



WATER SOLUBLE POLYMER

ISOBAM[™]

kuraray

“ISOBAM™” is

ISOBAM™ is the trade name of a copolymer of isobutylene and maleic anhydride developed by KURARAY CO., LTD. using its PVA (polyvinyl alcohol) technology. ISOBAM™ is an alkali water soluble polymer with outstanding characteristics which have never been attained with conventional water soluble polymers such as polyvinyl alcohol and cellulose derivatives.

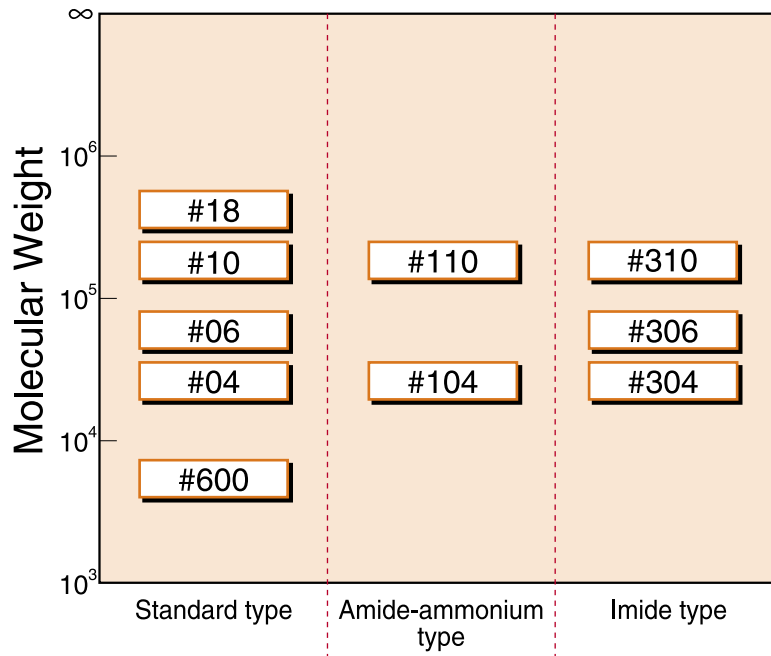
ISOBAM™ is a white powder in appearance. It is generally used as a water soluble polymer reacting with sodium hydroxide, ammonia and amine.

Various useful reactants are obtained by the reaction of ISOBAM™ with alcohol, amine and epoxy compounds. These can be applied to resins and plastics.

■ Applications

- **Adhesives**
 - SBR emulsion type
 - Polyvinyl acetate type
- **Protective colloids**
 - Vinyl acetate
 - Acryloyl monomer
 - Micro-capsule for pressure sensitive paper
- **Binders**
 - Binder for ceramic powder
 - Binder for solid catalyst
 - Binder for glass fiber
- **Metal processing oils**
 - Lubricant for forging and casting
 - Hardening agent for steel
- **Gel base**
 - Air freshener
- **Dispersants**
 - Water-reducing agent for cement
 - Scale inhibitor
 - Dispersing agent for pesticide
 - Water soluble paint
 - Dispersant for ceramic powder
- **Coating for papers**
 - Coating agent for thermal paper

Grades of “ISOBAM™”



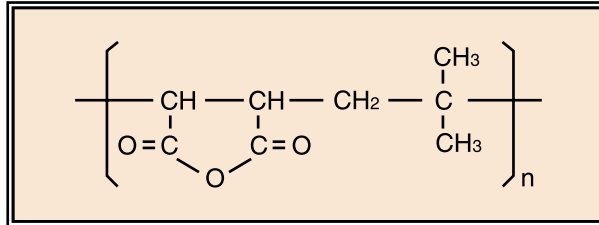
Physical properties of “ISOBAM™”

Tested by KURARAY CO., LTD.

