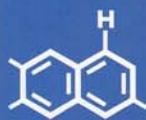


Excipients

NISSO HPC

Hydroxypropyl Cellulose

Application Guide



NIPPON SODA CO.,LTD.



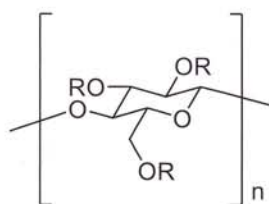
CONTENTS

NISSO HPC and Main Application	2
Features and Grades	3
Basic Properties (1) (Physical and Chemical Characteristics)	4
Basic Properties (2) (Physical and Chemical Characteristics)	5
Basic Properties (3) (Solubility)	6
Solution Characteristics	7
Film Characteristics	8
General Information	9
Precautions	10

NISSO HPC

NISSO HPC (Hydroxypropyl Cellulose) is a modified cellulose obtained by reacting propylene oxide with cellulose. The presence of hydroxypropoxy group prevents the hydrogen bonding between the hydroxy groups on the cellulose chain, thereby making HPC soluble.

NISSO HPC was first sold in Japan in 1969 and was listed in the Japanese Pharmacopeia (JP) by 1971. It was designated as food additive in 2005 and manufacturing has been fully IPC GMP compliant since 2010.



R=H or CH₂CH(OH)CH₃
Hydroxypropyl Cellulose



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Main Applications










Features of NISSO HPC





1. Exceptional binding force
2. Soluble in water and most organic solvents
3. Chemically inert and virtually non-reactive
4. Non-toxic and not harmful to the human body
5. GMP compliant and conforms to JP, USP and EP
6. Various grades of viscosity and particle size available
7. Minimal lot-to-lot variability
8. 5-year shelf life
9. No additives such as silica

NISSO HPC Grades



NISSO HPC		SSL	SL	L	LM	LMM	M	H	VH
Viscosity (mPa·s) 20°C/2% aq. solution		2.0-2.9	3.0-5.9	6.0-10.0	11-20	21-50	150-400	1000-4000	4001-6000
Molecular weight / GPC method		40,000	100,000	140,000	180,000	280,000	700,000	1,000,000	2,500,000
AVAILABILITY	Regular Powder (40 mesh) D ₅₀ : 150 -190 μm	●*	●	●	●	●	●	●	●
	Fine Powder (100 mesh) D ₅₀ : 80-110 μm		●	●			●	●	●
	Super Fine Powder (330 mesh) D ₅₀ : 20 μm	●							
APPLICATION	High Shear Granulation 								
	Fluidized Bed Granulation 								
	Direct Compression Dry Granulation 								
	Hot Melt Processing 								
	Film Coating 								
	Solubility Enhancement 								
	Controlled Release Matrix Tablets 								

*: Particle Size of the Regular Powder: 85 μm

 = Dry / Powder Use  = Wet / Solution Use

Physical and Chemicals Characteristics



■ Average Particle Size Distribution for Each Grade (reference value)

	D ₁₀ (μm)	D ₅₀ (μm)	D ₉₀ (μm)
SSL	30	85	185
SL	65	155	275
L	75	160	355
M	80	185	355
H	85	185	365
FP	35-50	80-110	150-200
SFP	8	20	50

■ Powder Characteristics (Regular Powder)

	SSL	SL	L	M	H
Bulk Density (Aerated, g/mL)	0.38	0.38	0.44	0.44	0.42
Bulk Density (Packed, g/mL)	0.55	0.50	0.52	0.52	0.50
Compressibility (%)	32	24	22	16	17
Angle of Repose (degrees)	46	43	45	43	44

■ Powder Characteristics (Fine Powder/ Super Fine Powder)

	SSL-SFP	SL-FP	L-FP	M-FP	H-FP
Bulk Density (Aerated, g/mL)	0.18	0.31	0.33	0.38	0.36
Bulk Density (Packed, g/mL)	0.33	0.47	0.46	0.49	0.49
Compressibility (%)	46	33	28	23	25
Angle of Repose (degrees)	53	47	42	44	43

■ Softening Temperature

	Softening Temperature/°C		
Grade	1st	2st	3rd
SSL	75	183	-
SL	68	192	255
L	60	185	255
M	68	178	253
H	73	164	252

► Conforms to Japan Industrial Standard JIS K-7196 "Testing Method for Softening Temperature of Thermoplastics Film and Sheet by Thermomechanical Analysis." Note that an insertion pressure of 5mN was used to eliminate the effect of creep which occurs on the low temperature side.

