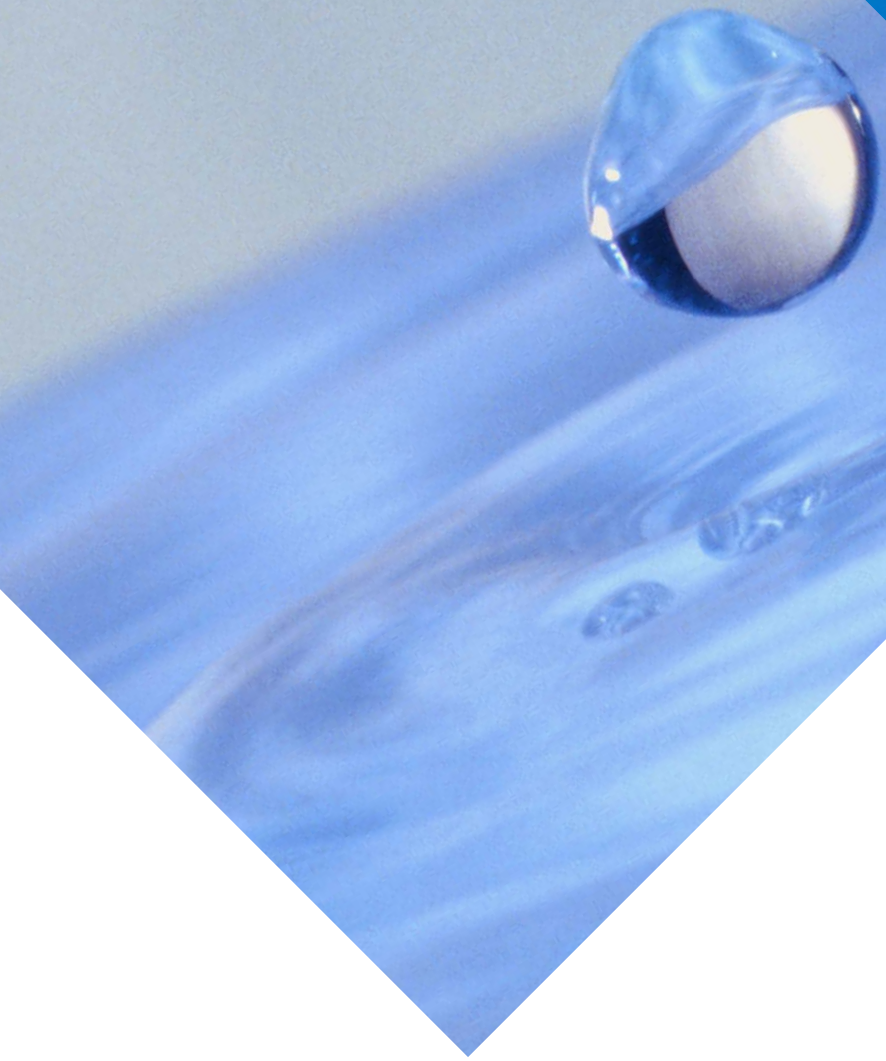
SEKISUI

A Versatile High Performance Polymer



SELVOL™
POLYVINYL ALCOHOL

TABLE OF CONTENTS

About the Company

The Sekisui Chemical Group is a global company that operates in three major businesses: High Performance Plastics, Urban Infrastructure and Environmental Products, and Housing. Founded in 1947 and currently headquartered in Osaka and Tokyo, Japan, Sekisui strives to deliver a wide range of products and services to enrich people's lives and the social infrastructure.

Architectural Glass

Urban Intrastructure and Environmental Product

Our Promise

Through prominence in technology and quality, Sekisui Chemical Group will contribute to improving the lives of the people of the world and the Earth's environment, by continuing to open up new frontiers in residential and social infrastructure creation and chemical solutions.

Housing

Introduction

This brochure is intended to serve as an introduction and overview of the Selvol Polyvinyl Alcohol line. For more detailed information on specific applications, the preparation of polyvinyl alcohol solutions, please refer to our other brochures, visit our website at www.selvol.com, or call our Product Information Center at +1-281-280-3460.

Environmental, Health, and Safety

Please refer to our Material Safety Data Sheets (MSDSs) or Safety Data Sheets (SDSs) for information on the safe use and handling of Selvol Polyvinyl Alcohol, including toxicity, fire, and explosion hazards, as well as environmental effects. An MSDS can be obtained online at www.selvol.com.

FDA Compliance

Polyvinyl alcohol is used in many food contact applications, including food packaging adhesives, and coatings for paper and paperboard. For more specific information on the FDA status of any of our grades, please contact our Product Information Center at +1-281-280-3460.

TABLE 1:
Selvol Polyvinyl Alcohol Right-to-Know Information

Ingredient	CAS Number
Selvol Polyvinyl Alcohol	
• Super and Fully Hydrolyzed	9002-89-5
• Partially and Intermediate Hydrolyzed	25213-24-5
Water	7732-18-5
Methanol	67-56-1
Sodium Acetate	127-09-3