	Molecular weight *	Appearance	Particle Size distribution	Density (g/cm ³)	Melting point	Packed specific gravity (g/cm ³)	Volatile portion (%)
ISOBAM™-600	5,500 ~ 6,500	Powder	—	1.3	None	0.4 ~ 0.7	≦ 5
ISOBAM™-04	55,000 ~ 65,000	Powder	12 ~ 200 mesh ≧ 88%	1.3	None	0.3 ~ 0.5	≦ 4
ISOBAM™-06	80,000 ~ 90,000	Powder	12 ~ 200 mesh ≧ 88%	1.3	None	0.3 ~ 0.5	≦ 4
ISOBAM™-10	160,000 ~ 170,000	Powder	12 ~ 200 mesh ≧ 88%	1.3	None	0.3 ~ 0.5	≦ 4
ISOBAM™-18	300,000 ~ 350,000	Powder	12 ~ 200 mesh ≧ 88%	1.3	None	0.3 ~ 0.5	≦ 4
ISOBAM™-104	55,000 ~ 65,000	Powder	12 ~ 200 mesh ≧ 88%	1.3	None	0.3 ~ 0.5	—
ISOBAM™-110	160,000 ~ 170,000	Powder	12 ~ 200 mesh ≧ 88%	1.3	None	0.3 ~ 0.5	—
ISOBAM™-304	55,000 ~ 65,000	Powder	12 ~ 200 mesh ≧ 88%	1.3	None	0.3 ~ 0.5	—
ISOBAM™-306	80,000 ~ 90,000	Powder	12 ~ 200 mesh ≧ 88%	1.3	None	0.3 ~ 0.5	—
ISOBAM™-310	160,000 ~ 170,000	Powder	12 ~ 200 mesh ≧ 88%	1.3	None	0.3 ~ 0.5	—

* Weight- average molecular weight

Standard type of “ISOBAM™”



CAS NO. 26426-80-2
TSCA Registered

Differing from conventional water soluble polymers, ISOBAM™ is used by reacting with alkali.

These alkali solutions can be easily modulated from low viscosity to high viscosity and from acidity to alkalinity.

The standard type of ISOBAM™ is used as binders with excellent heat resistance, and hardness.

Also the standard type has an excellent dispersing effect due to the high functionality of the carboxyl group which is aligned side by side in the molecule.

■ ISOBAM™-600

ISOBAM™-600 has the lowest molecular weight of all ISOBAM™, with a molecular weight of approximately 6,000.

ISOBAM™-600 is used as a dispersing agent and surfactant.

Main applications	Characteristics etc ...
<ul style="list-style-type: none"> ■ Water-reducing agent for cement 	<ul style="list-style-type: none"> ■ Effective to use as solid. ■ Delayed action by dissolving in cement.
<ul style="list-style-type: none"> ■ Scale inhibitor 	<ul style="list-style-type: none"> ■ Function as chelator of metal ion in water. (Ca²⁺, Mg²⁺)
<ul style="list-style-type: none"> ■ Dispersing agent for pesticide 	<ul style="list-style-type: none"> ■ When dispersed into water, it collapses gradually.

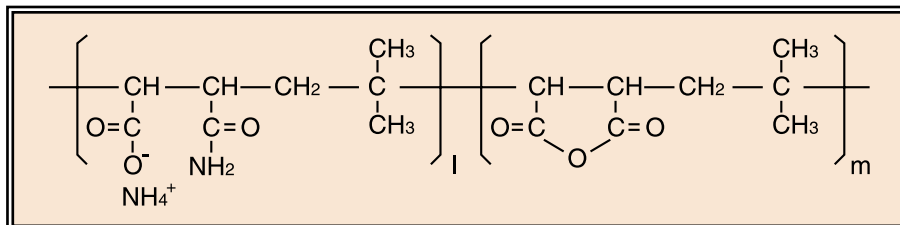
■ ISOBAM™-04,06,10,18

These grades cover molecular weight ranges from middle to high.

With features such as hardness and toughness, they are mainly used as binders and protective colloids.

Main applications	Characteristics etc ...
<ul style="list-style-type: none"> ■ Protective colloid of polymerizing emulsion 	<ul style="list-style-type: none"> ■ Add hardness and tackiness to polyvinyl acetate adhesive. ■ Add high viscosity to acrylic emulsion.
<ul style="list-style-type: none"> ■ Emulsion type of adhesive for wood and papers 	<ul style="list-style-type: none"> ■ SBR emulsion type of adhesive. ■ Function as dispersant for inorganic filler. ■ Non-formaldehyde adhesives.
<ul style="list-style-type: none"> ■ Water based binders for ceramic powders 	<ul style="list-style-type: none"> ■ Moderate decomposition. ■ No ash. ■ Improvement of strength of raw compound.
<ul style="list-style-type: none"> ■ Binder for glass fiber 	<ul style="list-style-type: none"> ■ Improved adhesion of glass fiber to thermoplastic resins. ■ Lower yellowness index.
<ul style="list-style-type: none"> ■ Coating agent for thermal paper 	<ul style="list-style-type: none"> ■ Water resistance combined with polyvinyl alcohol.
<ul style="list-style-type: none"> ■ Micro-capsule for pressure sensitive paper 	<ul style="list-style-type: none"> ■ Maintaining capsule hardness. ■ Excellent emulsifying dispersion property.
<ul style="list-style-type: none"> ■ Lubricant for forging and casting ■ Hardening agent for steel 	<ul style="list-style-type: none"> ■ Maintaining viscosity. ■ Moderate decomposition resistance property. ■ Excellent membrane construction to surface of metal.

