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Kuraray Poval™

KURARAY POVAL™, EXCEVAL™, ELVANOL™ Technical Data Sheet

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

Recommended Uses
The characteristics of PVOH make it well suited for an extensive range of applications in products that individuals use every day. From an emulsion polymerization aid to a binder for pigments in paper applications, the versatility of PVOH is widespread.

Supplied in the following form
Granules / fine powder with defined grain size.

Specifications
Kuraray's quality control team determines the data for each lot before it released.

KURARAY POVAL™ Fully saponified grades

Grade name	Viscosity [mPa•s]	Degree of hydrolysis [mol%]	Volatile [%]	Ash [%]	pH
3-98	3.2 – 3.8	98.1 – 98.7	≤ 5.0	≤ 0.6	5.0 – 7.0
5-98	5.2 – 6.0	98.0 – 99.0	≤ 5.0	≤ 0.6	5.0 – 7.0
11-98	10.2 – 11.8	98.0 – 99.0	≤ 5.0	≤ 0.6	5.0 – 7.0
28-98	25.0 – 31.0	98.0 – 99.0	≤ 5.0	≤ 0.4	5.0 – 7.0
60-98	54.0 – 66.0	98.0 – 99.0	≤ 5.0	≤ 0.4	5.0 – 7.0
25-100	21.5 – 28.5	99.85≤	≤ 8.5	≤ 1.0	–

* Referring to ISO-15023-2 and DIN 53015

KURARAY POVAL™ Medium saponified grades

Grade name	Viscosity [mPa•s]	Degree of hydrolysis [mol%]	Volatile [%]	Ash [%]	pH
17-94	14.5 – 18.5	92.5 – 94.5	≤ 5.0	≤ 0.4	5.0 – 7.0
27-96	24.0 – 30.0	95.5– 96.5	≤ 5.0	≤ 0.4	5.0 – 7.0
55-95	50.0 – 60.0	95.0 – 96.0	≤ 5.0	≤ 0.4	5.0 – 7.0

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KURARAY POVAL™ Partially saponified grades

Grade name	Viscosity [mPa•s]	Degree of hydrolysis [mol%]	Volatile [%]	Ash [%]	pH
5-74	4.2 – 5.0	72.5 – 74.5	≤ 5.0	≤ 0.4	5.0 – 7.0
32-80	29.0 – 35.0	79.0 – 81.0	≤ 5.0	≤ 0.4	5.0 – 7.0
35-80	32.0 – 38.0	79.0 – 81.0	≤ 5.0	≤ 0.4	5.0 – 7.0
40-80 E	37.0 – 45.0	79.0 – 81.0	≤ 5.0	≤ 0.4	5.0 – 7.0
48-80	45.0 – 51.0	78.5 – 80.5	≤ 5.0	≤ 0.2	5.0 – 7.0
3-83	2.5 – 3.5	80.4 – 84.7	≤ 5.0	≤ 0.5	4.5 – 7.0
3-85	3.4 – 4.0	84.2 – 86.2	≤ 5.0	≤ 0.5	5.0 – 7.0
3-88	3.2 – 3.6	87.0 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0
5-88	4.6 – 5.4	86.5 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0
22-88	20.5 – 24.5	87.0 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0
30-88	27.0 – 33.0	87.0 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0
44-88	40.0 – 48.0	87.0 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0
49-88	45.0 – 52.0	87.0 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0
95-88	80.0 – 110.0	87.0 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0

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KURARAY POVAL™ Fine Powder grades

Grade name	Viscosity [mPa•s]	Degree of hydrolysis [mol%]	Volatile [%]	Ash [%]	pH
28-98 S2	25.0 – 31.0	98.0 – 99.0	≤ 5.0	≤ 0.4	5.0 – 7.0
5-88 S2	4.6 – 5.4	86.5 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0
22-88 S2	20.5 – 24.5	87.0 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0
30-88 S2	27.0 – 33.0	87.0 – 89.0	≤ 5.0	≤ 0.4	5.0 – 7.0
44-88 S2	40.0 – 48.0	86.5 – 89.5	≤ 5.0	≤ 0.4	5.0 – 7.0

