

# LENPUR COMPARED WITH OTHER CELLULOSE FIBRES: VISCOSE, MODAL AND LYOCELL

Test Nr. 738 dated 02/07/2002

## MICROPHOTOGRAPHS OF FIBRES USING AN OPTICALMICROSCOPE: LONGITUDINAL VIEW

Product: samples of yarn and fibre

Re: Your letter dated 02/05/2002 delivered 02/05/2002 verbal agreement

Test Requested: various tests

Protocol:535/655

---

- **MICROPHOTOGRAPHS OF FIBRES USING AN OPTICALMICROSCOPE: LONGITUDINAL VIEW**

### IDENTIFICATION OF SAMPLES

4 fibre samples:	shiny Viscose 100%	Nr. 5
	classic Lyocell	Nr.20
	shiny classic Modal	Nr.26
	Lenpur 100%	Nr. 8

### EQUIPMENT USED

Leica DM LP optical microscope  
Image analysis

### NORM USED

Internal

### RESULTS

Photograph N°1:	shiny Viscose 100%, iodosulphuric reagent, transmitted light, 500 x
Photograph N°1A:	shiny Viscose 100%, iodosulphuric reagent, polarised light, 500 x
Photograph N°2:	shiny Viscose 100%, iodosulphuric reagent, transmitted light, 500 x
Photograph N°2A:	shiny Viscose 100%, iodosulphuric reagent, polarised light, 500 x
Photograph N°3:	classic Lyocell, iodosulphuric reagent, transmitted light, 500 x
Photograph N°3A:	classic Lyocell, iodosulphuric reagent, polarised light, 500 x
Photograph N°4:	classic Lyocell, iodosulphuric reagent, transmitted light, 500 x
Photograph N°4A:	classic Lyocell, iodosulphuric reagent, polarised light, 500 x
Photograph N°5:	shiny classic Modal, iodosulphuric reagent, transmitted light, 500 x
Photograph N°5A:	shiny classic Modal, iodosulphuric reagent, polarised light, 500 x
Photograph N°6:	shiny classic Modal, iodosulphuric reagent, transmitted light, 500 x
Photograph N°6A:	shiny classic Modal, iodosulphuric reagent, polarised light, 500 x
Photograph N°7:	Lenpur 100%, iodosulphuric reagent, transmitted light, 500 x
Photograph N°7A:	Lenpur 100%, iodosulphuric reagent, polarised light, 500 x
Photograph N°8:	Lenpur 100%, iodosulphuric reagent, transmitted light, 500 x
Photograph N°8A:	Lenpur 100%, iodosulphuric reagent, polarised light, 500 x

### NOTES

Photographs enclosed

Test date end 01/07/2002

## MICROPHOTOGRAPY OF FIBRES USING OPTICAL MICROSCOPE: SECTION COUNT OF SYNTHETIC AND ARTIFICIAL FIBRES

### • MICROPHOTOGRAPHY OF FIBRES USING OPTICAL MICROSCOPE: SECTION

#### IDENTIFICATION OF SAMPLES

As above

#### EQUIPMENT USED

Leica DM LP optical microscope

Microtron

#### NORM USED

Internal

#### RESULTS

Photograph N°9: shiny Viscose 100%, transmitted light, 1000 x  
Photograph N°9A: shiny Viscose 100%, transmitted light, 1000 x, after dyeing with reactive dyes  
Photographs N°9B: shiny Viscose 100%, transmitted light, 1000 x, after dyeing with direct dyes  
Photographs N°10: classic Lyocell, transmitted light, 1000 x  
Photographs N°10A: classic Lyocell, transmitted light, 1000 x, after dyeing with reactive dyes  
Photographs N°10B: classic Lyocell, transmitted light, 1000 x, after dyeing with direct dyes  
Photographs N°11: shiny classic Modal, transmitted light, 1000 x  
Photographs N°11A: shiny classic Modal, transmitted light, 1000 x, after dyeing with reactive dyes  
Photographs N° 11B: shiny classic Modal, transmitted light, 1000 x, after dyeing with direct dyes  
Photographs N°12: Lenpur 100%, transmitted light, 1000 x  
Photographs N°12A: Lenpur 100%, transmitted light, 1000 x, after dyeing with reactive dyes  
Photographs N°12B: Lenpur 100%, transmitted light, 1000 x, after dyeing with direct dyes

#### NOTES

Photographs enclosed

Test date end 01/07/2002

### • COUNT OF SYNTHETIC AND ARTIFICIAL FIBRES

#### IDENTIFICATION OF SAMPLES

As above

#### NORM USED

UNI EN ISO 1973

#### ENVIRONMENTAL CONDITIONS

Temperature 20° C- relative humidity 65%

#### RESULTS

	Mean fibre count [dTex]
shiny Viscose 100% N°5 :	1,4
classic Lyocell N°20 :	1,4
shiny classic Modal N°26 :	1,4
Lenpur 100% N°8 :	1,6