Amide-ammonium salt type of “ISOBAM™”



CAS.NO. 55893-87-3
TSCA Registered.

■ ISOBAM™-104,110

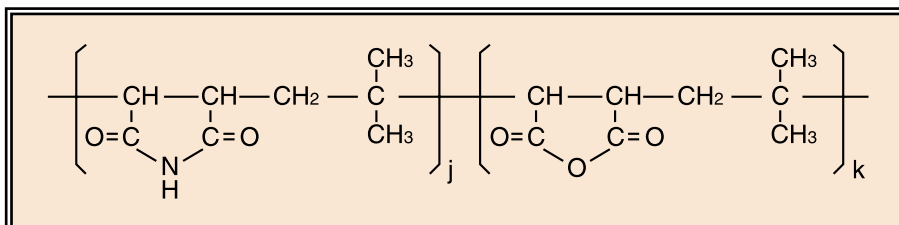
ISOBAM™-104 and 110 are amide-ammonium salt types of ISOBAM™. These are ammonium modified products based on standard type ISOBAM™.

They have features of the standard type of ISOBAM™ and are soluble in water.

The pH an aqueous solution is neutral.

Main applications	Characteristics etc …
<ul style="list-style-type: none"> ■ Binder for ceramic powder 	<ul style="list-style-type: none"> ■ Water soluble. ■ No ash.
<ul style="list-style-type: none"> ■ Binder for solid catalyst 	<ul style="list-style-type: none"> ■ Good activation. ■ Not easily broken for solid catalyst.
<ul style="list-style-type: none"> ■ Water soluble paint 	<ul style="list-style-type: none"> ■ Dispersion properties. ■ Excellent membrane construction. ■ Suitable for under coatings.
<ul style="list-style-type: none"> ■ Air freshener 	<ul style="list-style-type: none"> ■ Jelly type air freshener. ■ Preferable hardness and heat resistance at room temperature as crosslinked material.

Imide type of “ISOBAM™”



CAS NO. 89360-06-5 / 883747-78-2

TSCA Registered.

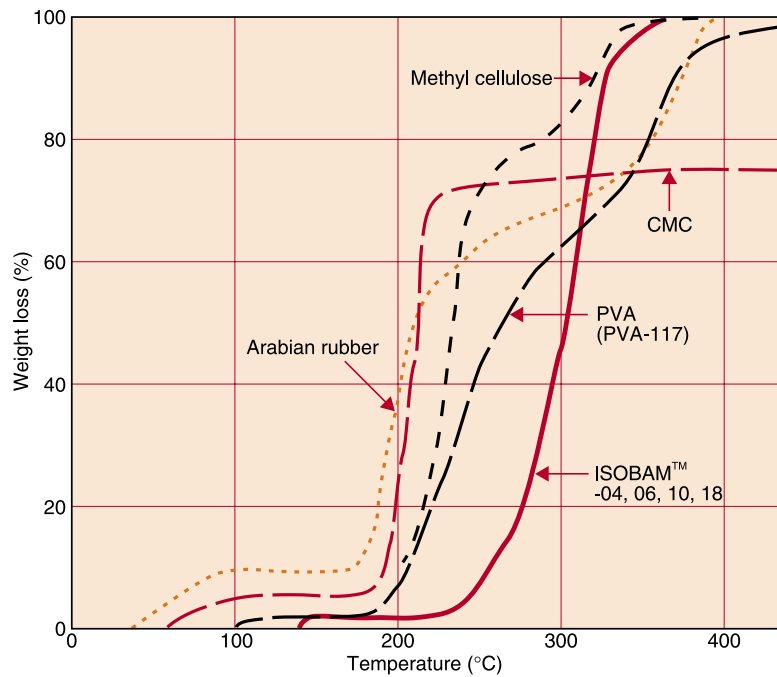
■ ISOBAM™-304,306,310

These grades are imide types of ISOBAM™ modified from standard type. They have the features of the standard type ISOBAM™ and are water resistant and heat resistant.