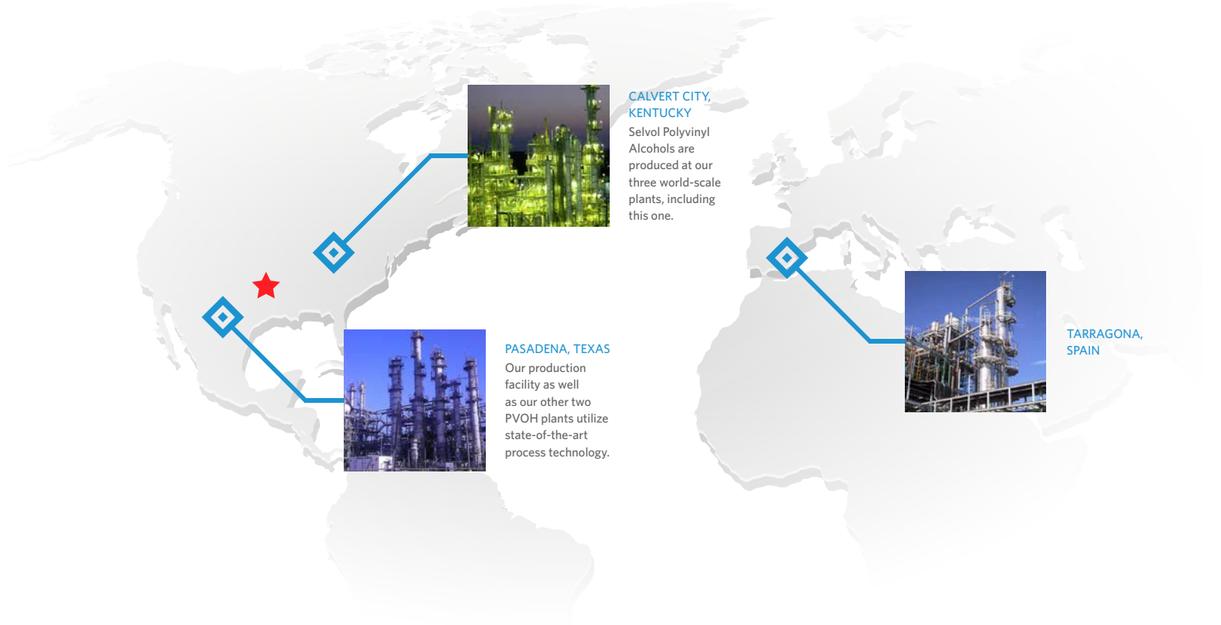
SELVOL™ POLYVINYL ALCOHOL

Sekisui Specialty Chemicals

Sekisui produces and sells one of the most complete lines of polyvinyl alcohol in the world. Since the introduction of Selvol Polyvinyl Alcohol, we have developed a high level of expertise in both the production and use of PVOH.

Based in Dallas, Texas, Sekisui Specialty Chemicals is a leading polyvinyl alcohol supplier with manufacturing facilities in Calvert City, Kentucky, Pasadena, Texas, and Tarragona, Spain. The combined capacity of the three plants makes Sekisui a leading global merchant supplier of polyvinyl alcohol.

Sekisui's commitment to polyvinyl alcohol is especially evident in our research and applications support activities. We have one of the largest technical services, product application, and analytical services groups in the world. Research and application development is carried out at our facilities in Houston, Texas. Sekisui also has a global sales force located in offices worldwide to respond more quickly to the needs of our customers.



CALVERT CITY, KENTUCKY

Selvol Polyvinyl Alcohols are produced at our three world-scale plants, including this one.

PASADENA, TEXAS

Our production facility as well as our other two PVOH plants utilize state-of-the-art process technology.

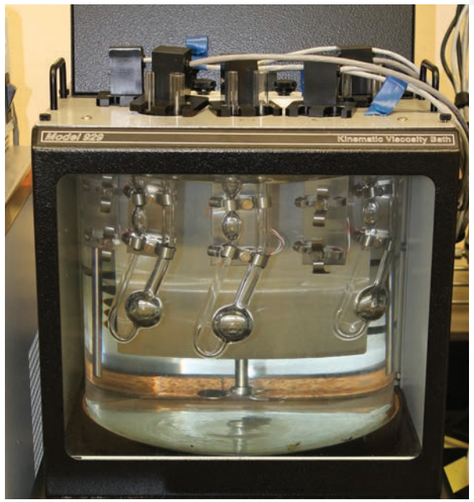
TARRAGONA, SPAIN

Commitment to Quality

Sekisui is committed to continued quality improvements. This commitment starts at executive levels and extends throughout the organization. Our quality improvement efforts focus not only on our products, but also on our customer service and technical support.

Today, employing advanced computer controlled production technology, Sekisui polyvinyl alcohol plants produce polyvinyl alcohol of the highest quality. Sophisticated SQC and SPC systems produce excellent lot-to-lot consistency and product uniformity.

In a continuing commitment to total quality, our plants in Calvert City, Kentucky, Pasadena, Texas, and Tarragona, Spain are ISO 9001 certified ensuring our products are made to a quality standard, that's recognized, and respected worldwide.



Fully equipped laboratories provide a wide range of research and application support activities.

Selvol Polyvinyl Alcohol

Selvol Polyvinyl Alcohol is a white, granular, water-soluble resin manufactured by polymerizing vinyl acetate and hydrolyzing the resultant polymer to produce the alcohol (Figure 1).

FIGURE 1:
General Structure of Polyvinyl Alcohol

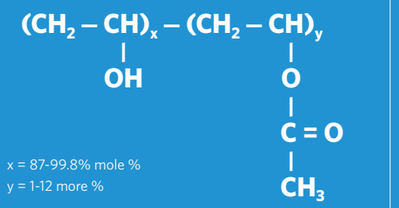


TABLE 2:
Physical Properties of Polyvinyl Alcohol

Appearance	White-to-cream granule solid
Bulk Density	40 lbs/cu ft 641.314 kg/m^3
Specific Gravity: of solid of 10 wt% solution 25˚C	 1.27 - 1.31 1.02
Thermal Stability	Gradual discoloration about 100˚C Darkens rapidly above 150˚C Rapid decomposition above 200˚C
Thermal Conductivity, W/(m•C)	~ 2
Electrical Resistivity, Ohm•cm	(3.1 - 3.8) * 10^7
Specific Heat, J/(g•K)[a]	1.65 - 1.67
Melting Point (unplasticized) ˚C	230 for fully hydrolyzed grades 180-190 for partially hydrolyzed grades
Tg, ˚C (dry film)	58-85
Storage Stability (solid)	5 years when protected from moisture and in original packaging
Flammability	Burns similarly to paper
Stability to Sunlight	Excellent

