CELLULOSE INDUSTRY
THE JOURNAL OF THE CELLULOSE INSTITUTE, TOKYO, JAPAN
VOL. 18, February, 1942, No. 2

— **ABSTRACTS FROM THE TRANSACTIONS** —

ON THE SECTION OF VISCOSE SILK. V.
ON THE INFLUENCE UPON THE SECTION OWING TO
THE PROPERTY OF VISCOSE AND SPINNING CONDITION.

by **Z. Kawata**

(Received 21st. Oct, 1941)

Experimental Method.

Viscose containing 8% cellulose and 7% alkali is prepared according to the usual method and spun under various conditions with the following spinning bath.

		M-bath	N-bath
H ₂ SO ₄	g/l	125	110
Na ₂ SO ₄	"	100	210
MgSO ₄	"	220	—
ZnSO ₄	"	12	11
glucose	"	—	125
2nd bath		warm water (37~40°C)	none

The prepared fibers are tested as in the previous report and the results are shown with table and photographs.

Ex. 1. Sort of pulp.

The property of viscose changes with the purity and viscosity of the pulp, and changes with quality and section of the fibers are produced with this property.

Ex. 2. Aging of alkali cellulose.

The temperature of aging is 18°C.

The viscosity of viscose decreases with aging and the serration produced is increased in case of lower viscosity.

Ex. 3. Ripeness of viscose.

Fibers of good quality and serration at over and under ripeness cannot be made, the best are at the moderate ripeness.

Ex. 4. Addition of Na_2SO_3

A small percentage of Na_2SO_3 is added to viscose in case of the centrifugal spinning process, because it reacts to become of lower viscosity, delay ripeness and protect from adherence of filaments to each other by the produced gas and sulphur. The quality of the fibers does not change with the addition of Na_2SO_3 , but the serration changes a little.

Ex. 5. Addition of Na_2CO_3 .

This is a method of making hollow silk; the fibers have good luster and softness but lower strength and elongation. The serration is extremely different from the usual fibers.

Ex. 6. Denier and number of filaments.

a) Change of number of filaments at constant denier of yarn: Strength per denier increases, elongation decreases and serration does not change.

b) Change of number of filaments at constant denier of filament: the reaction becomes incomplete with the increase of the number of filaments and the quality of the fibers is inferior with flat serration.

Ex. 7. Spinning velocity.

Strength per denier increases and elongation decreases with an increase in spinning velocity; the best quality of fibers is made in the same range of velocity.

Ex. 8. Depth or length of spinning bath.

The reaction is incomplete in short period in the bath and the quality of the fibers is inferior.

Ex. 9. Temperature of spinning bath.

The reaction is too slow at a low temperature and vigorous at a high temperature and the most suitable temperature being 45°C .

Ex. 10. Stretch spinning.

With the increase of stretch, strength per denier increases and elongation decreases; and then there is a portion of best strength and moderate elongation of the fibers in the same range of stretch.

Ex. 11. Bobbin and centrifugal spinning process.

There are some differences in the qualities of the fibers in both processes.

Imperfection of spinning reaction.

In order to make superior fibers, it is necessary to prepare viscose and a spinning bath of suitable composition and to spin it under the most suitable conditions. In this combination spinning reaction takes place perfectly to produce the best quality and serration of the fibers. All inferior qualities of the fibers are due to imperfect spinning reactions as these experiments show. Such fibers indicate alkalinity after spinning, washing or drying according to the extent of reaction and they cannot carry out aftertreatments (desulphur and bleaching) completely; consequently the fibers seem milky or yellowish and have inferior quality and serration, moreover they have much ash and sulphur as compared with the ordinary fibers.

Table (a)