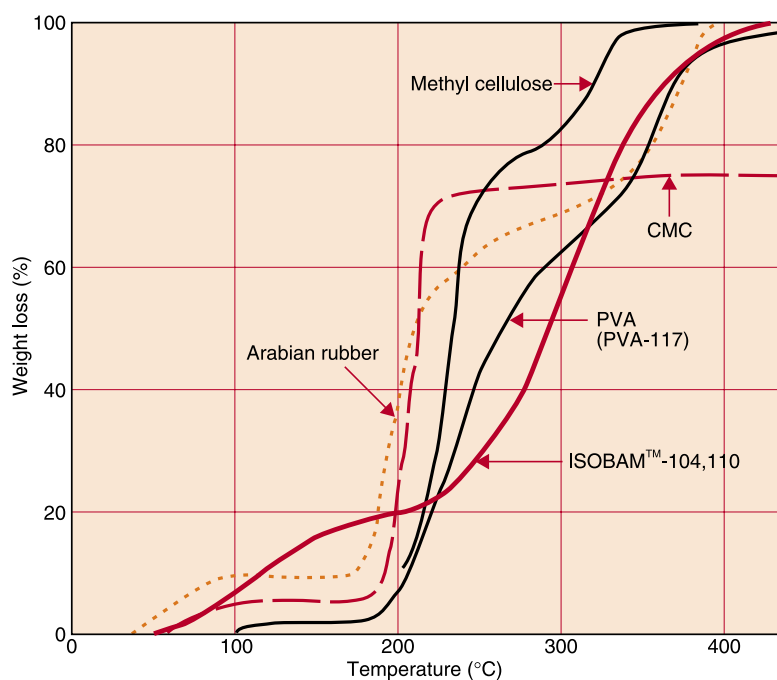
Main applications	Characteristics etc ...
<ul style="list-style-type: none"> ■ Protective colloid for polymerizing VAc. 	<ul style="list-style-type: none"> ■ Add water resistance and hardness to adhesive of polyvinyl acetate.
<ul style="list-style-type: none"> ■ Emulsion type of adhesive for wood 	<ul style="list-style-type: none"> ■ SBR emulsion type and polyvinyl acetate. ■ Good water resistance. ■ Good initial tackiness. ■ Non formaldehyde adhesives. ■ Instantaneous adhesion by uniting hydrogen bond between imide group and aldehyde.

Basic characteristics of “ISOBAM™” (Tested by KURARAY CO., LTD.)

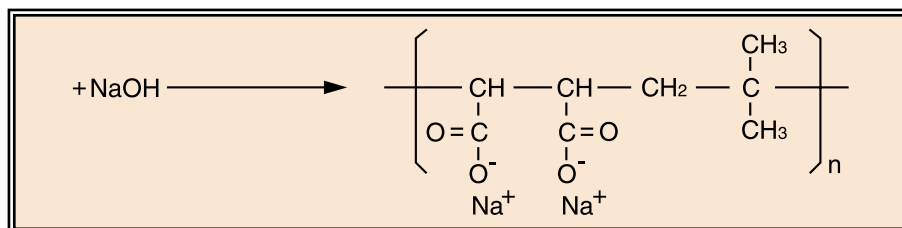
- Decomposition properties of ISOBAM™-04, 06, 10 and 18 compared to other polymers (Thermal gravity analysis, Heat up rate 5°C/min)



- Decomposition properties of ISOBAM™-104 and 110 compared to other polymers (Thermal gravity analysis, Heat up rate 5°C/min)



■ Neutralization of ISOBAM™



Definition for Degree of Neutralization(α)

If all carboxyl groups are neutralized, it's defined as $\alpha=1$

pH of Alkali Solution

Can be controlled by changing alkali and degree of neutralization.

The following pH range can be obtained by using NaOH and Ammonia.

NaOH	pH=3~12
Ammonia	pH=3~10

■ Method for Dissolving ISOBAM™ (Formulation)

Table 1 shows the required alkali quantity to dissolve 100 parts of ISOBAM™ powder for complete neutralization. (neutralization degree = 1)

Table 1: The amount of alkali quantity (unit : g)

	NaOH	NH ₃
ISOBAM™-04,06,10,18	51.88	22.05
ISOBAM™-600	50.96	21.66
ISOBAM™-304,306,310	27.40	11.60

Case 1: Preparation of ISOBAM™-04 with NaOH for 20% concentration of Isobam™

Concentration of Isobam™ : 20% ($\alpha = 0.8$) ISOBAM™-04 : 100 g NaOH : $51.88 \times 0.8 = 41.50$ g Distilled water : $(100 \div 0.20) - (100 + 41.50) = 358.5$ g

Case 2: Preparation of ISOBAM™-304 with 25%-ammonia solution for 15% concentration of ISOBAM™

Concentration of Isobam™ : 15% ($\alpha = 0.6$) ISOBAM™-304 : 100 g Ammonia solution : $11.60 \times 0.6 \div 0.25 = 27.84$ g Distilled water : $(100 \div 0.15) - (100 + 27.84) = 538.83$ g