[a] To convert J to cal, divide by 4.184

Polyvinyl Alcohol Characteristics

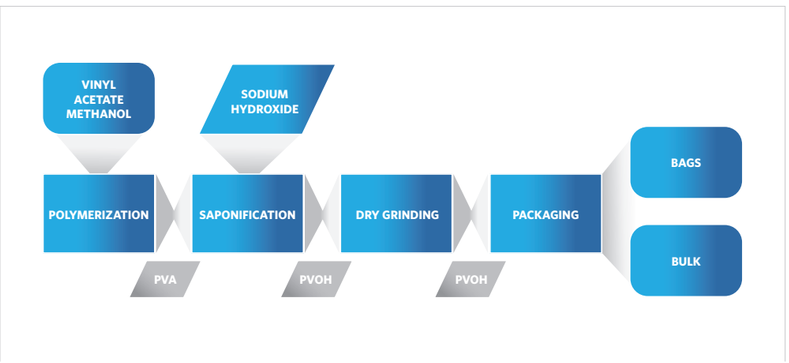
Selvol Polyvinyl Alcohols have many characteristics (Table 2) which make them useful in a wide range of application. Important end-use markets for these polymer products include paper, adhesives, building products, textiles, and specialty applications. Selvol Polyvinyl Alcohol resins perform well as textile sizing agents, pigment binders, emulsifying agents, and in adhesive and protective film applications.

By choosing among the many Selvol PVOH grades available, it is possible to obtain the performance properties required for your specific applications such as water solubility, abrasion resistance, tensile strength, adhesive or bonding properties, grease or oil resistance, and film forming qualities. Our highly skilled technical service group can help you with Selvol Polyvinyl Alcohol grade selection.

Polyvinyl Alcohol Product Line

Selvol Polyvinyl Alcohol is manufactured from vinyl acetate monomer (VAM) via a multistep process. VAM is polymerized into polyvinyl acetate and then converted to polyvinyl alcohol as shown in Figure 2.

FIGURE 2: Polyvinyl Alcohol Process Flow



SELVOL™ POLYVINYL ALCOHOL

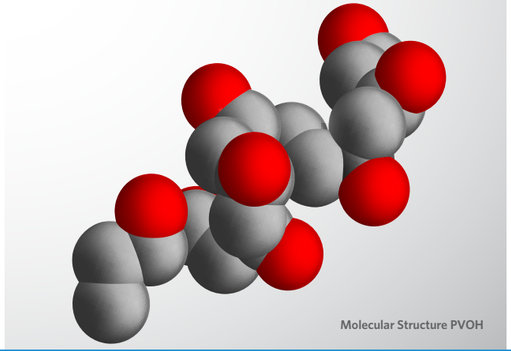
Standard Grades

Because PVOH is synthesized from polyvinyl acetate, a variety of different grades of Selvol is available that varies in molecular weight and hydrolysis level. Molecular weight is a measure of polymer chain length and is generally expressed in terms of 4% aqueous solution viscosity. The viscosities are classified as ultra-low, low, medium, and high (Table 3).

Degree of hydrolysis is commonly denoted as super, fully, intermediate, or partially hydrolyzed as shown on Table 4. A wide range of standard grades are available, refer to Table 5.

TABLE 3:
Selvol Polyvinyl Alcohol Molecular Weight

Viscosity	Viscosity Type	Degree of Polymerization	Average Weight Molecular Weight Range	Number Average Molecular Weight Range
3 - 4 cps	Ultra Low	150 - 300	13,000 - 23,000	7,000 - 13,000
5 - 6 cps	Low	350 - 650	31,000 - 50,000	15,000 - 23,000
22 - 30 cps	Medium	1000 - 1500	85,000 - 124,000	44,000 - 65,000
45 - 72 cps	High	1600 - 2200	146,000 - 186,000	70,000 - 101,000



Molecular Structure PVOH

TABLE 4:
Description of the Different Hydrolysis levels for PVOH

Grade	Hydrolysis Mole %
Super	99.3+
Fully	98.0-98.8
Intermediate	90.0-97.0
Partially	87.0-89.0

Specialty Grades

In addition to Sekisui's standard product line of Selvol Polyvinyl Alcohol, several specialty grades are available, refer to Table 5.

Selvol Polyvinyl Alcohols 805, 818, 823, and 840 are improved versions of our standard polymerization grades Selvol Polyvinyl Alcohols 205, 518, 523, and 540, respectively. These products offer a number of advantages in emulsion polymerization and applications including improved water solubility and lower foaming.

Selvol Polyvinyl Alcohol S-grades are similar to standard grades, but have a fine particle size so that 99.0% of the product will pass through a U.S. Standard 80-mesh screen (177 μ). These grades are available as Selvol Polyvinyl Alcohols 203S/E 203S, 205S/E 205S, 513S, 523S/E 523S, and 540S. As well as the super fine Selvol Polyvinyl Alcohol 165SF (99% pass through 120-mesh; 125 μ). Due to their fine particle size, S-grades have a tendency to agglomerate and form soft compression lumps during storage. The soft compression lumps will usually break apart upon further processing such as dry blending with inorganics like calcium carbonate, gypsum, and cement.

Tackified Selvol PVOH grades are produced by controlled boration of certain super and fully hydrolyzed grades. These borated alcohols yield viscous aqueous solutions which have a tailored degree of tack and, when applied onto surfaces such as paper, significantly reduce penetration.