■ Pyrolysis

- Temperature at which coloration starts to occur: 195-210°C (380-410°F)
- Temperature at which blackening starts to occur: 260-275°C (500-527°F)

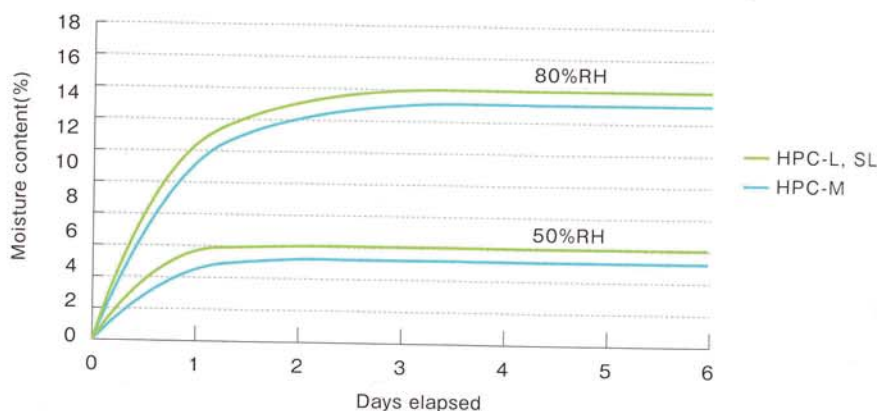
Grade	Burnout Temperature(°C)
SSL	497
SL	506
L	508
M	528
H	541

- TG/DTA measurement conditions
 - Atmospheric
 - 30-750°C (20°C/min)
 - Pt container (open)

Physical and Chemical Characteristics



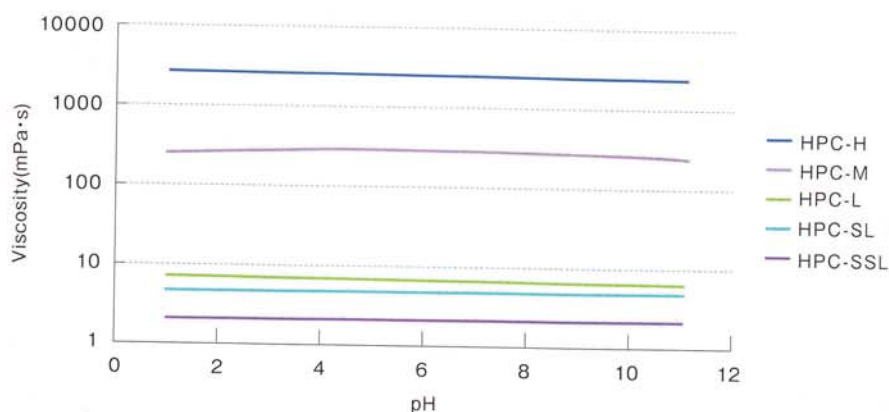
Moisture content over time



Test method

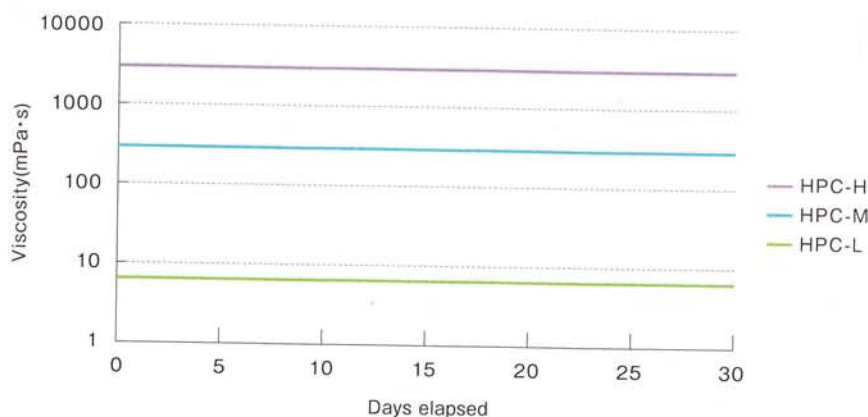
Approximately 1g of the sample were inserted into a 50ml weighing bottle (f45mm, H50mm) at 25°C and a constant relative humidity (50%RH and 80%RH) the percent changes in weight were measured over time.