Process for a dissolving ISOBAM™

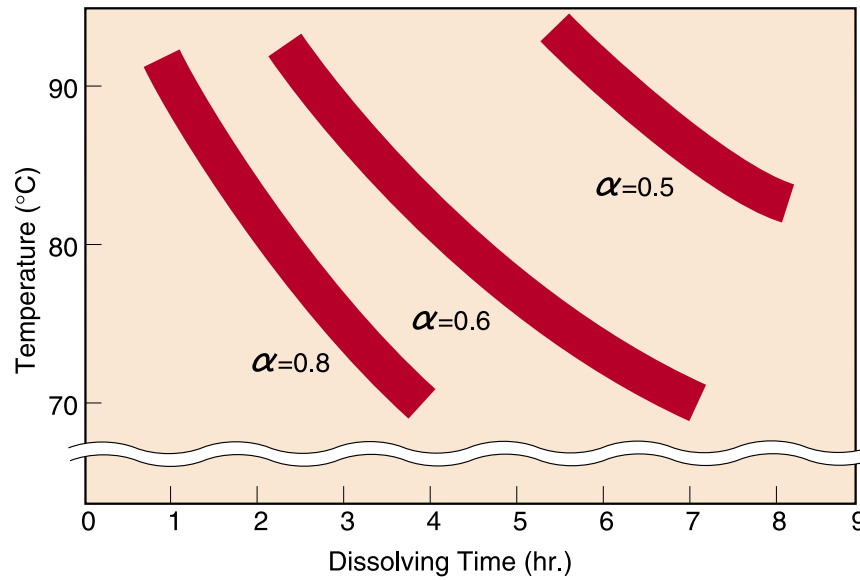
- ① In a vessel, place ISOBAM™ gradually into the alkali solution. To avoid bumping, it is desirable to put the vessel in a cooling bath such as a "waterbath".
 - ② Dissolve for 4 to 5 hours at 90 to 100°C while stirring.
- ※ In case of using ammonia aqueous solution for dissolving, it is desirable to dissolve in a closed vessel such an "autoclave" to avoid exposure to ammonia.

■ Dissolving speed of ISOBAM™ in a sodium hydroxide solution

Neutralization degree of ISOBAM™-10 : 0.5, 0.6 and 0.8

Concentration : 20wt%

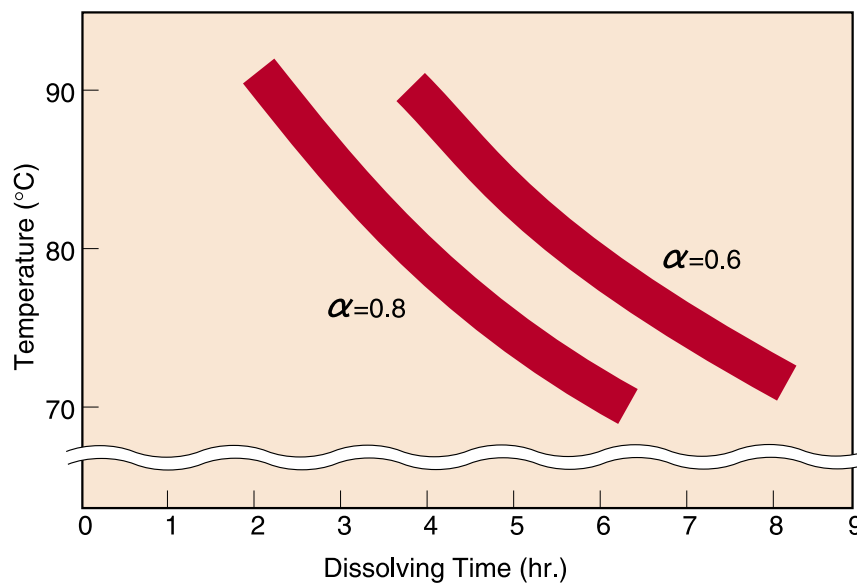
Rotation speed of the stirrer : 120 r.p.m