* Referring to ISO-15023-2 and DIN 53015

KURARAY POVAL™ Specialty grades

Grade name	Viscosity [mPa•s]	Degree of hydrolysis [mol%]	Volatile [%]	Ash [%]	pH
25-88 KL	20.0 – 30.0	85.0 – 90.0	≤ 5.0	≤ 1.5	5.0 – 7.0
3-86 SD	2.4 – 3.4	83.0 – 88.0	≤ 5.0	≤ 1.8	–
25-98 R	20.0 – 30.0	98.0 – 99.0	≤ 5.0	≤ 0.6	–
105-88 KX SB	90.0 – 120.0	87.0 – 89.0	≤5.0	≤0.4	5.0 – 7.0
200-88 KX SB	175.0 – 225.0	87.0 – 89.0	≤5.0	≤0.4	5.0 – 7.0
200-88 KX	175.0 – 225.0	87.0 – 89.0	≤5.0	≤0.4	5.0 – 7.0

* Referring to ISO-15023-2

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EXCEVAL™ grades

Grade name	Viscosity [mPa•s]	Degree of hydrolysis [mol%]	Volatile [%]	Ash [%]	pH
HR-3010	12.0 –16.0	99.0 – 99.4	≤ 5.0	≤ 0.6	5.0 – 7.0
AQ-4104	3.6 – 4.4	98.0 – 99.0	≤ 5.0	≤ 0.1	4.0 – 7.0
RS-2117	25.0 – 30.0	97.5 – 99.0	≤ 5.0	≤ 0.4	5.0 – 7.0
RS-2817 SB	23.0 – 30.0	95.5 – 97.0	≤ 5.0	≤ 0.4	5.0 – 7.0
RS-1717	23.0 – 30.0	92.0 – 94.0	≤ 5.0	≤ 0.4	5.0 – 7.0

* Referring to ISO-15023-2

ELVANOL™ grades

Grade name	Viscosity [mPa•s]	Degree of hydrolysis [mol%]	Volatile [%]	Ash [%]	pH
71-30	27.0 – 33.0	99.2 – 99.7	≤ 5.0	≤ 0.7	5.0 – 7.0
90-50	11.6 – 15.4	99.2 – 99.7	≤ 5.0	≤ 0.7	4.0 – 7.0
80-18	17.0 – 23.0	99.2 – 99.7	≤ 5.0	≤ 0.7	5.0 – 7.0
85-82	24.0 – 32.0	99.2 – 99.7	≤ 5.0	≤ 0.7	5.0 – 7.0
75-15	11.6 – 15.4	99.2 – 99.7	≤ 5.0	≤ 0.7	5.0 – 7.0

* Referring to ISO-15023-2

Additional data valid for all KURARAY POVAL™ grades

Non-volatile content min. 95% (after 3 hours of drying at 105˚C). Methanol content is less than 3%. 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 KURARAY POVAL™ grades; the second number denotes the degree of hydrolysis of the polyvinyl acetate from which the KURARAY POVAL™ grade is derived.

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Properties
PVOH 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 the acetyl groups.

Specialty grades
At the same degree of hydrolysis, the carboxylate modified PVOH (KURARAY POVAL™ 25-88 KL and 3-86 SD) has more hydrophilic property than conventional PVOH even at a lower degree of hydrolysis. Due to its advantageous hygroscopic property films produced from 25-88 KL are soft and flexible at standard condition (20°C, 65% RH) or under higher humidity. 25-88 KL can react with aluminum sulfate $Al_2(SO_4)_3$ to form a gel, enabling 25-88 KL to work effectively in the field of paper sizing. Furthermore, 25-88 KL and 3-86 SD are less sensitive to salting-out effects, judged with comparable conventional PVOH.

KURARAY POVAL™ 25-98 R is a 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. 25-98 R can be applied with inorganic substances to form water-resistant films. 25-98 R is mainly used as a binder for inorganic substances and as a surface coating agent for organic materials which contain inorganic substances such as paper.