TABLE 5:

STANDARD GRADES							
Grade	**Hydrolysis, %**	**Viscosity, cP[1]**	**pH[2]**	**Volatiles, % Max**		**Ash, % Max[5]**	**Methanol, wt % Max**
				Total [3]	VOC[4]		
Super Hydrolyzed							
Selvol PVOH 125	99.3+	28.0-32.0	5.5-7.5	5.0	1.0	1.2	0.9
Selvol PVOH 165	99.3+	62.0-72.0	5.5-7.5	5.0	1.0	1.2	0.9
Fully Hydrolyzed							
Selvol PVOH 103/E 103	98.0-98.8	3.5-4.5	5.0-7.0	5.0	1.0	1.2	0.9
Selvol PVOH 107/E 107	98.0-98.8	5.5-6.6	5.0-7.0	5.0	1.0	1.2	0.9
Selvol PVOH 310/E 310	98.0-98.8	9.0-11.0	5.0-7.0	5.0	1.0	1.2	0.9
Selvol PVOH 325/E 325	98.0-98.8	28.0-32.0	5.0-7.0	5.0	1.0	1.2	0.9
Selvol PVOH 325LA[8]	98.0-98.8	28.5-31.5	5.0-7.0	5.0	1.0	0.6	0.9
Selvol PVOH 350	98.0-98.8	62.0-72.0	5.0-7.0	5.0	1.0	1.2	0.9
Intermediate Hydrolyzed							
Selvol PVOH 418	91.0-93.0	14.5-19.5	4.5-7.0	5.0	1.0	0.9	0.9
Selvol PVOH 425	95.5-96.5	27.0-31.0	4.5-6.5	5.0	1.0	0.9	0.9
Selvol PVOH 443	92.0-94.0	53.0-63.0	4.5-6.5	5.0	1.0	0.9	0.9
Partially Hydrolyzed							
Selvol PVOH 502	87.0-89.0	3.0-3.7	4.5-6.5	5.0	1.0	0.9	0.9
Selvol PVOH 203/E 203	87.0-89.0	3.5-4.5	4.5-6.5	5.0	1.0	0.9	0.9
Selvol PVOH 504	87.0-89.0	4.0-5.0	4.5-6.5	5.0	1.0	0.7	0.9
Selvol PVOH E 4/88LA*	87.0-89.0	4.0-5.0	4.5-6.5	5.0	1.0	0.9	0.9
Selvol PVOH E 5/88LA*	87.0-89.0	5.0-6.0	4.5-6.5	5.0	1.0	0.7	0.9
Selvol PVOH 205/E 205	87.0-89.0	5.2-6.2	4.5-6.5	5.0	1.0	0.7	0.9
Selvol PVOH E 8/88	87.0-89.0	7.0-9.0	4.5-6.5	5.0	1.0	0.7	0.9
Selvol PVOH 508	87.0-89.0	7.5-9.5	4.5-6.6	5.0	1.0	0.7	0.9
Selvol PVOH 513	87.0-89.0	13.0-15.0	4.5-6.5	5.0	1.0	0.7	0.9
Selvol PVOH 518	87.0-89.0	17.5-20.5	4.5-6.5	5.0	1.0	0.7	0.9
Selvol PVOH 523/E 523	87.0-89.0	23.0-27.0	4.5-6.5	5.0	1.0	0.5	0.9
Selvol PVOH 540	87.0-89.0	45.0-55.0	4.5-6.5	5.0	1.0	0.5	0.9
SPECIALTY GRADES							
Grade	**Hydrolysis, %**	**Viscosity, cP[1]**	**pH[2]**	**Volatiles, % Max**		**Ash, % Max[5]**	**Methanol, wt % Max**
				Total [3]	VOC[4]		
Warp Size							
Selvol PVOH WS-724	91.0-95.5	13.0-24.0	4.0-7.0	5.0	1.0	1.2	0.9
Selvol PVOH WS-53NF	86.0-90.0	18.5-29.0	4.0-7.0	5.0	1.0	1.2	0.9
Polymerization							
Selvol PVOH 805	87.0-89.0	5.2-6.2	4.5-6.5	5.0	1.0	0.7	0.9
Selvol PVOH 818	87.0-89.0	17.0-21.0	4.0-6.5	5.0	1.0	0.3-0.6	0.9
Selvol PVOH 823	87.0-89.0	23.0-27.0	4.5-6.5	5.0	1.0	0.5	0.9
Selvol PVOH 830	87.0-89.0	29.0-35.0	4.5-6.5	5.0	1.0	0.5	0.9
Selvol PVOH 840	87.0-89.0	45.0-55.0	4.5-6.5	5.0	1.0	0.5	0.9
Fine Particle (S-Grade)							
Selvol PVOH 165SF	99.3+	62.0-72.0	5.5-7.5	5.0	1.0	1.2	0.9
Selvol PVOH 203S[9]/E 203S[9]	87.0-89.0	3.5-4.5	4.5-6.5	5.0	1.0	0.9	0.9
Selvol PVOH 205S/E 205S	87.0-90.0	5.2-6.2	4.5-6.5	5.0	1.0	0.7	0.9
Selvol PVOH 513S	86.0-89.0	13.0-15.0	4.5-6.5	5.0	1.0	0.7	0.9
Selvol PVOH 523S/E 523S	87.0-90.0	23.0-27.0	4.5-6.5	5.0	1.0	0.5	0.9
Selvol PVOH 540S	87.0-90.0	45.0-55.0	4.5-6.5	5.0	1.0	0.5	0.9
TACKIFIED GRADES							
Grade	**Viscosity, cP[6]**	**pH[7]**					
Selvol PVOH MH-82	4200-5900	4.4-4.9	Derived from Fully Hydrolyzed Grades				
Selvol PVOH MM-81	1300-1700	4.4-4.9					
Selvol PVOH MM-51	1100-1500	4.4-4.9					

*Low ammonia (for E grades).
[1] 4% aqueous solution, 20°C.
[2] 4% aqueous solution.
[3] Total volatiles incl. water.
[4] Volatile organic compound, primarily methanol. (max 0.9%) with methyl acetate.
[5] As % Na_2O, corrected volatiles.
[6] 10% aqueous solution, 25°C.
[7] 10% aqueous solution.
[8] Low Ash.
[9] Use of Selvol PVOH 203S is covered by U.S. Patient No. 5,057,570.

Physical Properties

Selvol Polyvinyl Alcohol combines high tensile strength with ease of film formation. Additionally, Selvol Polyvinyl Alcohol exhibits excellent adhesive and bonding characteristics. Partially hydrolyzed grades have better adhesion to hydrophobic surfaces.

