Cationic Starch for Wet End

Application Of ViscoStar® Cationics

ViscoStar® Cationics are very efficient. Their characteristics should be thoroughly understood and proper precaution taken on their application.

(1) Cooking operation

A batch steam boiling system, a high pressure cooker or a continuous cooker can be used, but sufficient cooking is necessary in all cases.

The use - if a batch cooker - is given below for reference.

Make up slurry of a fixed concentration in a cooking tank. Blow in steam with agitation and cook at 95 °C for 20 minutes. Cooking concentration must be less than 5% because the viscosity of *ViscoStar®* is high both during cooking and as a finished paste. Dilute to the final concentration (less than 1%) in order to provide adequate dispersion in the furnish.

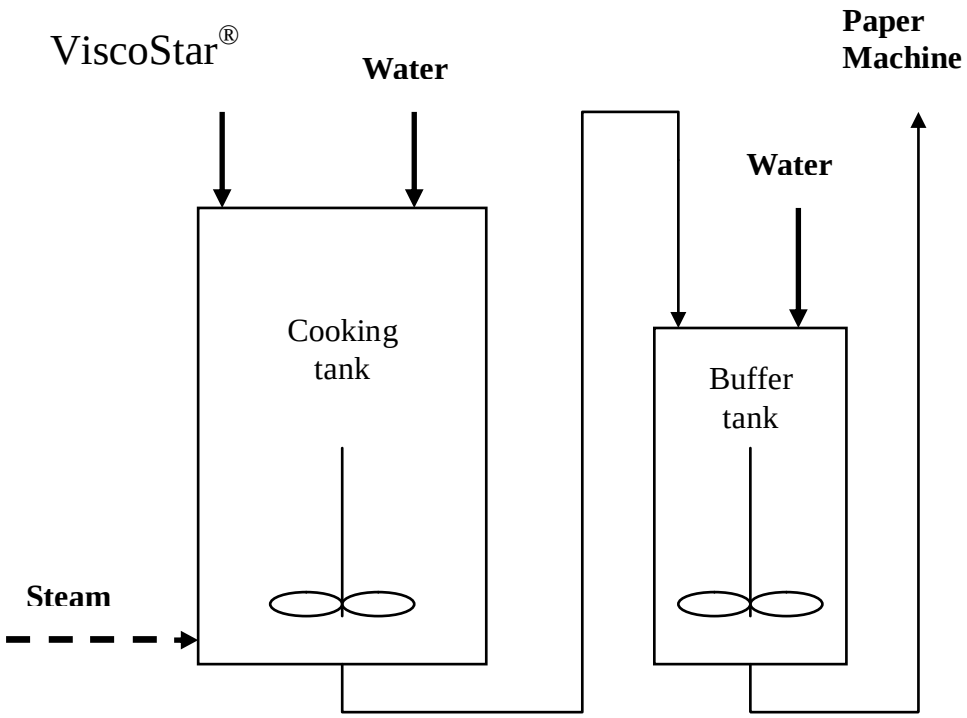

Figure is a simplified flow sheet of batch cooker.

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(2) Position in addition *of ViscoStar®*

The position at which *ViscoStar*® is added greatly influences its effect. Adding starch paste to the beaten pulp changes the charge of fines and filler to be caught by long anionic pulp fibres and forms totally loose flocks. However, if such a flocculation occurs before the machine process, it may affect the formation etc. *ViscoStar*® should be added so that flocculation occurs at the wire part. The suction side and the delivery side - if a fan pump - or after a screen are usually selected. Effective positions are shown as follows. But strong shear should be avoided after the addition of *ViscoStar*®.

Effect by position in adding *ViscoStar*®

	Location to add	Retained filler	Bursting Strength
ViscoStar® 4630	Head box	137	98
	Stock chest	120	106
	Beater	106	125

*Calcium carbonate used as filler(blank - 100)

- For enhancing strength mainly: from around the chest to before the fan pump
- For improving retention mainly: after fan pump
- For both of above purpose: around fan pump

(3) Amount of addition

The amount of *ViscoStar*® to be added cannot be stated clearly. This depends on the purpose of addition, the kind of pulp, the degree of pulp washing, the amount of filler, pH during papermaking, water quality, the kind of paper, the degree of beating etc. A general rule is as follows.

- For improving drainage and retention : 0.2—0.5 % on pulp
- For enhancing strength : 0.5—10 % on pulp
- Containing high yield pulp, poorly washed pulp and cationic resistant substance etc. : more should he added.