EXCEVAL™ is a hydrophobically modified grade so that it is high-water resistant among all PVOH. Emulsions and adhesives modified with EXCEVAL™ show higher water resistance than those with standard PVOH. Also, EXCEVAL™ possesses remarkable barrier properties for oxygen, aroma, hydrophobic materials such as oil, grease, and fat even at high humidity conditions.

ELVANOL™ is a porous-powder grade. It is used for paper and film coatings, textile sizing agents, and viscosity modifiers added to emulsions. Furthermore, as a fine powder with a high degree of saponification, it is suitable for applications where it is added in a fine powder state.

Application examples
Adhesive promoter
KURARAY POVAL™ as an adhesive raw material is used similarly to natural products such as casein, starch, and its degraded derivatives (for example, dextrin) to produce aqueous adhesive solution. Compared to dextrin and casein, KURARAY POVAL™ has the advantage of a more uniform chemical structure and greater adhesion.

Water-activated adhesives
Re-moistenable 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. Partially saponified KURARAY POVAL™ grades with low to medium viscosity, e.g. KURARAY POVAL™ 5-88

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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 4% KURARAY POVAL™ solution is generally accompanied by decreasing open time. An applied quantity of some 10 g KURARAY POVAL™ 5-88 solid per m^2 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

Modification of emulsion adhesives

Aqueous solution of KURARAY POVAL™ can be added to polymer emulsion already stabilized with PVOH. The addition of PVOH provides the following:

- Extension of the open time
- Acceleration of the setting speed
- Influence on the rheology

The open time is very important in such operations as the manual mechanical bonding of wood and paper. In several polymer emulsions, addition of KURARAY POVAL™ solution increases the bonding speed considerably. Addition of 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 adhesives. Preference should be given to partially saponified KURARAY POVAL™ grades on account of their faster solubility at lower temperatures. In the application of emulsion adhesives by dip wheel or roll-on applicator machines, addition of our PVOH solution has the advantage of largely preventing skin formation during processing.

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 characterization of this polymer as a suitable agent for this purpose.

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Versatile auxiliary aid in paper applications

Due to its broad property profile, KURARAY POVAL™ is used as a co-binder in paper coatings. The 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-solid-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 fiber and the pigment particles, respectively

KURARAY POVAL™ possesses remarkable barrier properties. Due to its insolubility in most organic solvents, surfaces treated with KURARAY POVAL™ repel hydrophobic materials 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 labels
- Banknote paper and grades with high folding endurance
- Thermal paper for barcode labels
- Film casting (release) paper
- Ink-jet paper

Preparation of PVOH solution

PVOH is processed as aqueous solution. The solution should be prepared in corrosion-resistant vessels. In case of fully and medium hydrolyzed PVOH, PVOH is sprinkled into cold water during stirring, and its dispersion is heated to 90–95°C in a water bath or by using live steam. In case of partially hydrolyzed PVOH, PVOH is sprinkled into cold water during stirring, and the dispersion is heated to 70–95°C in a water bath or by using of live steam. The solution should be stirred during cooling to prevent the skin formation. The speed of dissolution increases with increasing temperature. For both partially and fully hydrolyzed PVOH grades, the dissolution speed decreases with increasing molecule size (i.e., increasing viscosity of 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. PVOH solution may generate 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. The quantities are 0.001-0.010% relative to the solution. PVOH solution which has been stored for lengthy periods may show increases in viscosity. This is especially true of fully hydrolyzed grades in high

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concentrations and at low temperature. The original viscosity can be restored by heating and stirring.

Preservation

Under certain conditions, PVOH solution can be attacked by micro-organisms. The PVOH solutions can be preserved from any microorganism attack by the addition of preservatives. The dosage depends on the concentration of the solution, the storage temperature and the nature and intensity of the infection. Quantities of about 0.01-0.20% 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, 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 solution (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 essential to refer to the relevant regulations.

Storage

KURARAY POVAL™ can be stored for an unlimited period under appropriate conditions that is in its original packs in closed, dry rooms, at room temperature. Kuraray would recommend that our product is used within 12 months from the shipment date as given on the certificate of analysis.

Industrial Safety and Environmental Protection

Refer to the Safety Data Sheet (SDS) prepared in accordance with the laws and regulations of each country.

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