The degree of hydrolysis affects the water sensitivity of both resin and film. Water resistance increases with increasing hydrolysis. The super hydrolyzed grades should be used when maximum water resistance and humidity resistance are desired.

Selvol Polyvinyl Alcohols are generally unaffected by greases, petroleum hydrocarbons, and animal or vegetable oils. Resistance to organic solvents increases with the degree of hydrolysis. Selvol Polyvinyl Alcohol film can be plasticized with glycerol or the lower molecular weight glycols.

FIGURE 3:
Changes in PVOH Properties in relation to Molecular Weight and Hydrolysis Level

Lower Viscosity
Higher Application Solids
Better Coating Rheology
Slightly More Water Solubility

Higher Viscosity
Much Higher Strength
Increased Block Resistance

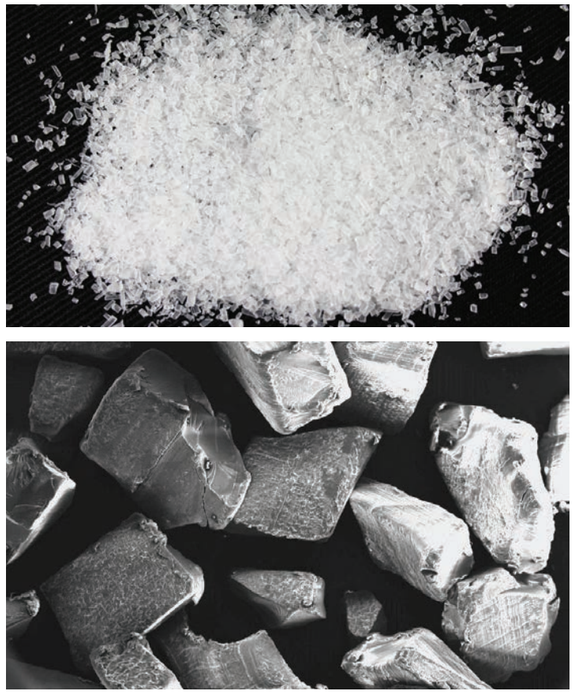
Molecular Weight

DECREASING **INCREASING**

% Hydrolysis

Lower Hydrogen Bonding
Films Cold Water Soluble
Better Adhesion to Hydrophobes
Lower Cohesive Strength
Higher Foam Characteristics
Higher Lumping Tendencies

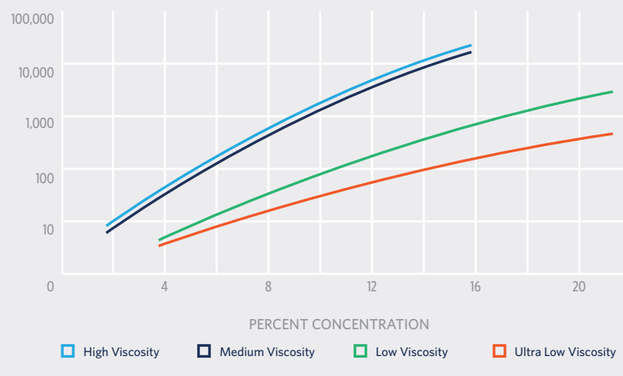
Higher Hydrogen Bonding
Increased Water Resistance
Higher Adhesion to Cellulose
Higher Cohesive Strength
Lower Foaming
Non-Lumping



Top: Selvol PVOH Granules; Bottom: Selvol under a scanning electron microscope.

The relationship between the viscosity and concentration of aqueous Selvol Polyvinyl Alcohol solutions at 20˚ C is shown in Figure 4.

FIGURE 4:
Viscosity/ Concentration of Aqueous Selvol Solutions at 20˚C



Solution Preparation

For a complete description of the various methods for preparing Selvol Polyvinyl Alcohol solutions, please refer to our Solution Preparation Guildelines brochure. Following is a list of important highlights:

- S-grades (fine particle size) are designed for use in dry blends with inorganic substances such as calcium carbonate, gypsum, and cement. (These blends are typically mixed with water at the job site.) We recommend S-grades not be cooked as they tend to clump when added directly to water.
- Selvol Polyvinyl Alcohols should first be dispersed in cold or room temperature water using sufficient agitation to uniformly suspend all particles. (As a general rule, the surface of the water should be moving vigorously.)
- Addition rates, solid and cook out temperatures vary by grade as illustrated on the adjacent chart. For best results, do not exceed maximum solids.
- Elevate solution temperature to recommended levels (185-205˚F/85-96˚C) and hold for 30 minutes.
- Selvol Polyvinyl Alcohols are stable in solution after cooking and can be used at temperatures above 50˚F or 10˚C.
- Tech services can assist with non-standard cooking procedure.

TABLE 6:
Solution Preparation

Grade	Addition Rate	Maximum Recommended Solids	Minimum Cook-out Temperature
STANDARD GRADES			
Super Hydrolyzed	10 sec/bag	7-10%	205°F (96°C)
Fully Hydrolyzed	10 sec/bag	7-25%	200°F (93°C)
Intermediate Hydrolyzed	1 min/bag	7-12%	195°F (91°C)
Partially Hydrolyzed	2 min/bag	7-30%	185°F (85°C)

Addition rates and equipment suggestions will vary for Selvol S, SF, and F grades.
Please refer to our Solutions Preparation Guidelines brochure or contact Sekisui Specialty Chemicals directly for further assistance.

