.

Preservation

Under certain conditions, aqueous solution PVOH can be attacked by micro-organisms. The main organisms that can reproduce in the acidic pH range are the fission fungi, whilst bacteria grow most readily in a neutral to weakly alkaline medium. The PVOH solutions can be preserved from any micro organism attack by the addition of preservatives. Suitable preservatives are offered by numerous suppliers such as Dow Chemical, Bayer Chemicals, Troy Corporation, Thor Specialties, Inc. etc. The dosage depends on the concentration of the solution, the storage temperature and the nature and intensity of the infection. Quantities of about 0.01-0.2% by weight preservative, relative to the PVOH solution, are generally sufficient. Compatibility and efficiency must be tested. Information on the quantity to be used is available directly from the suppliers.

It is advisable for the PVOH solution to be prepared and stored in clean containers. Considering the resistance that is shown by some micro-organisms to the preservatives employed, the dissolving vessel in particular, together with the filling equipment (pipes, valves, tubing etc.), needs to be kept clean. Any skins or incrustations should be removed. In the event of complications the possibility of changing to a different preservative must be considered. Certain applications of PVOH solutions (cosmetic, finger paints etc.) require that the preservatives employed are are physiologically inert and are approved for the application in question. In such instances, it is absolutely essential to refer to the relevant regulations.

Storage

In its original packaging, KURARAY POVAL™ can be stored under dry and cool conditions for at least 12 months.

Industrial Safety and Environmental Protection

Not classified as a dangerous substance or preparation according to the current criteria of chemical legislation, or of the EU Directives 67/548/EC. A safety data sheet is available on request.

Special remarks

Status as governed by foodstuffs legislation

Refer to the KURARAY POVAL™ webpage for regulatory information.