# KURARAY POVAL™ 200-88KX SB

## New High Molecular Weight PVOH

TECHNICAL INFORMATION SHEET

### Introduction

Polyvinyl alcohol (PVOH) is widely used as a stabilizer for the emulsion polymerization of VAM or as a post additive for emulsion. In general, the emulsion with PVOH provides such advantages as, high viscosity, high mechanical stability, high film strength and high heat resistance compared to other stabilizers. But the large dosage of PVOH decreases water resistance of the adhesive (or the film) produced with the emulsion. KURARAY has developed new high-molecular-weight PVOH "200-88KX SB". The polymer can achieve high viscosity emulsions in a small dosage of PVOH. The emulsion with the new high-molecular-weight PVOH can have better balanced performances than with conventional PVOH.

### Advanced characteristics of 200-88KX SB

In the post addition process;

- Thixotropic solution and emulsion
- Tacky solution
- High viscosity emulsion in a small dosage of PVOH
- Excellent viscosity stability
- Excellent adhesive properties for wood and paper

### Specification of 200-88KX SB

Table 1

| Grade | | 4% Viscosity (1) (mPa·s) | DH (3) (mol%) |
|---|---|---|---|
| **New grade** | **200-88KX SB** | **175-225** | **87.0-89.0** |
| Conventional PVOH | DP 2600Type (2) | 60 | 87.0-89.0 |
| Conventional PVOH | DP 3500Type | 95 | 87.0-89.0 |

(1) Measured at 20°C determined by Brookfield viscometer
(2) DP: Degree of Polymerization
(3) DH: Degree of Hydrolysis

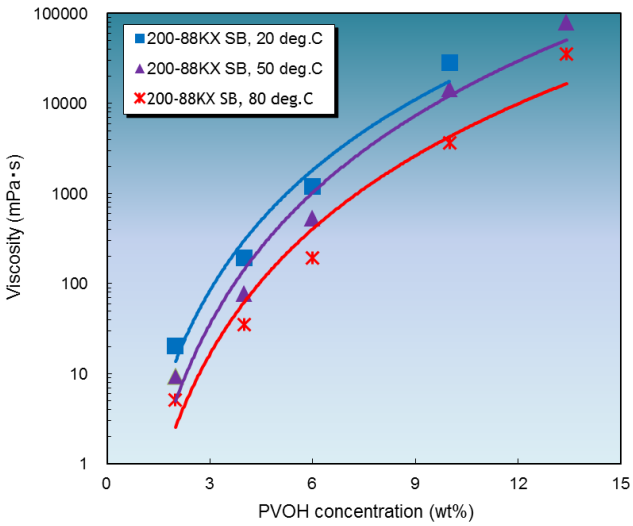


Fig. 1 PVOH concentration and Viscosity curve

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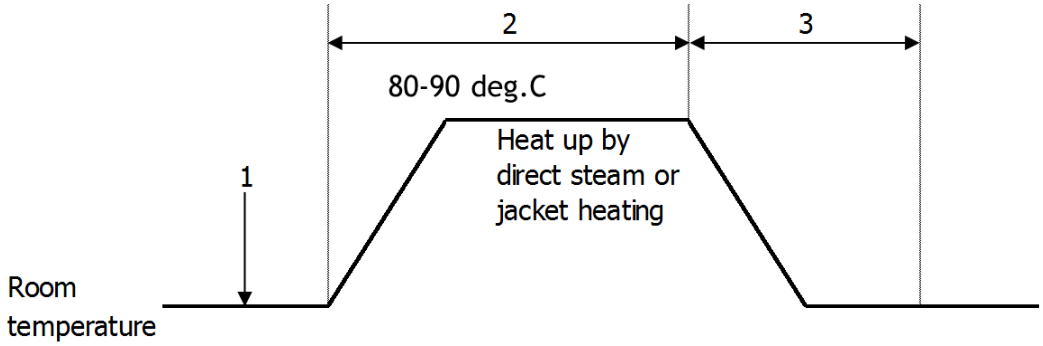
### Dissolving procedure of 200-88KX SB in water

1. Charge 200-88KX SB into room temperature water slowly with agitation
2. Heat up the solution to 80-90°C with agitation. Keep agitation for 1hour at around 80-90°C.
3. Reduce the agitation speed and cool down the solution gradually




### Rheology of PVOH solution

The aqueous solution of 200-88KX SB is more thixotropic and tackier than conventional PVOHs.