SELVOL™ POLYVINYL ALCOHOL

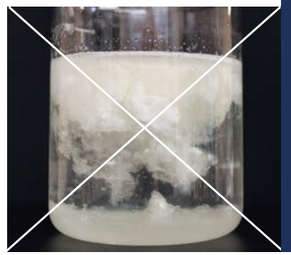
Solution Preparation

While the cooking process is straightforward, please be aware of the following pitfalls:

- There is a high risk of lumping if polyvinyl alcohol is added to preheated water. Lumps are very difficult to cook out.
- All tanks and lines must be free of borax and other crosslinkers to avoid coagulation.
- Tanks should have baffles and flush bottom valves to avoid dead spots where polyvinyl alcohol particles can agglomerate.
- Failure to reach the minimum temperature may result in an undissolved polyvinyl alcohol regardless of cook time.
- Selvol Polyvinyl Alcohols cannot be overcooked. However, boiling can induce foam and add color.
- Avoid high speed, small diameter mixers which may induce air entrainment and create foam. Further, they may not provide sufficient agitation to the sides of the tank allowing polyvinyl alcohol particles to settle out and not dissolve.
- A defoamer is generally recommended. Several grades, including Selvol PVOH 805, 818, 830, 823, 840, WS-724, and WS-53NF are designed to be used without a defoamer.
- If solutions are kept for more than 24 hours, a biocide addition is recommended.

Selvol Polyvinyl Alcohols may be jet cooked. However, unlike starch which explodes rapidly into colloidal sized fragments in a steam jet, Selvol Polyvinyl Alcohols will dissolve slowly by shedding layers. Maximizing time in the post-jet residence coils and providing a holding tank for the polyvinyl alcohol solution after the coils will ensure complete solubility. A 15 minute hold time at 200 °F is recommended.

PREPARATION PITFALL:
Coagulation



PREPARATION PITFALL:
Lumping

PREPARATION PITFALL:
Foaming

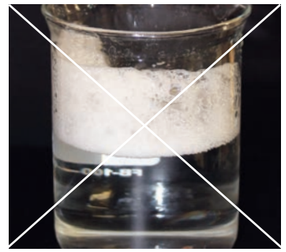


TABLE 7:
Recommended Additives for Selvol Polyvinyl Alcohol*

Type	Brand or Generic Name	Manufacturer	Use Level
Crosslinkers	Bacote - 20 Glyoxal Polycup 172	Magnesium Elektron, Ltd. BASF Ashland	2 - 10% d/d 5 - 115% d/d 5 - 10% d/d
Defoamers	Foam-a-Tac 407 Antifoam 116 FC 402**	ESP Enterprises Harcros ESP Enterprises	<1% d/d <1% d/d <1% d/d
Biocides	Kathon LX Dowicil 75	Dow Chemical Dow Chemical	<50 ppm 1000-2000 ppm
Plasticizers	Glycerine Ethylene Glycol Urea	- - -	2 - 5% 2 - 5% 1-5%

* The FDA compliance status of the recommended additives should be verified with the respective manufacturer.
** Not FDA approved.

Special properties may be imparted by blending grades or compounding with other ingredients. You can see the suggested additives in Table 7.

Chemical Reactions

Polyvinyl alcohol reacts in a manner similar to other secondary polyhydric alcohols. Esterification reactions of polyvinyl alcohol can be carried out with a number of compounds. A commercially important reaction is the formation of tackified PVOH using boric acid or borax to form cyclic esters. This reaction is very sensitive to pH, and an insoluble gel is formed above 4.5-5.0. Other esterification reactions include those with chloroformate ester to yield poly(vinyl carbonate), urea to yield polymeric carbamate ester, and with isocyanates to form substituted carbamate esters.

Another commercially important reaction is the acetylization with aldehydes. Polyvinyl butyral is produced by the reaction of polyvinyl alcohol with butyraldehyde and is used in the production of the inner adhesive film for safety glass. Reaction with dialdehydes such as glyoxal or gluteraldehyde can be used to crosslink polyvinyl alcohol. Other reactions include ethoxylation, propoxylation, and cyanoethoxylation.

TABLE 8:
Effect of Glyoxal Polyvinyl Alcohol Wet Tensile Strength Chromatography Base Paper*

Selvol PVOH Grade	% Hydrolysis Spec. Range	% Glyoxal (Dry/Dry)	Wet Tensile, pli (3 min in 1% Aerosol OT Solution)
540	87.0-89.0	None	0.0
540	87.0-89.0	20	6.1
350	98.0-98.8	None	3.2
350	98.0-98.8	20	6.6
165	99.3+	None	6.7
165	99.3+	20	8.6

* 9% Add-on level based on fiber; cure 5 min @ 149°C

Crosslinking

All Selvol Polyvinyl Alcohol grades are crosslinkable through their secondary hydroxyl functionality. Even lower hydrolysis grades which are exceptional on paper surfaces for oil, grease and organic solvent resistance, and Gurley porosity can be made water resistant. Degree of water resistance varies from grade to grade. Table 8 shows the effect of glyoxal, a commonly used and favored crosslinker for polyvinyl alcohol.

When glyoxal was added to Selvol Polyvinyl Alcohol grades 540, 350, and 165 at 20% dry-on-dry, significant water resistance improvements resulted. Note that the wet tensile of Selvol Polyvinyl Alcohol 540 increased from no measurable wet strength when uncrosslinked to 6.1 pli when crosslinked. Also, the wet tensile of crosslinked Selvol Polyvinyl Alcohol 350 was more than double that of uncrosslinked Selvol Polyvinyl Alcohol 350, and crosslinked Selvol Polyvinyl Alcohol 165 was 28% higher than uncrosslinked Selvol Polyvinyl Alcohol 165.

A vast array of crosslinkers or insolubilizers are available. They include several classes: (1) aldehydes, of which glyoxal, a simple dialdehyde, is the most common, along with the higher aldehydes, such as gluteraldehyde and hydroxyadipaldehyde; (2) thermosetting resins, such as urea-formaldehyde and melamineformaldehyde; and (3) salts of multi-valent anions, such as zirconium ammonium carbonates.

There continues to be a growing interest in zero-formaldehyde, or low-formaldehyde crosslinkers. Two such products are Polycup 172, a water soluble, polyamide epichlorohydrin resin, and Bacote-20, a zirconium ammonium carbonate salt. The results in Table 9 indicate that the addition of Polycup 172 to Selvol Polyvinyl Alcohol 165 at 5% dry/dry parts was as effective as glyoxal added at 20%, both resulting in a 36% wet tensile improvement. The addition of 5% Bacote-20 resulted in an 11% wet tensile improvement.