Effect of pH on HPC aqueous viscosity



2% solutions of HPC were measured at various pH at 20°C.

Effect of UV radiation on HPC aqueous viscosity



2% solution of HPC-L, M and H were exposed to UV rays (wavelength: 254nm, temperature: 25-30°C, Apparatus: LT-6 life tester Freund Corporation) for 30 days, and the viscosities were measured at 20°C.

Solubility



HPC dissolves in water at room temperature and majority of polar organic solvents. Below table shows HPC solubility in various single solvents and mixed solvents.

■ Solubility of HPC-L 2%

Solution name (general name)	Viscosity (mPa·s)	Viscosity ratio* ¹	Appearance	Solubility* ²
Water	6.3	1.0	Transparent	○
Methanol	3.4	0.5	Transparent	○
Ethanol	6.9	1.1	Transparent	○
Isopropyl alcohol	13.1	2.1	Transparent	○
tert-Butanol	33.0	5.2	Transparent	△
n-Butanol	17.0	2.7	Transparent	○
Cyclo-hexanol	397.0	62.7	Transparent	△
Propylene glycol	276.0	43.6	Transparent	△
Acetone	2.0	0.3	Very slight clouding	△
Cyclohexanone	16.9	2.7	Transparent	○
THF	3.5	0.6	Transparent	○
Dioxane	8.5	1.3	Very slight clouding	△
Cellosolve	12.6	2.0	Transparent	○
Butyl cellosolve	19.1	3.0	Transparent	○
Glacial acetic acid	9.4	1.5	Transparent	○
Formic acid	11.5	1.8	Transparent	○
Lactic acid	416.0	65.7	Transparent	△
Ethyl acetate	-	-	Dense clouding	×
Butyl acetate	-	-	Dense clouding	×
DMF	4.7	0.7	Transparent	○
DMSO	10.9	1.7	Transparent	○
Pyridine	5.8	0.9	Transparent	○
Methyl chloride	5.9	0.9	Transparent	○
Chloroform	7.7	1.2	Transparent	○
Benzene:Methanol (1:1)	3.8	0.6	Transparent	○
Toluene:Ethanol (3:2)	4.6	0.7	Transparent	○
Glycerin:Water (3:7)	15.3	2.4	Transparent	○

*¹: Aqueous solution is defined as 1. *²: ○=Soluble, △=Difficult to dissolve, ×=Insoluble



○Soluble



△Difficult to dissolve



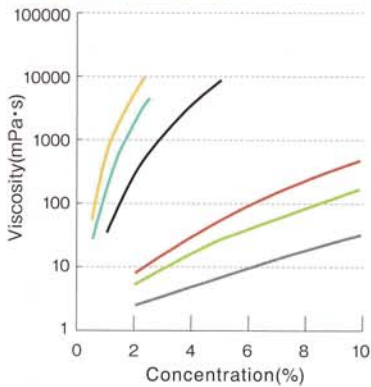
×Insoluble

Solution Characteristics

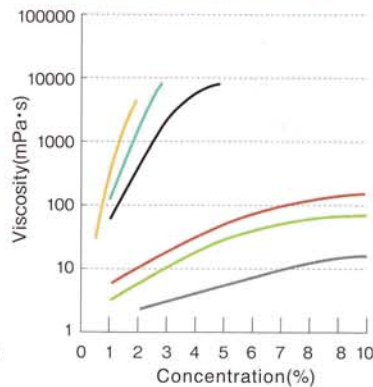


Aqueous solution of HPC appears as clear and smooth and its viscosity decreases with increasing temperature until about 45°C, at which point thermal precipitation will occur. This process is completely reversible and is due to the limit of solubility being exceeded at higher temperatures.

■ Viscosity vs. Solution Concentration (aq.)

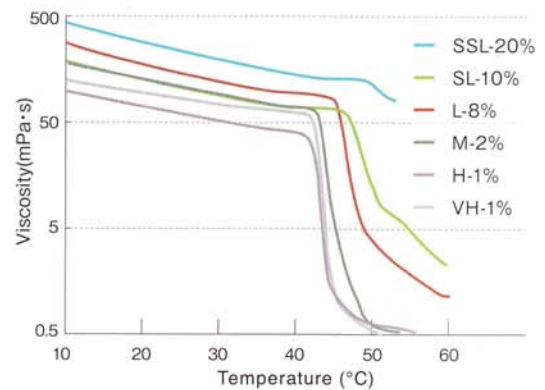


■ Viscosity vs. Solution Concentration (ethanol)