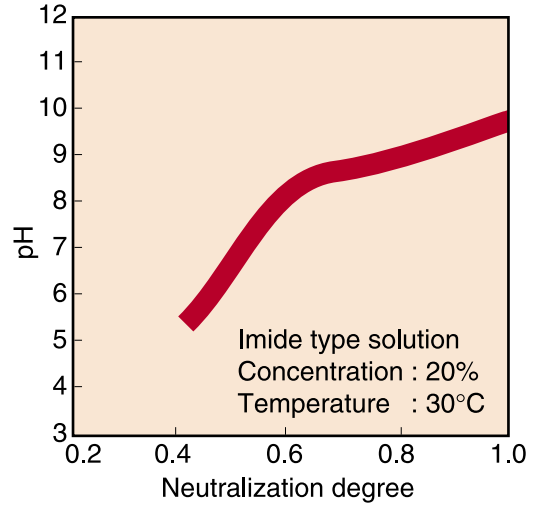
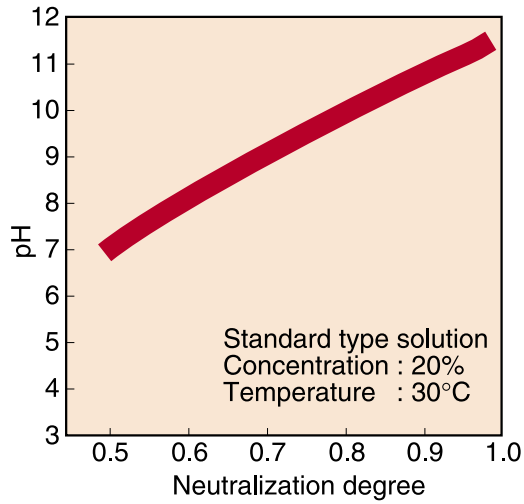
Neutralization degree of ISOBAM™-304 : 0.6, 0.8

Concentration : 20wt%

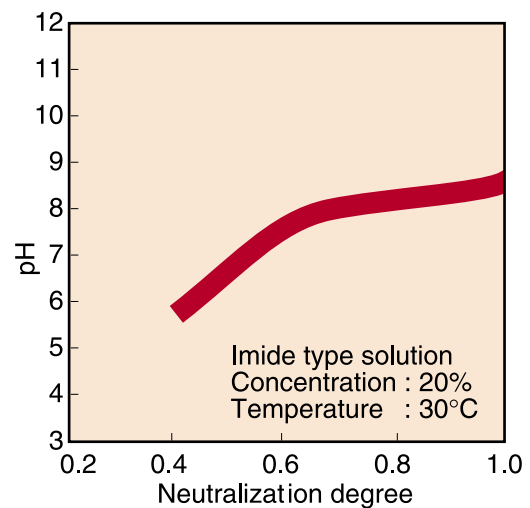
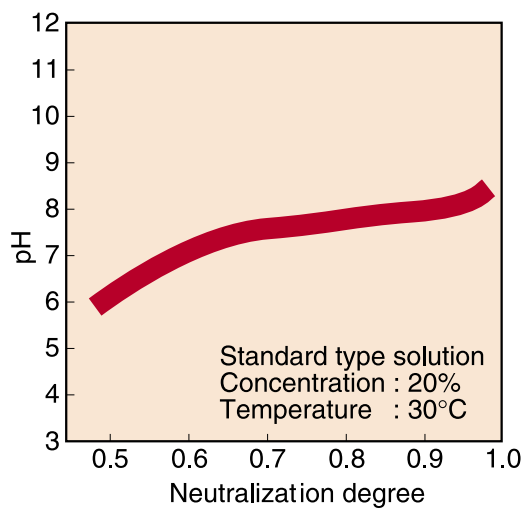
Rotation speed of the stirrer : 120 r.p.m



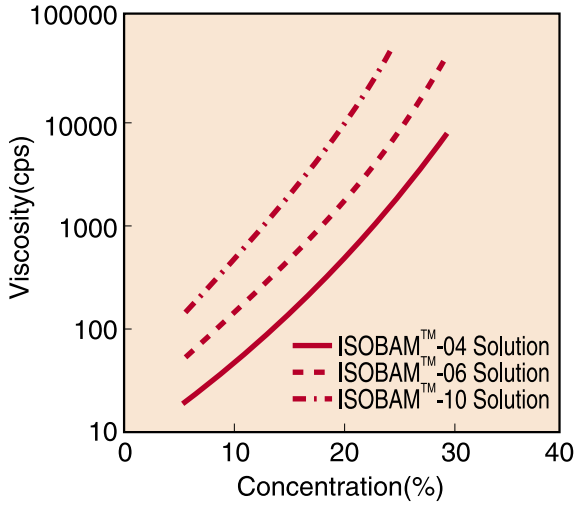
■ pH - Neutralization degree curve (NaOH solution)



