

KURARAY POVAL™, EXCEVAL™ & ELVANOL™

Grade List

Characteristics

Polyvinyl alcohol (PVOH) having varying degrees of polymerization and hydrolysis.

Recommended Uses

Ranging from emulsion polymerization aid to binder for pigments in paper applications.

Form Supplied: Granules / fine powder defined by grain size.

Specifications

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

Partially saponified grades

Grade name KURARAY POVAL™	Viscosity ¹ [mPa•s]	Degree of hydrolysis [mol%]	Non- volatile content [w%]	Ash ² [w%]	pH
5-74	4.2 - 5.0	72.5 - 74.5	97.5 ± 2.5	≤0.4	5.0 - 7.0
3-80	2.8 - 3.3	78.5 - 81.5	97.5 ± 2.5	≤0.4	5.0 - 7.0
32-80	29.0 - 35.0	79.0 - 81.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
35-80	32.0 - 38.0	79.0 - 81.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
40-80 E	37.0 - 45.0	79.0 - 81.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
48-80	45.0 - 51.0	78.5 - 80.5	97.5 ± 2.5	≤0.2	5.0 - 7.0
5-82	4.5 - 5.2	80.0 - 83.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
3-85	3.4 - 4.0	84.2 - 86.2	97.5 ± 2.5	≤0.5	4.5 - 7.0
5-88	4.6 - 5.4	86.5 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
22-88	20.5 - 24.5	87.0 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
49-88	45.0 - 52.0	86.5 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
100-88	90.0 - 110.0	87.0 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
30-92	28.0 - 32.0	91.5 - 93.3	97.5 ± 2.5	≤0.5	4.5 - 7.0
27-96	24.0 - 30.0	95.5 - 96.5	97.5 ± 2.5	≤0.4	5.0 - 7.0
22-88 PK	20.5 - 24.5	87.0 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0

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Ultra low saponified grades

Grade name KURARAY POVAL™	Viscosity ³ [mPa•s]	Degree of hydrolysis [mol-%]	Non-volatile content [w%]	Ash ² [w%]	pH
LM-10 HD	4.5 - 5.7	38.0 - 42.0	98.5 ± 1.5	≤0.6	No spec
LM-20	3.0 - 4.0	38.0 - 42.0	98.5 ± 1.5	≤1.0	No spec

Fully saponified grades

Grade name KURARAY POVAL™	Viscosity ¹ [mPa•s]	Degree of hydrolysis [mol-%]	Non-volatile content [w%]	Ash ² [w%]	pH
6-98	5.0 - 7.0	98.0 - 98.8	97.5 ± 2.5	≤0.5	4.5 - 7.0
28-98	25.0 - 31.0	98.0 - 99.0	97.5 ± 2.5	≤0.4	5.0 - 7.0

Fine powder grades

Grade name KURARAY POVAL™	Viscosity ¹ [mPa•s]	Degree of hydrolysis [mol-%]	Non-volatile content [w%]	Ash ² [w%]	pH
5-88 S2	4.6 - 5.4	86.5 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
22-88 S2	20.5 - 24.5	87.0 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
49-88 S2	45.0 - 52.0	86.5 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0

EXCEVAL™ grades

Grade name EXCEVAL™	Viscosity ¹ [mPa•s]	Degree of hydrolysis [mol-%]	Non-volatile content [w%]	Ash ² [w%]	pH
HR-3010	12.0 - 16.0	99.0 - 99.4	97.5 ± 2.5	≤0.4	5.0 - 7.0
RS-2117	25.0 - 30.0	97.5 - 99.0	97.5 ± 2.5	≤0.4	5.0 - 7.0