TABLE 9:
Effect of Crosslinker Type on Wet Tensile of Selvol PVOH 165 Polyvinyl Alcohol-Saturated Paper*

Crosslinker	% (Dry/Dry)	Instron Wet Tensile (CMD) pli
None	-	6.4
Glyoxal	20	8.0
Bacote-20	5	7.1
Polycup 172	5	8.1

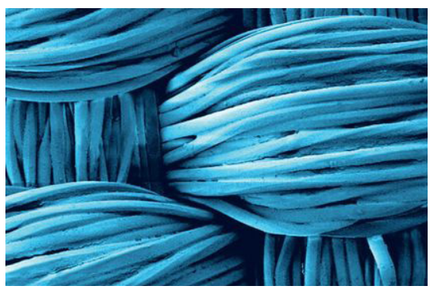
* Whatman No. 4 chromatography paper; 10% Selvol PVOH 165 add-on Drying Conditions were 5 min @ 149°C

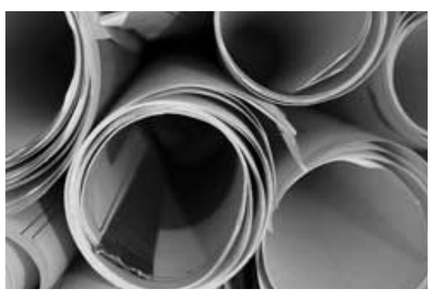
SELVOL™ POLYVINYL ALCOHOL

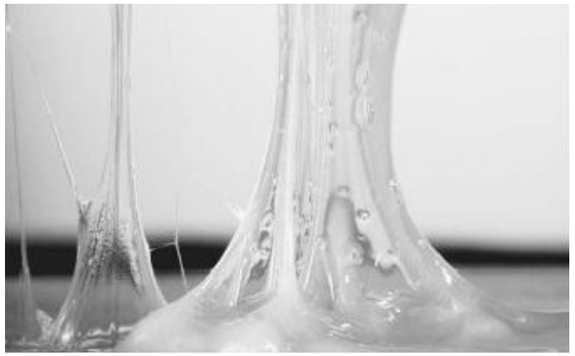
Applications

Selvol Polyvinyl Alcohols are widely used by the **paper industry** for surface sizing and coating. Selvol PVOH significantly improves grease, solvent, and water resistance as well as web strength. Selvol™ Polyvinyl Alcohol products are also well suited as binders in pigmented coatings systems and as carriers for optical brighteners.

Additionally, Selvol Polyvinyl Alcohols are often used for **textile warp sizing**. Selvol Polyvinyl Alcohol films exhibit high abrasion resistance, elongation, tensile strength and flexibility. Partially hydrolyzed grades, which possess increased polyester adhesion, can lead to superior abrasion resistance and weavability. These grades will also desize far easier than other grades providing numerous benefits in textile finishing operations







In **adhesive** formulations Selvol Polyvinyl Alcohols can function as the primary binder or a compounding agent. They bond particularly well to cellulosic surfaces and offer improved water resistance, strength, and resistance to grease and other petroleum hydrocarbons.

Polymerizers also find Selvol Polyvinyl Alcohols valuable as a dispersing/stabilizing agent. They behave primarily as a protective colloid and often enhance the emulsifying action at very low concentrations.

Selvol Polyvinyl Alcohols are used in a wide variety of other industrial applications such as a **temporary binder** for ceramics, water soluble films, strippable coatings, and nonwovens. The products also find use in various building products such as joint cements and mortars.

A more explicit list of Selvol Polyvinyl Alcohol applications is shown in Table 10 with grades comparison.

Information on the uses of Selvol Polyvinyl Alcohol products, or assistance with new applications, is available from our technical service staff. The product applications matrix on the next page shows the broad range of applications that are feasible for the various Selvol PVOH grades. For polyvinyl alcohol information related to specific applications, please visit our website at www.selvol.com.

SELVOL™ POLYVINYL ALCOHOL

TABLE 10:

	TEXTILES					ADHESIVES												BUILDING PRODUCTS				
	Spun Yarn Sizing	Filament Yarn Sizing	Screen Printing	Non Wovens	Hand Building	Envelope	Sealing	Water Resistant	Remoistenable	Tube Winding	Label	Bookbinding	Padding	Solid Fiber Lamination	Cup	Cigarette Filter	Carton Case Sealing	Wood	Joint Cement/Mortars	Gypsum Boards	Cement/Plaster Additive	Stucco Finishes	Peelable Caulks
STANDARD GRADES																							
Super Hydrolyzed																							
Selvol PVOH 125										■				■									
Selvol PVOH 165										■				■									
Fully Hydrolyzed																							
Selvol PVOH 103/E 103				■		■				■		■	■	■	■	■	■						
Selvol PVOH 107/E 107	■			■		■				■		■	■	■	■	■	■						
Selvol PVOH 310/E 310	■			■		■				■		■	■	■	■	■	■						
Selvol PVOH 325/E 325	■			■	■	■	■	■		■		■	■	■	■	■	■						
Selvol PVOH 325LA																							
Selvol PVOH 350						■				■		■	■	■	■	■	■	■					
Intermediate Hydrolyzed																							
Selvol PVOH 418	■					■				■		■	■		■	■	■						
Selvol PVOH 425	■			■	■	■				■		■	■		■	■	■						
Selvol PVOH 443						■													■		■		
Partially Hydrolyzed																							
Selvol PVOH 502	■	■				■			■		■	■	■				■	■	■	■			
Selvol PVOH 203/E 203	■	■	■			■			■		■	■	■				■	■	■	■		■	■
Selvol PVOH 504	■	■	■	■		■			■		■	■	■				■	■	■	■			
Selvol PVOH E 4/88LA	■	■	■	■		■			■		■	■	■				■	■	■	■			
Selvol PVOH E 5/88LA	■	■	■	■		■			■		■	■	■				■	■	■	■			
Selvol PVOH 205/E 205	■	■	■	■		■			■		■	■	■				■	■	■	■		■	■
Selvol PVOH E 8/88	■	■	■	■		■			■		■	■	■				■	■	■	■			
Selvol PVOH 508	■	■	■	■		■			■		■	■	■				■	■	■	■			
Selvol PVOH 513	■	■	■	■	■	■			■		■	■	■				■	■	■			■	
Selvol PVOH 518	■	■	■	■	■	■			■		■	■	■				■	■	■			■	
Selvol PVOH 523/E 523	■	■	■	■	■	■			■		■	■	■				■	■	■	■		■	
Selvol PVOH 540	■	■	■	■	■	■			■		■	■	■				■	■	■			■	
SPECIALTY GRADES																							
Warp Size																							
Selvol PVOH WS-724	■				■																		
Selvol PVOH WS-53NF	■	■	■		■																		
Polymerization																							
Selvol PVOH 805																							
Selvol PVOH 818																							
Selvol PVOH 823																							
Selvol PVOH 830																							
Selvol PVOH 840																							
Fine Particle (S-Grade)																							
Selvol PVOH 165SF																							
Selvol PVOH 203S/E 203S																			■	■	■	■	■
Selvol PVOH 205S/E 205S																			■	■	■	■	■
Selvol PVOH 513S																			■	■	■	■	■
Selvol PVOH 523S/E 523S																			■	■	■	■	■
Selvol PVOH 540S																			■	■	■	■	■
TACKIFIED GRADES																							
Selvol PVOH MH-82										■		■		■	■	■	■						
Selvol PVOH MM-81										■		■		■	■	■	■						
Selvol PVOH MM-51										■		■		■	■	■	■						

	PAPER												SPECIALTY											
	Surface Sizing	Carbonless Paper	Thermal Paper	Pigment Coating	Casting Papers	Release Papers	Grease Resistant Papers	Protein Replacement	Optical Brightener Carrier	Flourchemical Carrier	Ink Jet	Creping	Water Soluble Films	Protective Strip Coating	Polymerization/Emulsions	Seed Coating	Microencapsulation	Temporary Binder/Powder	Wet End	PVB Production	PVC Polymerization	Ceramics Binder/Coating	Molded Products	Mold Release
STANDARD GRADES																								
Super Hydrolyzed																								
Selvol PVOH 125	■		■		■	■	■		■	■		■											■	
Selvol PVOH 165	■				■	■	■		■	■		■	■	■										
Fully Hydrolyzed																								
Selvol PVOH 103/E 103	■			■	■	■	■	■	■			■	■	■								■		
Selvol PVOH 107/E 107	■		■	■	■	■	■	■	■	■	■	■	■	■								■		
Selvol PVOH 310/E 310	■		■	■	■	■	■		■	■	■	■	■	■								■		
Selvol PVOH 325/E 325	■		■	■	■	■	■		■	■	■	■	■	■								■	■	
Selvol PVOH 325LA									■											■			■	
Selvol PVOH 350	■						■			■	■	■	■	■									■	
Intermediate Hydrolyzed																								
Selvol PVOH 418															■							■		
Selvol PVOH 425	■					■	■					■	■	■	■							■	■	
Selvol PVOH 443															■								■	
Partially Hydrolyzed																								
Selvol PVOH 502		■	■	■					■				■	■	■	■	■	■				■		■
Selvol PVOH 203/E 203		■	■	■					■		■		■	■	■	■	■	■				■		■
Selvol PVOH 504		■	■	■					■		■		■	■	■	■	■	■				■		■
Selvol PVOH E 4/88LA		■	■	■					■		■		■	■	■	■	■	■				■		■
Selvol PVOH E 5/88LA		■	■	■					■		■		■	■	■	■	■	■				■		■
Selvol PVOH 205/E 205		■	■	■					■		■	■	■	■	■	■	■	■				■		■
Selvol PVOH E 8/88		■	■	■					■		■		■	■	■	■	■	■				■		■
Selvol PVOH 508		■	■	■					■		■		■	■	■	■	■	■				■		■
Selvol PVOH 513	■						■				■		■	■	■	■	■					■	■	■
Selvol PVOH 518	■						■						■	■	■	■	■					■	■	■
Selvol PVOH 523/E 523	■		■				■				■	■	■	■	■	■	■				■	■	■	■
Selvol PVOH 540	■						■						■	■	■		■			■		■	■	■
SPECIALTY GRADES																								
Warp Size																								
Selvol PVOH WS-724																								
Selvol PVOH WS-53NF																								
Polymerization																								
Selvol PVOH 805														■	■									
Selvol PVOH 818														■	■									
Selvol PVOH 823														■	■					■				
Selvol PVOH 830														■	■									
Selvol PVOH 840														■	■					■				
Fine Particle (S-Grade)																								
Selvol PVOH 165SF																			■					
Selvol PVOH 203S/E 203S				■				■	■															
Selvol PVOH 205S/E 205S																								
Selvol PVOH 513S																								
Selvol PVOH 523S/E 523S																								
Selvol PVOH 540S																								
TACKIFIED GRADES																								
Selvol PVOH MH-82																								
Selvol PVOH MM-81																								
Selvol PVOH MM-51																								

SEKISUI

North America:

Sekisui Specialty Chemicals America
1501 LBJ Freeway, Suite 530
Dallas, TX 75234-6034
Tel +1-972-277-2901
Fax +1+972-277-2907
www.sekisui-sc.com

Europe:

Sekisui Specialty Chemicals Europe S.L
Ctra. N-340 Km. 1157 Apdo. 1388
43080 Tarragona, Spain
Tel +34 977549899
Fax +34 977544982

Visit www.selvol.com for more information about our products.