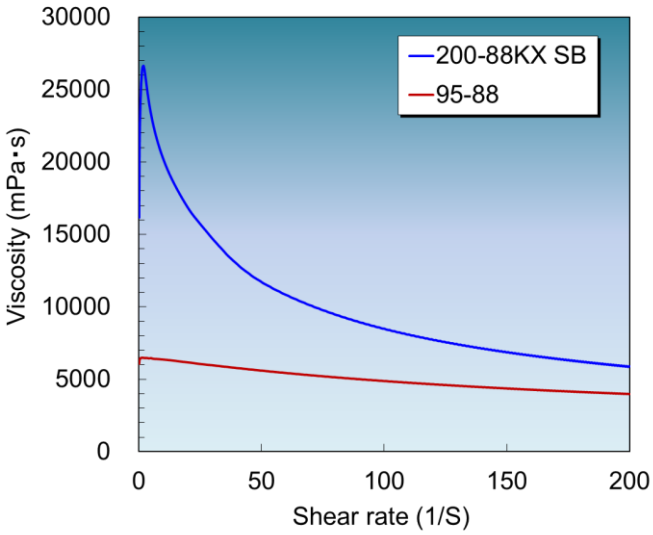
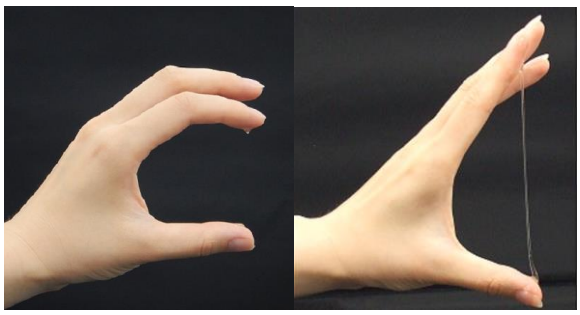



Fig. 2 Shear rate and 10 wt% PVOH solution viscosity curve



DP3500type 200-88KX SB

Fig. 3 Tackiness of 10 wt% PVOH solution

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### Concept: PVOH dosage reduction for post addition

### Recipe example

200-88KX SB can be used as a post additive for emulsion. The scheme example for post addition is as below (Fig. 4). Table 2 shows the detail recipes and the viscosities of the emulsions after adding PVOHs. A small amount of 200-88KX SB could achieve the high viscosity emulsions.

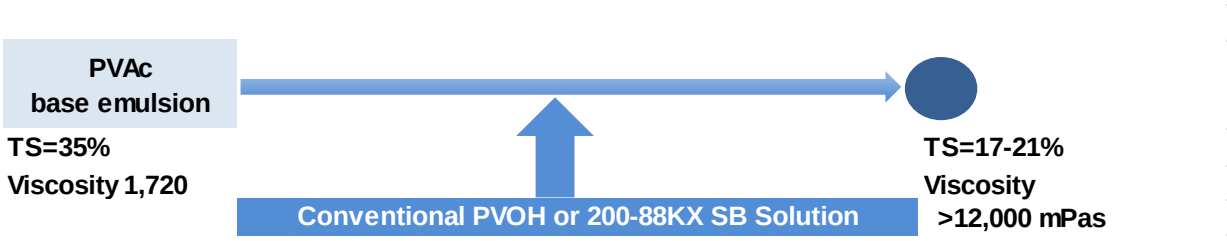


Fig. 4 A scheme example of post addition

Table 2 Recipe and property examples of prepared emulsions

| No. | | | Base Em | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| Composition | PVOH solution | Grade | - | 200-88KX SB | | DP2600Type |
| | | Concentration (wt%) | 0.0 | 11.0 | 10.0 | 15.0 |
| | | Blending amount (part) | 0.0 | 70.0 | 70.0 | 70.0 |
| | Base Em | Concentration (wt%) | 35.0 | 35.0 | 35.0 | 35.0 |
| | | Blending amount (Part) | 100.0 | 30.0 | 30.0 | 30.0 |
| | Total | (Part) | 100.0 | 100.0 | 100.0 | 100.0 |
| Solid content | Total | (wt%) | 35.0 | 18.2 | 17.5 | 21.0 |
| | PVOH | (wt%) | 0.0 | 7.7 | 7.0 | 10.5 |
| | Em | (wt%) | 35.0 | 10.5 | 10.5 | 10.5 |
| Viscosity at 30°C | 2rpm | (mPa s) | 6,100 | 26,000 | 16,000 | 15,000 |
| | 20rpm | (mPa s) | 1,720 | 20,650 | 12,800 | 13,800 |