CHARACTERISTICS AND VARIETIES OF *ViscoStar®*

ViscoStar® is a cationic starch. There are three varieties of *ViscoStar®* classified by degree of substitution (D.S.). They are especially effective as a wet end additive and have the following characteristics

Items	*ViscoStar® 4620*	*ViscoStar® 4630*	*ViscoStar® 4640*
APPEARANCE	white powder	white powder	white powder
MOISTURE %	12.5 +/- 1.5	12.5 +/- 1.5	12.5 +/- 1.5
ASH %	1.0 Max.	1.0 Max.	1.0 Max.
D. S.	0.018 ~ 0.023	0028 ~ 0.033	0.038 ~ 0.043

- Enhances sheet strength. It is well adsorbed by pulp fibre to bind the fibre and sets the fines and filler to improve sheet properties and strength.
- Improves yield to reduce costs. It has a very strong adsorption that retains additives end fines well and prevents them flowing out with the white water. This improves yield significantly and reduces cost.
- Reduces vast water pollution. Main cause if waste pollution is overflow of fines, filler, additives etc. to the waste water facilities. *ViscoStar®* strongly adsorbs these materials and reduces pollution. This also reduces the load on the waste water treatment facilities.
- Helps to improve machine speed. Its strong adsorption improves drainage in the wet end, and improves dewatering to speed up drying at the dry end. This improves total machine speed.
- Can be used to neutral papermaking. As *ViscoStar®* can retain a cationic charge on the alkaline side, it can be used in making neutral paper. It can be used together with a neutral sizing agent and alkaline filler.

Either one can therefore be selected, depending on price and application.

ViscoStar® 4620 is used mainly for just improving sheet strength. It can be used at rather higher dosage on pulp to achieve excellent improvement.

ViscoStar® 4630 is used mainly for improving both sheet strength and retention proportionately. It can be used in various machines to achieve excellent improvement.

ViscoStar® 4640 can be used mainly for improving emulsification & retention of ASA size, retention of filler & fines and drainage especially in neutral papermaking.

EXPERIMENTAL EXAMPLES

(A) Neutral papermaking

Pulp condition: LBKP / NBKP = 3 /1, freeness (CSF) = 400 ml
pH: 7.5 at papermaking
Sizing agent: AKD size, 0.07 wt % of pulp
Filler: Ca1cium carbonate, 12 wt % of pulp

	Addition rate of ViscoStar® to pulp (wt %)	Stockigt sizing degree (sec)	Burst factor	Internal bond (kgf/cm)	Surface strength	Dennison wax pick (A)
Blank	0	2.3	3.34	2.32	0	10
ViscoStar® 4630	0.5	9.3	3.91	3.47	2.0	12
	1.0	12.3	4.12	4.35	5.7	13
	1.5	14.6	4.44	5.11	9.4	14
ViscoStar® 4640	0.5	12.4	3.77	3.38	2.5	12
	1.0	13.3	4.12	4.45	6.5	13
	1.5	14.7	4.22	5.08	9.1	14

(B) Acid papermaking

Pulp condition: LBKP / NBKP = 4 /1, freeness (CSF) = 380 ml
pH: 5.3 at papermaking
Sizing agent: Rosin size, 0.3 wt % of pulp
Alum: 1.0 wt % of pulp

	Addition rate of ViscoStar® to pulp (wt %)	Stockigt sizing degree (sec)	Burst factor	Internal bond (kgf/cm)	Surface strength
Blank	0	12	2.29	3.54	76
ViscoStar® 4630	0.4	31	2.54	3.91	93
	0.8	35	2.72	3.99	108
	1.2	39	2.93	4.12	123
ViscoStar® 4640	0.4	33	2.50	3.71	113
	0.8	39	2.78	4.08	142
	1.2	42	2.90	4.21	120

(C) Effect on filler retention

Pulp condition: LBKP / NBKP = 9 /1, freeness (CSF) = 400 ml
pH: 8.0 at papermaking
Sizing agent: AKD size, 0.15 wt % of pulp
Filler: Ca1cium carbonate, 15 wt % of pulp

	Addition rate of ViscoStar® to pulp (wt %)	Retained filler (%)	Burst factor
Blank	0	5.98	2.31
ViscoStar® 4630	0.5	6.47	2.62
	1.0	6.67	2.90
	1.5	6.93	3.05
ViscoStar® 4640	0.5	6.52	2.61
	1.0	6.95	2.82
	1.5	7.04	3.03

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