No.	Experimental terms	Viscose		Spinning bath	Qualities of Fibers							Section					
		Viscosity	Degree of Ripeness		Denier	Strength per denier	Elongation	Quality number	Condition		Luster	Softness	Drawing ability	Form	α	β	
									Temp.	Hum.							
Ex. 1-1	Pulp VS	27	11.0	M	123.97	1.228	23.40	28.74	23	67	a	a	a	3-ii-c	2680	1.338	
"	Corona	22	11.3	M	126.00	1.145	27.13	31.06	24	70	a	a	a	3-ii-c	2393	1.382	
"	Tissue paper	24	10.5	M	123.84	1.456	20.60	30.01	22	56	a	b'	b	3-ii-c	2450	1.340	
Ex. 2-1	Aging of alkali cellulose { 48hs 72hs 96hs	122	12.6	M	116.86	1.562	19.87	30.99	23	55	a	b	b	1-c	2053	1.184	
"		66	12.9	M	116.23	1.579	17.47	27.60	"	"	a	b'	b'	1-c	2527	1.368	
"		44	13.5	M	119.52	1.571	16.70	26.24	"	"	a	a	a	1-c	2270	1.406	
Ex. 3-1	Ripeness of viscose	22.4	12.5	M	126.07	1.132	27.60	30.24	23	58	a	a	b	3-ii-c	2012	1.315	
"	"	25.2	10.5	M	112.61	1.307	24.10	31.50	"	"	a	a	a	3-ii-c	1950	1.330	
"	"	32.2	8.5	M	115.92	1.245	18.70	23.27	"	"	a'	b	a'	3-ii-c	2055	1.262	
Ex. 4-1	addition of Na ₂ SO ₃	19.8	10.9	M	125.86	1.293	21.76	27.13	21	64	a	a	b'	1-c	1931	1.238	
"	in viscose	23.4	10.9	M	125.78	1.392	19.66	27.37	"	"	a	a	b	3-ii-c	2003	1.298	
"	addition	22.6	11.2	N	132.91	1.228	23.24	28.54	20	66	a	b'	a'	1-c	1890	1.225	
"	none	26.6	11.2	N	133.71	1.315	22.76	29.93	"	"	a	b'	a	3-ii-c	1690	1.238	
Ex. 5	addition of Na ₂ CO ₃	34	11.1	N	118.30	0.891	13.42	11.96	23	65	b	a'	a	2-ii-c	6250	3.250	
Ex. 6-1	change of No. of filament at const. denier of yarns. { 18 24 30	30	9.5	M	115.05	1.190	21.02	25.01	16	63	a	b'	a	3-ii-c	2490	1.427	
"		"	"	"	M	115.78	1.312	20.18	26.48	"	"	a	a	b'	1-c	2685	1.402
"		"	"	"	M	115.78	1.330	18.52	24.68	"	"	a	a'	b	1-c	2815	1.370
"	change of No. of filament at const. denier of filament. { 24 30 38	24	9.8	N	142.00	1.245	21.86	27.22	25	63	a	a	a	1-c	2312	1.260	
"		"	"	N	193.32	1.228	22.68	27.85	"	"	a	a	a	1-c	2235	1.315	
"		"	"	N	248.56	1.230	22.32	27.45	"	"	a	a	a	2-ii-c	2440	1.448	
"	velocity { 45m/min 55m/min 65m/min	"	"	N	291.41	1.203	21.95	26.41	"	"	b'	a	a'	2-ii-c	2424	1.480	
Ex. 7-1		25.2	10.1	M	101.02	1.439	19.40	27.92	22	54	a	a	a	1-c	2216	1.380	
"		"	"	"	M	90.14	1.587	16.70	26.50	"	"	a	b'	b'	3-ii-c	2315	1.392
"	"	"	"	M	75.83	1.530	14.10	21.57	"	"	a	b	b	2-ii-c	2790	1.617	

Table (b)

No.	Experimental Terms	Viscose		Spinning bath %	Qualities of Fibers							Section				
		Viscosity	Degree of Ripeness		Denier	Strength per denier	Elongation %	Quality number	Condition		Luster	Softness	Dyeing affinity	Form	α	β
									Temp. °C	Hum. %						
Ex 8-1	depth of bath 1 cm	29	9.6	M	114.70	1.165	18.22	21.24	17	60	b	b	a	2-ii-c	3665	1.774
"	" 2 cm	"	"	M	115.70	1.190	19.89	23.65	"	"	b	b	a	2-ii-c	2800	1.625
"	" 6 cm	"	"	M	119.63	1.230	20.17	24.81	"	"	b'	b'	a	2-ii-c	2868	1.493
"	" 10 cm	"	"	M	120.15	1.280	20.42	26.14	"	"	a	a	b'	3-ii-c	2800	1.410
"	" 15 cm	"	"	M	125.57	1.312	20.18	26.48	"	"	a	a	b'	3-ii-c	2640	1.348
"	" 20 cm	"	"	M	121.13	1.308	19.82	26.00	"	"	a	a	b	1-c	2240	1.354
"	" 28 cm	"	"	M	124.20	1.303	19.50	25.94	"	"	a	a	b	1-c	1920	1.272
Ex 9-1	Temp. of bath 23°C	26.8	9.8	M	112.64	1.190	19.12	22.75	20	65	b'	b	a	2-ii-c	2375	1.477
"	" 33°C	"	"	M	114.62	1.200	20.18	24.22	"	"	b'	b	a	2-ii-c	2250	1.455
"	" 40°C	"	"	M	115.56	1.223	21.34	26.10	21	63	a	a	a	2-ii-c	2305	1.452
"	" 45°C	"	"	M	117.36	1.273	21.05	26.80	"	"	a	a	a	3-ii-c	2003	1.384
"	" 50°C	"	"	M	112.39	1.156	20.59	23.80	"	"	a	a	b'	3-ii-c	2122	1.360
Ex 10-1	Stretch spinning no.	27	11.5	M	113.67	1.108	25.68	28.45	32	65	a	a	a'	3-ii-c	2185	1.375
"	" medium	"	"	M	115.12	1.203	20.26	24.40	"	"	a	a	a	1-c	2032	1.310
"	" strong	"	"	M	116.56	1.404	17.32	24.32	"	"	a	b'	b'	1-c	1895	1.246
"	" no.	"	"	M	142.78	1.202	22.11	26.58	"	"	a	b	b	1-c	2020	1.160
"	" strong	"	"	M	148.04	1.516	14.05	21.30	"	"	a	c'	c	2-i-c	2310	1.490
Ex 11-1	Bobbin spinning	22.6	11.2	N	132.19	1.308	23.24	28.54	20	66	a	b'	a'	1-c	1800	1.280
"	Centrifugal spinning	23.2	11.0	N	138.71	1.288	24.03	29.66	23	60	a	a	a'	1-c	1861	1.260

Notice: Viscosity: Sec. of falling of seat ball (dia 1/8") in Viscose in the distance of 15 cm at 20°C

Degree of Ripeness: Amm. chloride method

Bath M and N: Secthis literature

Quality Number: Strength per denier $\times$ Elongation

Luster: Classified by sight

Softness: Classified by feeling

Dyeing affinity: Classified by sight

Form: See 1st report