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### Effect of the post addition of 200-88KX SB for PVAc-Em viscosity

PVOH dosage can be reduced by using 200-88KX SB to achieve same emulsion viscosity level compared with using standard PVOH (Fig. 5). The emulsion by using 200-88KX SB is more thixotropic. (Fig. 6).

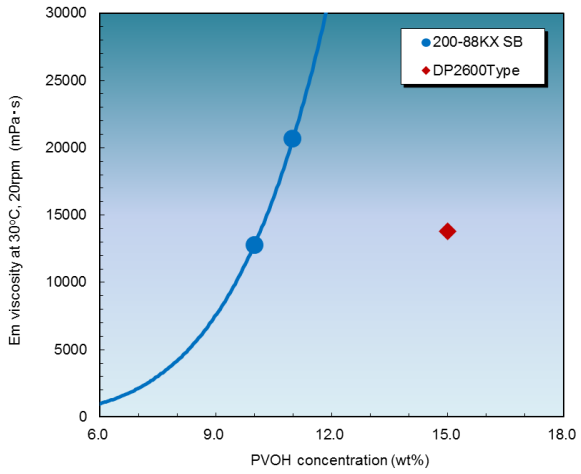


Fig. 5 PVOH concentration vs PVAc-Em viscosity curve

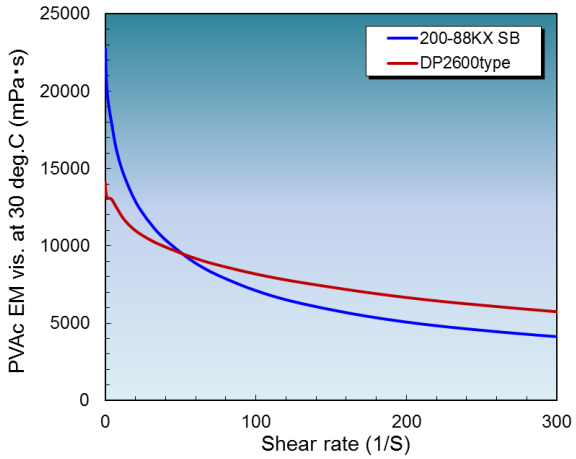


Fig. 6 Shear rate and PVAc EM viscosity curve

### Emulsion film and wood adhesive strength

Water resistance of emulsion can be improved by using 200-88KX SB.

Table 4 Detail property of prepared emulsions

| PVOH grade | 200-88KX SB | DP2600type | Base Em |
|---|---|---|---|
| Concentration of PVOH | 11.0 | 15.0 | |
| **Result of polymerization** | | | |
| Total solid content (%) | 18.2 | 21.0 | 35.0 |
| Viscosity (mPa.s), B-type@20rpm 30°C | **20,650** | 13,800 | 1,720 |
| Thixotropic index: (Viscosity@2rpm) / (Viscosity@20rpm) | 1.3 | 1.1 | 3.5 |
| **Film properties** | | | |
| <Mechanical property> | | | |
| *@Dry condition (20° C 65%RH)* | | | |
| Tensile strength (kg/cm$^2$ ) | 144 | 107 | 147.9 |
| Elongation (%) | 1,046 | 1,049 | 562.1 |
| <Water resistance, dipped in 20oC water for 24hour> | | | |
| Water adsorption (%) | Not measurable | Not measurable | 39.5 |
| Elution rate (%) | Not measurable | Not measurable | 5.2 |
| **Wood adhesive strength *based on JIS K6852** | | | |
| *@Dry condition (20° C 65%RH)* | | | |
| Compressive shear strength (kg/cm$^2$ ) | 107.5 | 85.9 | 109.9 |
| Wood failure (%) | 40 | 20 | 75 |
| *@Wet condition (dipped in 30° C water for 3hour)* | | | |
| Compressive shear strength (kg/cm$^2$ ) | **10.9** | 8.0 | 14.9 |
| Wood failure (%) | 0 | 0 | 0 |