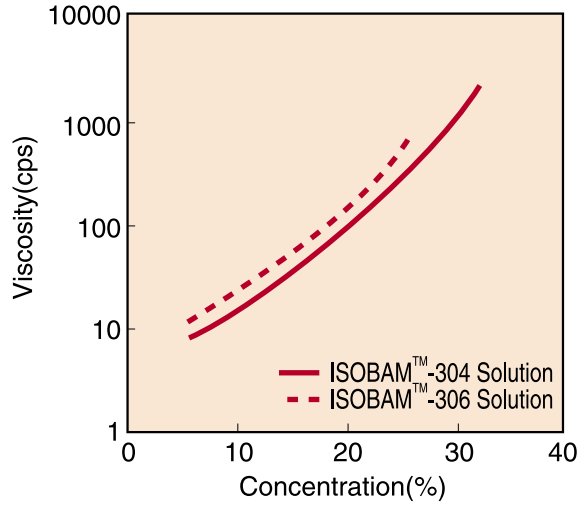
■ pH - Neutralization degree curve (Ammonia solution)



■ Viscosity-Concentration curve (NaOH solution)

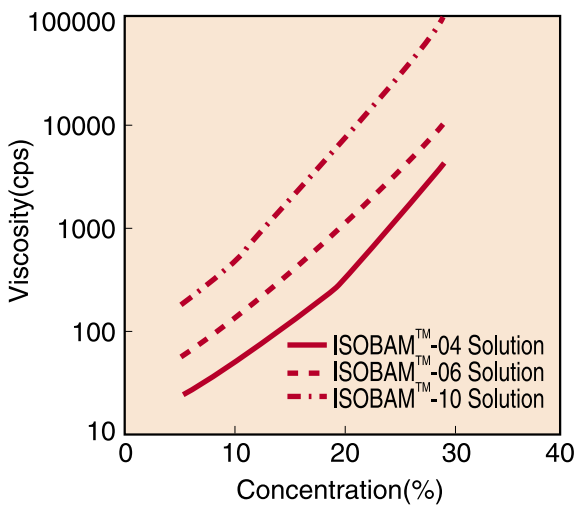


Standard type of ISOBAM™
(NaOH Solution. $\alpha=0.8$)

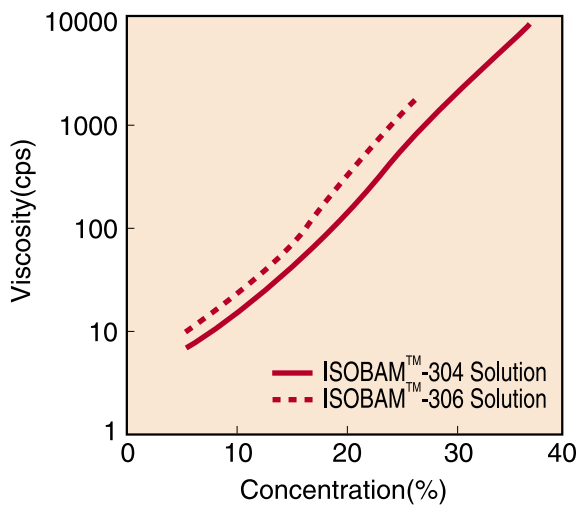


Imide type of ISOBAM™
(NaOH Solution. $\alpha=0.6$)

■ Viscosity-Concentration curve (Ammonia solution)

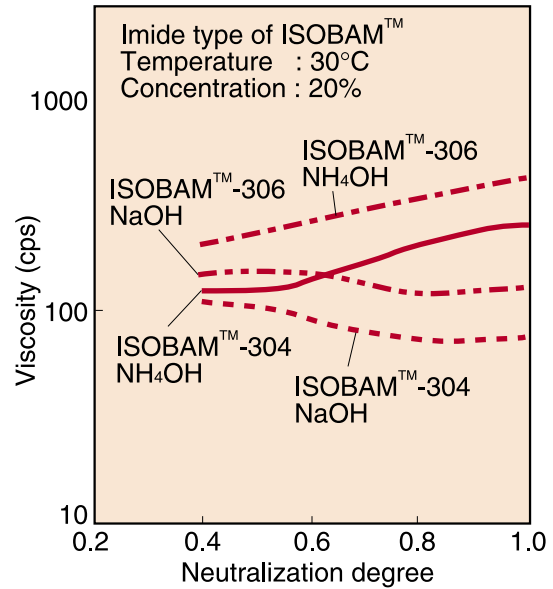
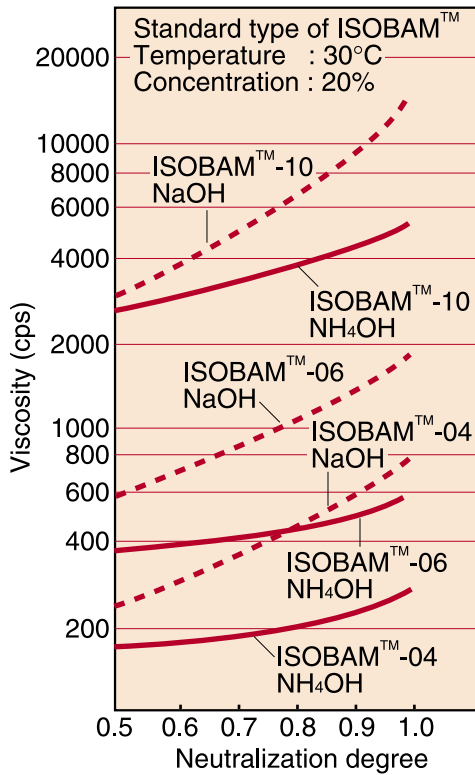


