67700 - 67760 Polyvinyl Alcohol

Characteristic
The Polyvinyl Alcohol (PVA) types consist of different degrees of polymerization and hydrolysis.

Fields of Application
Modification of dispersion glues, manufacture of paper glues and glues which can be remoistened. Protective gel for the emulsion polymerization, raw material for finishing and textile glaze, binding agent for the surface processing of paper.

Data

		Viscosity[1] DIN 53015 (mPa·s)	Degree of Hydrolysis (Saponification) (mol.-%)	Non volatile content (%)	Ash[2] (NaOAc) content (%)	pH
Partially Saponified Type	PVA 5-74	4.2 – 5.0	72.5 – 74.5	97.5 ± 3.0	≤ 0.5 (1.06)	5 - 7
	PVA 3-80	2.8 – 3.3	78.5 – 81.5	97.5 ± 2.5	≤ 0.4 (1,0)	5 - 7
67760	PVA 4-88	3.5 – 4.5	86.7 – 88.7	97.5 ± 2.5	≤ 0.5 (1.32)	4.5-7.5
	PVA 8-88	7.0 – 9.0	86.7 – 88.7	97.5 ± 25	≤ 0.5 (1.32)	4.5-7.0
	PVA 13-88	11.5 – 14.5	86.7 – 88.7	97.5 ± 2.5	≤ 0.5 (1.32)	4.5-7.0
	PVA 18-88	16.5 – 19.8	86.7 – 88.7	97.5 ± 2.5	≤ 0.5 (1.32)	4.5-7.0
	PVA 23-88	21.5 – 24.5	86.7 – 88.7	97.5 ± 2.5	≤ 0.5 (1.32)	4.5-7.0
	PVA 26-88	24.5 – 27.5	86.7 – 88.7	97.5 ± 2.5	≤ 0.5 (1.32)	4.5-7.0
	PVA 40-88	38.0 – 42.0	86.7 – 88.7	97.5 ± 2.5	≤ 0.5 (1.32)	4.5-7.0
	PVA 47-88	45.0 – 49.0	86.7 – 88.7	97.5 ± 2.5	≤ 0.5 (1.32)	4.5-7.0
	PVA 95-88	80.0 – 110.0	87.0 – 89.0	97.0 ± 3.0	≤ 0.4 (1.06)	5 - 7
Fully Saponified Type	PVA 3-98	3.2 – 3.8	98.0 – 99.0	97.0 ± 3.0	≤ 0.6 (1.58)	5 - 7
67700 / 67710	PVA 4-98	4.0 – 5.0	98.0 – 98.8	97.5 ± 2.5	≤ 0.5 (1.32)	5 - 7
	PVA 6-98	5.0 – 7.0	98.0 – 98.8	97.5 ± 2.5	≤ 0.5 (1.32)	5 - 7
	PVA 10-98	9.0 – 11.0	98.0 – 98.8	97.5 ± 2.5	≤ 0.5 (1.32)	5 - 7
	PVA 20-98	18.5 – 21.5	98.0 – 98.8	97.5 ± 2.5	≤ 0.5 (1.32)	5 - 7
	PVA 56-98	52.0 – 60.0	98.0 – 98.8	97.5 ± 2.5	≤ 0.5 (1.32)	5 - 7
	PVA 15-99	12.5 – 17.5	99.0 – 99.8	97.5 ± 2.5	≤ 0.5 (1.32)	5 - 7
	PVA 28-99	26.0 – 30.0	99.0 – 99.8	97.5 ± 2.5	≤ 0.5 (1.32)	5 - 7

[1] a 4% aqueous solution at 20°C
[2] calculated as Na_2O

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Further Properties for Polyvinyl Alcohol

Non-volatile content:	min. 95 % (after drying 3 h at 105°C, DIN 53189).
Methanol content:	< 3 %
pH-Value of a 4 %-solution in dest. water (DIN 19261):	5 – 7 for partially and fully saponified types
Bulk density:	approx. 0.4 – 0.6 g/cm^3

The first number in the nomenclature denotes the viscosity of the 4% aqueous solution at 20°C as as relative measure for the molar mass of the PVA-type; the second number denotes the degree of hydrolysis of the polyvinyl acetate.

Properties and Uses

Polyvinyl alcohols are water-soluble polymers manufacture 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

Polyvinyl Alcohol (PVA) as Adhesive Promoter:
Polyvinyl alcohol (PVA) as an adhesive raw material is used in a similar manner as natural products such as casein as well as starch and ist degraded derivatives (e.g. dextrins) as raw material for the production of aqueous adhesive solutions. Compared to dextrins and casein PVA 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 sie (e.g. postage stamps and labels) and the application of gum to the flaps envelopes and Juffy®-type bags. Partially saponified PVA-grades with low to medium viscosity, e.g PVA 4-88 **(67760)** are particularly suitable for this function. To produce the adhesive, PVA solutions of up to 30 % are applied according to the viscosity requirements, these solutions containing additions of preservative and defoamer is necessary. The open time of the adhesive depends on the grade of PVA employed. Increasing viscosity of a 4 % PVA solution is generally accompanied by decreasing open time. An applied quantity of some 10 g PVA 4-88 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 solutions of polyvinyl alcohol (PVA) can be added to polymer emulsions already stabilized with polyvinyl alcohol. This effects the:

- extention 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 PVA solution inceases the bonding speed considerably. Additions up to 10 % of an approx. 15 % solution of PVA to the polymer emulsion have proved to be suitable for this purpose.

The choice of PVA grades is primarily dependent on the viscosity required in the ready-to-use adhesive. Generally speaking, preference should be given to partially saponified PVA grades on account of their faster solubility at lower tempertures. In emulsion adhesives suitable for application by dip wheel or roller on applicatior machines the addition of PVA solution has the advantage of largely preventing skin formation during processing.

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Fully Saponified Grades

Polyvinyl Alcohol (PVA) as a Versatile Auxiliary Aid in Paper Applications:

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

- its outstanding carrier properties of optical brightening agents
- ist 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.

Low molecular weight PVA grades such as PVA 4-98 are the preferred polyvinyl alcohols to be used in paper coatings. PVA possesses remarkable barrier properties. Due to its insolubility in most organic solvents, surfaces treated with PVA repel hydrophobic products such as oil, grease and fat. Furthermore, PVA 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 PVA, such as

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

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 Directive 67/548/EC.

When stored in the original container at room temperature and dry environment, PVA can be stored unlimited.

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