#### NOTES

Test date end 01/07/2002

## DETERMINATION OF FORCE AND BREAK EXTENSION ON A SINGLE FIBRE

### • DETERMINATION OF FORCE AND BREAK EXTENSION ON A SINGLE FIBRE

#### IDENTIFICATION OF SAMPLES

As above

#### NORM USED

UNI EN ISO 5079

#### TESTING PARAMETERS

Test time : 10 mm

Test speed : 10 mm/minute

The wet tests were performed on fibres previously immersed in water as in the norm but not kept in immersion during the test.

#### ENVIRONMENTAL CONDITIONS

Temperature 20° C- relative humidity 65%

#### RESULTS

shiny Viscose 100% N°5

	Test on conditioned fibre	Wet test
Breaking force [cN] :	2,95	2,55
Extension at break % :	16,86	10,49
CV force % :	16,45	22,22
CV elongation % :	22,46	22,18
Tenacity [cN/dTex] :	2,11	1,82

classic Lyocell N°20

	Test on conditioned fibre	Wet test
Breaking force [cN] :	5,22	5,44
Extension at break % :	15,79	19,29
CV force % :	18,93	11,41
CV elongation % :	25,18	18,67
Tenacity [cN/dTex] :	3,73	3,89

shiny classic Modal N°26

	Test on conditioned fibre	Wet test
Breaking force [cN] :	4,25	3,57
Extension at break % :	13,23	7,42
CV force % :	8,45	34,42
CV elongation % :	12,88	30,05
Tenacity [cN/dTex] :	3,03	2,55

Lenpur 100% N°8

	Test on conditioned fibre	Wet test
Breaking force [cN] :	3,27	2,69
Extension at break % :	20,46	11,62
CV force % :	22,91	24,92
CV elongation % :	28,50	30,39
Tenacity [cN/dTex] :	2,05	1,68

#### NOTES

Printed enclosure

Test date end 01/07/2002

**FRICION ON COEFFICIENT ON YARN  
DETERMINATION OF TENSILE YARN**

• **FRICION COEFFICIENT ON YARN**

IDENTIFICATION OF SAMPLES

N°4 samples of yarn Ne 40

EQUIPMENT USED

Rothschild - F - meter

NORM USED

Internal

TESTING PARAMETRS

- material speed: 150 m/l'
- diagram speed: 2 cm/l'
- testing time: 2.5 inert minutes - 2.5 normal minutes
- creep angle thread/metal: 180°

ENVIRONMENTAL CONDITIONS

Temperature 20° C- relative humidity 65%

RESULTS

	T2 (g)	T1(g)	f
Shiny Viscose yarn	20	72	0.41
Lyocell yarn	20	51	0.30
Modal yarn	20	51	0.30
Lenpur yarn	20	50	0.29

NOTES

T2: entrance strain

T1: exit strain

f : friction coefficient

Diagram enclosed

Test date end 01/07/2002

• **DETERMINATION OF TENSILE YARN**

IDENTIFICATION OF SAMPLES

As above

NORM USED

Internal L.F. 3

ENVIRONMENTAL CONDITIONS

Temperature 20° C- relative humidity 65%

RESULTS

Length variation %

Material as is

Shiny Viscose yarn - 1,8

Lyocell yarn	- 0,6
Modal yarn	- 0,8

### **DETERMINATION OF TENSILE YARN DYEING TESTS**

Lenpur yarn	- 3,0
-------------	-------

#### Material dyed with direct dyes

Shiny Viscose yarn	- 0,4
Lyocell yarn	- 0,1
Modal yarn	- 0,2
Lenpur yarn	- 0,2

#### Material dyed with reactive dyes

Shiny Viscose yarn	- 0,7
Lyocell yarn	- 0,5
Modal yarn	- 0,4
Lenpur yarn	- 0,7

#### NOTES

Test date end 07/06/2002

- **DYEING TESTS**

#### IDENTIFICATION OF SAMPLES

As above

#### RESULTS

##### SCOURING:

The samples were scoured in an aqueous bath at a temperature of 55°C with 1g/l of non ionic ethoxylated surfactant in a slightly alkaline medium due to the presence of sodium bicarbonate.

##### DYEING:

a) dyeing with direct dyes:

3% dye, 10% sodium sulphate, 5% sodium carbonate, bath ratio 1:30. 30 minutes at 98° C, remains in bath for 15 minutes before cooling and rinsing.

b) dyeing with reactive dyes:

3% dye, 10% sodium sulphate, 1% sodium carbonate, bath ratio 1:30. 30 minutes at 98° C, remains in bath for 15 minutes before cooling, washing with non ionic surfactants, rinse.