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Specialty grades

Grade name KURARAY POVAL™	Viscosity ¹ [mPa•s]	Degree of hydrolysis [mol-%]	Non- volatile content [w%]	Ash ² [w%]	pH
25-88 KL*	20.0 - 30.0	85.0 - 90.0	97.5 ± 2.5	≤1.5	5.0 - 7.0
32-97 KL*	29.0 - 34.0	95.0 - 99.0	97.5 ± 2.5	≤1.5	6.0 - 8.0
3-86 SD*	2.4 - 3.4	83.0 - 88.0	97.5 ± 2.5	≤1.4	No spec
25-98 R*	20.0 - 30.0	98.0 - 99.0	97.5 ± 2.5	≤0.6	No spec
L-8	5.0 - 5.8	69.5 - 72.5	97.5 ± 2.5	≤1.0	5.0 - 7.0
L-9	5.5 - 6.1	69.5 - 72.5	97.5 ± 2.5	≤1.0	5.0 - 7.0
L-10	5.0 - 7.0	71.5 - 73.5	97.5 ± 2.5	≤1.0	5.0 - 7.0
L-11	5.5 - 7.5	71.5 - 73.5	97.5 ± 2.5	≤0.5	5.0 - 7.0
L-508W	6.0 - 7.0	71.5 - 73.5	97.5 ± 2.5	≤0.5	5.0 - 7.0
L-9-78	6.0 - 6.7	76.5 - 79.0	97.5 ± 2.5	≤1.2	5.0 - 7.0
200-88 KX SB	175.0 - 225.0	87.0 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0
105-88 KX SB	90.0 - 120.0	87.0 - 89.0	97.5 ± 2.5	≤0.4	5.0 - 7.0

*For US, Available only for paper application. For other regions, Available for all application.

Elvanol™ grades

Grade name Elvanol™	Grade type	Viscosity ¹ [mPa•s]	Degree of hydrolysis [mol-%]	Non- volatile content [w%]	Ash ² [w%]	pH
71-30	Standard	27.0 - 33.0	99.2 - 99.7	97.5 ± 2.5	≤0.7	—
90-50	Standard	11.6 - 15.4	99.2 - 99.7	97.5 ± 2.5	≤0.7	—
80-18	Copolymer	17.0 - 23.0	99.2 - 99.7	97.5 ± 2.5	≤0.7	—
85-82	Copolymer	24.0 - 32.0	99.2 - 99.7	97.5 ± 2.5	≤0.7	—
75-15	Copolymer	11.6 - 15.4	99.2 - 99.7	97.5 ± 2.5	≤0.7	—

- 1) of a 4% aqueous solution at 20 °C JIS K 6726 / DIN 53015 / Falling needle viscometer
- 2) Calculated as Na₂O
- 3) 4% methanol/water (1/1) solution at 20 °C

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Additional data, valid for all Kuraray POVAL grades

Non-volatile content min. 95% (after 3 hours' drying at 105 °C/DIN 53189). Methanol content: less than 3%. pH of a 4% solution in distilled water (DIN 19261): 5-7. Bulk density (DIN 53466): approx. 0.4-0.6 gcm⁻³, depending on grade. The first number in the nomenclature denotes the viscosity of the 4% aqueous solution at 20 °C as a relative measure for the molar mass of the KURARAY POVAL; the second number denotes the degree of hydrolysis of the polyvinyl acetate from which the KURARAY POVAL grade is derived.

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.

PARTIALLY SAPONIFIED GRADES

KURARAY POVAL as adhesive promoter

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 dextrans) as raw material for the production of aqueous adhesive solutions. Compared to dextrans and casein KURARAY POVAL has the advantage of a more uniform chemical structure and greater adhesion, being obtained with minimum raw material requirements.

Water-activated adhesives

Remoistenable adhesives are employed mainly in the paper processing industry. Very familiar uses are the gumming of paper on the reverse side (e.g. postage stamps and labels) and the application of gum to the flaps of envelopes and Jiffy®-type bags. Partially saponified KURARAY POVAL grades with low to medium viscosity, e.g. KURARAY POVAL 4-88 are particularly suitable for this function. To produce the adhesive, KURARAY POVAL solutions of up to 30% are applied according to the viscosity requirements, these solutions containing additions of preservative and defoamer if necessary. The open time of the adhesive depends on the grade of KURARAY POVAL employed. Increasing viscosity of a 4% KURARAY POVAL solution is generally accompanied by decreasing open time. An applied quantity of some 10 g KURARAY POVAL 4-88 solid per m² allows the production of coatings with very good remoistening properties and the following advantages:

- high degree of flatness during storage under fluctuating air humidity
- colorless, flexible coatings
- minimal blocking tendency, even in high air humidity
- fast setting after reactivation

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Modification of emulsion adhesives

Aqueous solutions of KURARAY POVAL can be added to polymer emulsions already stabilized with polyvinyl alcohol. This affects the:

- extension of the open time
- increase of the setting speed
- influence on the rheology

The open time is very important in such operations like the manual or machine bonding of wood and paper. In a number of polymer emulsions the addition of KURARAY POVAL solution increases the bonding speed considerably. Additions of up to 10% of an approx. 15% solution of KURARAY POVAL to the polymer emulsion have proved to be suitable for this purpose.