— HPC-VH — HPC-H — HPC-M — HPC-L — HPC-SL — HPC-SSL

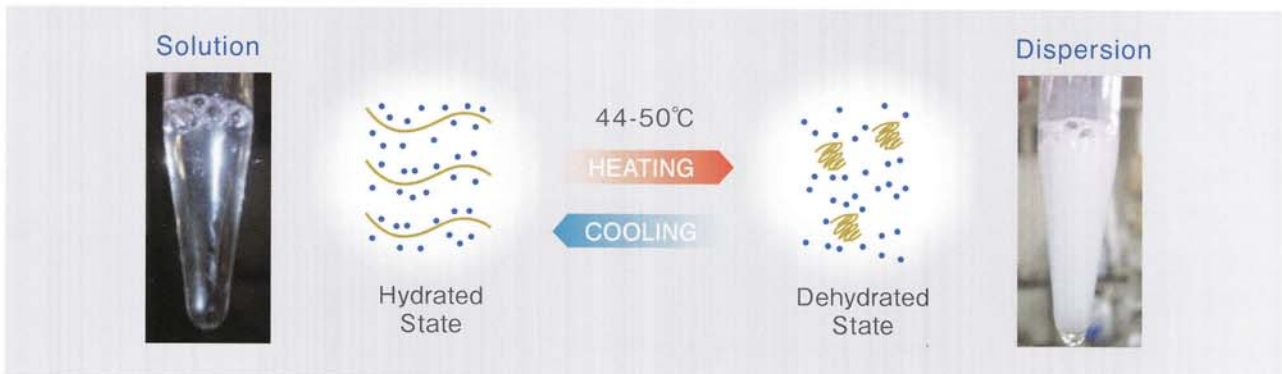
■ Viscosity vs Temperature Curve



Gelation Temperature	SSL-20%	SL-10%	L-8%	M-2%	H-1%	VH-1%
Temp. (°C)	50	47	45	42	41	41

■ Thermal Cohesiveness of HPC

Beginning at about 45°C, the aqueous solution of HPC will become hazy and its viscosity will abruptly decrease. This is referred to as the cloud point of HPC and is completely reversible. The HPC cloud point is inversely related to its viscosity; as the viscosity of HPC increases, the observed cloud point temperature will decrease.



■ Surface Tension

HPC will reduce the surface tension of aqueous solution.

	Specific Gravity	Refractive Index	Surface Tension*			
	20°C	20°C	Concentration of aqueous solution			
Grade	2% aq.	2% aq.	0.01%	0.1%	1%	10%
HPC-L	1.0064	1.34	51.0	49.1	46.3	45.8
HPC-M	1.0064	-	54.8	49.7	46.3	-

*dyne/cm; Conforms to JIS-K-3362: Test method of household synthetic detergent.

Film Characteristics



HPC can be used to create a tough and elastic film when dissolved in appropriate solvents.

HPC Film Properties



Grade	Tensile Strength (kg/mm ²)	Elongation (%)	Moisture Permeability (g/m ² ·24Hrs)
HPC-SL	1.93	5.6	1606
HPC-L	1.82	6.8	1338
HPC-M	2.00	110	1253
HPC-H	1.55	59	1125

The tensile strength and elongation of a film of approximately 0.1mm thickness were measured according to JIS-K-6732. The moisture permeability was measured according to JIS-Z-0208.

Oxygen Permeability



Grade	Film Thickness (mm)	Transmission Coefficient (cm ³ /m ² ·24h·atm)	Transmission Coefficient	
			cm ³ ·mm/m ² ·24h·atm	cm ³ ·cm/cm ² ·s·cmHg
HPC-SL	0.074 - 0.076	191.0	14.3	2.18E-11
	0.107 - 0.129	97.5	11.3	1.72E-11

JIS-K-7126B method

Oxygen permeability tester: TRAN2/20 (Mocon) Test temperature= 23°C Test humidity= 0%RH



General information



Applicable standards Japanese Pharmacopeia (JP)
United States Pharmacopeia (USP)
European Pharmacopeia (EP)

HS code 3912-39
CAS number 9004-64-2
CFR number 21CFR 172.870
E number E463

Packaging 10kg cardboard box, double lined PE bag



Pharmaceutical grade



Industrial grade



Food grade

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Precautions



Handling and Storage

• Handling	Refer to the SDS and the product label before handling. 1) Avoid raising excess dust as this material has dust explosion property. 2) Avoid contact with eye, skin or clothing. 3) Avoid breathing dust. 4) Avoid releasing it to environment.
• Storage	1) Store in a cool dry place without direct sunshine. 2) Keep in a container tightly closed, in a safe place.