Standard type of ISOBAM™
(Ammonia Solution. $\alpha=0.8$)

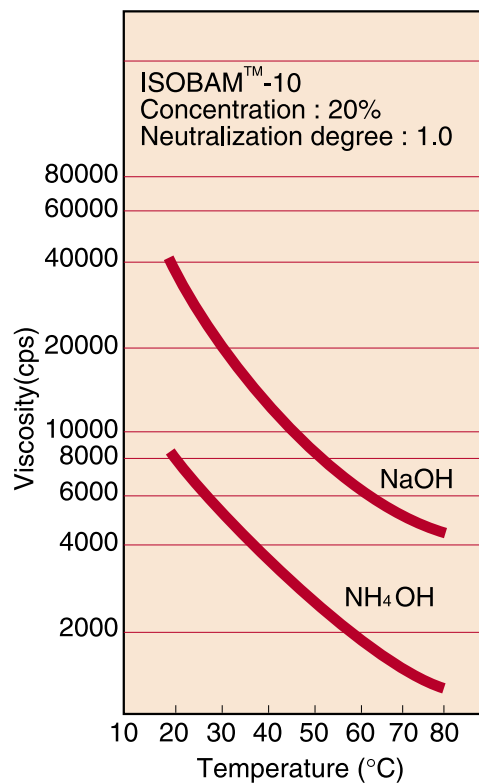


Imide type of ISOBAM™
(Ammonia Solution. $\alpha=0.6$)

■ Viscosity - Neutralization degree curve



■ Viscosity - Temperature curve



■ Mixing property of ISOBAM™ solution and metal compound

Metal compound \ Solution type	Sodium hydroxide	Ammonia	Sodium acetate	Ammonium acetate
	$\alpha = 0.8$	$\alpha = 0.8$	$\alpha = 1.0$	$\alpha = 1.0$
Ca(OH) ₂	+++	+	+	+
Mg(OH) ₂	+++	+++	+++	+++
Co(OH) ₂	+++	+++	+++	+++
Mn(OH) ₂	+++	+++	+++	+++
Al(OH) ₃	+++	+++	+++	+++
Fe(OH) ₃	+++	+++	++	++
Ni(OH) ₂	+++	+++	+++	+++
Zn(OH) ₂	+++	+++	+	+
Ba(OH) ₂	+++	+++	+++	++
ZnO	+++	+++	+++	+++
Al ₂ O ₃	+++	+++	+++	+++
Sb ₂ O ₃	+++	+++	+++	+++

Mixing quality : +++ (favorable) \longleftrightarrow + (Poor)

■ Mixing property of ISOBAM™ with other polymers

Alkali for dissolving ISOBAM™	NaOH				NH ₄ OH			
	1:3		3:1		1:3		3:1	
Mixing ratio (ISOBAM™:polymer)								
State of the mixture	Solution	dried Film	Solution	dried Film	Solution	dried Film	Solution	dried Film
Casein	+	+	+++	+	+++	+	+	+
Denatured starch	+++	+++	+++	++	+++	+++	+++	+++
Phenol resin	+++	++	+++	+	+++	++	+++	+
CMC	+++	++	+++	+++	+++	+++	+++	+++
PVA	+++	++	+++	+++	+++	+++	+++	++
Polyacrylic soda	+++	+++	+++	+++	+++	+++	+++	+++
Polyacryl amide	+++	++	+++	+++	+++	+++	+++	+++
Copolymer of styrene & maleic anhydride	+++	+++	+++	+++	+++	+++	+++	+++

Mixing quality : +++ (favorable) \longleftrightarrow + (Poor)

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For Medical, Healthcare and Food Contact applications, please contact your ISOBAM™ representative for specific recommendations ISOBAM™ should not be used in any devices or materials intended for implantation in the human body.

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