The choice of KURARAY POVAL grades is primarily dependent on the viscosity required in the ready-to-use adhesive. Generally speaking, preference should be given to partially saponified KURARAY POVAL 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 KURARAY POVAL solutions has the advantage of largely preventing skin formation during processing.

KURARAY POVAL as protective colloid

KURARAY POVAL grades, preferably of the partially hydrolyzed range, are used as protective colloids in the polymerization of polymer emulsions. Because of their ability to anchor to the surface of the polymer particles that form, they help to stabilize the polymer emulsion during and after the polymerization. Those KURARAY POVAL types influence not only particle size distribution but also the application properties such as viscosity, stability to stirring, the freeze/thaw stability, pigment compatibility, electrolyte stability and open time of the emulsion.

FULLY SAPONIFIED GRADES

KURARAY POVAL as a binder in textile sizes

A binder in sizes is based on its good penetration capacity and good adhesion properties on all types of fibrous material. The excellent film characteristics of KURARAY POVAL like high cohesion and toughness, low electrostatic charging and redissolving capacity of the dried film in water complete the characterisation of this polymer as suitable agent for this purpose.

KURARAY POVAL as a versatile auxiliary aid in paper applications

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

- its outstanding carrier properties of optical brightening agents
- its excellent colloidal protection becoming effective in high solids pigment formulations which establishes a smooth viscosity profile
- its good water retention in coating colors
- its 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, respectively

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Low molecular weight KURARAY POVAL grades such as KURARAY POVAL 4-98 are the preferred polyvinyl alcohols to be used in paper coatings. KURARAY POVAL possesses remarkable barrier properties. Due to its insolubility in most organic solvents, surfaces treated with KURARAY POVAL repel hydrophobic products such as oil, grease and fat. Furthermore, KURARAY POVAL displays excellent mechanical strength properties if applied as a film on paper or paperboard. Therefore, it fits well as a surface sizing agent. Many special paper grades are produced using KURARAY POVAL, such as:

- silicon base paper, to be used as release paper for PSA labels
- banknote paper and grades with high folding endurance
- thermoreactive paper for bar code labels or facsimile machines
- film casting (release) paper
- ink-jet paper

SPECIALTY GRADES

Properties and uses

At the same degree of hydrolysis, the carboxylate polymer (K-types), has stronger hydrophilic property than conventional PVOH even at a lower degree of hydrolysis. Therefore, K Grades such as e.g. KURARAY POVAL 6-77 KL has a good affinity to hydrophobic substances such as polyester, polystyrene etc. as well as a good water solubility. Due to its advantageous hygroscopic property, films produced from K Grades are soft and flexible at standard condition (20° C, 65% RH) or under higher humidity. K Grades can react with aluminum sulphate $Al_2(SO_4)_3$ to form a gel, enabling K Grades to work effectively in the field of paper sizing. Furthermore, K Grades is less sensitive to salting-out effects, judged with comparable conventional PVOH.

L-Polymer grades are polyvinyl alcohol grades that have been developed to be used as primary suspending agents for vinyl suspension polymerization. The desired grain size can be obtained at low level of L-Polymer. Also a precise control of the particle size distribution is achieved and PVC grains tend to be more spherical using L-Polymer grades. PVC grains of good porosity are produced while maintaining a satisfactory bulk density. The plasticizer speed, the “fish eyes” count and the residual vinyl chloride monomer level are drastically improved using L-Polymer grades.

R Grade is water-soluble polymer, which molecular structure contains peculiar functional groups, i.e., silanol groups. The silanol groups are reactive with inorganic substances such as silica or alumina. R Grade can be applied with inorganic substances to form water resistant films. R Grade is mainly used as a binder for inorganic substances and as a surface coating agent for organic materials which contain inorganic substances such as e.g. paper.

PROCESSING

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.

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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 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 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.