First Aid

• Ingestion	Rinse mouth with water. Get medical advice/attention, if a still feeling unwell.
• Inhalation	Move to place with access to fresh air and keep at rest in a position comfortable for breathing. Get medical advice/attention, if still feeling unwell.
• Skin Contact	Rinse skin with water/shower.
• Eye Contact	Immediately rinse eyes with plenty of water for at least 15 minutes. Remove contact lenses if wearing them and if it is easy to do so. Continue rinsing. Contact a physician, if eye irritation persists.

Harmfulness

• Overall information regarding harmfulness	HPC is neither toxic nor an irritant, and its harmfulness is low.
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Stability and Reactivity

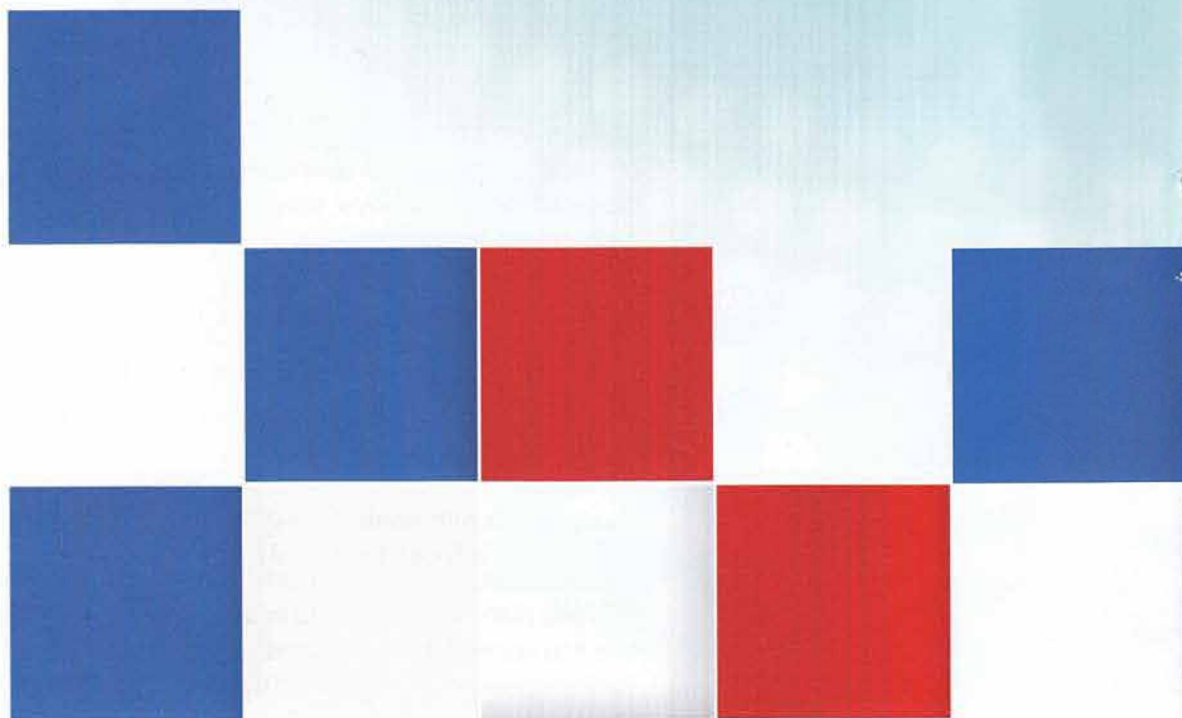
• Flash Point	Not applicable.
• Powder explosiveness (lower limit)	Not explosive.
• Chemical Stability	Stable in normal condition. Keep away from strong oxidizing agents.

Disposal

Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and alkaline scrubber.

Notice

The information described in this sheet is believed to be accurate and is presented in good faith with no guarantee or obligation as to accuracy and no assumption on of liability. Users should make their own tests to determine the suitability of products for their own particular use. NISSO makes no warranty of any kind, express or implied, including those of merchantability and fitness for particular purpose other than the materials conforms to its applicable current standard specifications.



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<http://www.dalian-diligence.com>