#### NOTES

Test date end 02/07/2002

Enclosed to test N° 738

## TEST 738 ENCLOSED N. 1

UNI EN ISO 5079 (10 mm)

Determination of force and break extension on a single fibre

Test type:	yarn/fibre	Instron Corporation
Operator:	bsm	Series IX Automated Materials Testing System 8.12.00
Identification lot:	655 lenpur	Data test: Monday, 3 <sup>rd</sup> June 2002
Interface:	5500	

Sample speed (pt/s):	50.0000		
Throughput speed:	10.0000	mm/min	Humidity (%): 65
Second speed:	0.0000	mm/min	Temperature: 20 C
Third speed:	0.0000	mm/min	
Campo car. f scala:	0.0100	kN	

SAMPLE                      Lenpur (wet)

Lot comments:

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
1	2.73	19.90	1.708	117.883
2	4.05	17.80	2.533	161.327
3	3.63	17.66	2.267	150.459
*excluded*	0.06	2.48	0.038	0.000
5	3.22	16.27	2.012	164.452
6	3.60	15.00	2.250	148.771
7	3.53	11.37	2.208	108.083
8	2.10	7.93	1.311	156.576
9	3.06	11.30	1.910	148.627
10	2.23	9.50	1.394	106.058
11	2.97	10.03	1.856	128.904
12	2.11	8.47	1.318	116.548
13	2.34	8.10	1.461	109.127
14	3.95	12.53	2.472	152.413
15	3.14	12.67	1.965	154.111
16	2.18	13.26	1.365	166.156
17	2.27	8.47	1.417	142.470
18	1.93	7.27	1.206	145.409
*excluded*	0.18	0.05	0.115	134.798
20	3.51	8.97	2.196	121.063
21	2.23	7.07	1.397	152.958
22	1.99	6.80	1.242	145.078
23	3.27	13.87	2.041	71.682
24	3.06	14.33	1.912	188.434
25	2.95	15.97	1.842	184.997
26	2.98	11.87	1.863	97.936
27	3.13	16.10	1.959	80.183
28	3.47	11.00	2.169	45.376
29	1.86	10.10	1.162	156.102
30	2.18	8.77	1.362	162.199
31	2.16	11.23	1.348	153.160
32	3.02	12.56	1.887	138.038
33	2.34	9.10	1.461	155.020
34	1.38	6.17	0.865	150.467
35	2.45	10.66	1.532	159.158
36	2.84	10.06	1.773	150.453
37	2.00	7.90	1.251	139.733
38	1.87	13.97	1.169	171.228

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
39	2.77	14.10	1.734	138.729
40	2.52	12.17	1.578	172.179
*excluded*	0.10	2.48	0.061	0.000
42	2.41	10.70	1.506	138.859
43	2.06	10.80	1.287	145.301
*excluded*	0.01	0.00	0.007	-
45	2.30	11.27	1.435	155.158
46	2.46	12.70	1.540	154.235
47	2.76	12.36	1.726	137.128
48	3.22	13.67	2.015	108.639
49	1.94	9.10	1.210	165.346
50	1.45	8.16	0.904	145.972
51	2.42	10.10	1.512	155.274
52	3.81	14.90	2.384	170.619
53	2.57	9.03	1.605	123.682
54	2.44	11.30	1.522	126.742
55	2.29	7.87	1.429	133.159
56	3.78	17.30	2.365	202.596
57	4.01	21.77	2.504	152.905
58	2.13	5.90	1.334	148.938
Average	2.69	11.62	1.679	142.153
D.S.	0.67	3.53	0.418	28.248
C.V.	24.92	30.39	24.918	19.871
Minimum	1.38	5.90	0.865	45.376
Maximum	4.05	21.77	2.533	202.596

**TEST 738 ENCLOSED N. 2**

UNI EN ISO 5079 (10 mm)

Determination of force and break extension on a single fibre

Test type:	yarn/fibre		Instron Corporation
Operator:	bsm		Series IX Automated Materials Testing System 8.12.00
Identification lot:	655 lenpur		Data test: Wednesday, 29 <sup>th</sup> May 2002
Interface:	5500		
Sample speed (pt/s):	50.0000		
Throughput speed:	10.0000	mm/min	Humidity (%): 65
Second speed:	0.0000	mm/min	Temperature: 20 C
Third speed:	0.0000	mm/min	
Campo car. f scala:	0.0100	kN	

SAMPLE                      Lenpur 100%

Lot comments:

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
1	2.93	24.11	1.834	31.544
2	2.14	13.92	1.339	61.925
3	2.73	22.03	1.703	122.423
4	3.40	30.36	2.124	164.080
5	2.85	15.03	1.784	129.382
6	3.24	15.03	2.027	109.920
7	3.98	23.57	2.490	162.152
*excluded*	0.32	0.05	0.202	149.798
*excluded*	0.10	2.48	0.063	0.000
10	3.69	9.17	2.308	207.318
11	3.12	25.87	1.951	125.156
12	4.06	26.91	2.539	45.928
13	2.25	14.58	1.403	153.302
14	3.44	17.94	2.148	63.001
15	2.88	28.03	1.802	143.046
16	3.96	14.94	2.477	125.910
17	3.27	24.06	2.046	150.216
18	3.16	28.83	1.974	153.845
19	4.53	27.70	2.834	124.834
20	4.19	11.90	2.616	174.021
21	2.55	23.13	1.591	176.384
22	3.32	16.77	2.075	152.684
23	3.87	24.63	2.416	137.293
24	1.36	13.99	0.850	45.345
25	2.56	17.50	1.600	142.737
26	2.66	20.83	1.663	148.508
27	2.55	19.33	1.592	161.447
28	2.96	26.43	1.848	143.228
29	3.58	22.53	2.235	77.344
30	4.02	12.07	2.511	102.277
31	2.48	18.83	1.550	143.226
32	3.45	20.23	2.159	195.163
33	4.05	12.17	2.534	155.963
34	3.07	15.93	1.919	138.047
35	3.50	10.33	2.190	136.593
36	4.86	18.80	3.040	154.703
37	2.39	31.03	1.491	160.620
38	3.87	15.53	2.420	152.175
39	3.44	18.46	2.153	115.644
40	3.18	20.93	1.985	151.187



	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
41	3.28	19.90	2.051	152.499
42	2.94	21.50	1.840	143.809
43	2.65	32.87	1.654	159.256
44	2.66	23.77	1.660	116.879
45	5.13	29.40	3.206	133.445
46	2.47	13.26	1.543	166.869
47	2.31	12.90	1.447	152.405
48	3.17	25.57	1.983	218.384
49	3.03	22.03	1.896	156.366
50	4.08	24.43	2.551	179.324
51	4.07	11.10	2.541	98.565
52	4.37	22.63	2.728	103.090
Average	3.27	20.46	2.046	136.389
D.S.	0.75	5.83	0.469	39.232
C.V.	22.91	28.50	22.915	28.764
Minimum	1.36	10.33	0.850	31.544
Maximum	5.13	32.87	3.206	218.384

**TEST 738 ENCLOSED N. 3**

UNI EN ISO 5079 (10 mm)

Determination of force and break extension on a single fibre

Test type:	yarn/fibre	Instron Corporation
Operator:	bsm	Series IX Automated Materials Testing System 8.12.00
Identification lot:	655 mshiny	Data test: Friday, 31 <sup>st</sup> May 2002
Interface:	5500	
Sample speed (pt/s):	50.0000	
Throughput speed:	10.0000	mm/min
Second speed:	0.0000	mm/min
Third speed:	0.0000	mm/min
Campo car. f scala:	0.0100	kN
		Humidity (%): 65
		Temperature: 20 C

SAMPLE classic Modal shiny (wet)

Lot comments:

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
1	4.11	10.63	2.934	74.773
2	3.97	9.37	2.837	84.661
3	2.82	5.10	2.015	80.631
4	2.94	6.03	2.103	69.838
5	1.97	4.37	1.408	172.391
6	3.09	4.23	2.208	60.669
7	5.48	8.83	3.916	77.800
8	3.16	6.43	2.260	179.191
9	2.96	4.87	2.115	187.772
10	2.91	7.10	2.082	70.650
11	3.94	9.53	2.812	84.027
12	3.00	6.83	2.140	177.370
13	2.57	6.73	1.833	168.861
14	2.64	6.93	1.886	167.930
15	1.72	2.97	1.229	156.042
16	3.10	8.17	2.217	169.718
17	3.12	7.77	2.226	83.787
*excluded*	0.46	5.12	0.329	144.255
*excluded*	5.66	8.80	4.041	122.004
20	2.73	6.33	1.953	87.514
*excluded*	0.54	13.96	0.387	194.380
22	2.96	10.10	2.112	163.045
23	2.79	4.96	1.992	132.882
24	2.77	5.93	1.975	198.087
*excluded*	0.33	0.05	0.235	147.665
26	2.89	5.67	2.066	61.030
27	3.39	4.10	2.420	77.976
28	2.86	6.12	2.046	175.328
*excluded*	0.25	2.48	0.182	0.000
30	3.11	6.53	2.223	133.978
31	3.03	7.20	2.165	160.582
32	5.17	8.03	3.695	76.195
33	2.93	6.63	2.089	53.425
34	2.93	6.73	2.096	179.296
35	3.12	6.80	2.231	84.865
36	2.90	6.90	2.072	92.043
37	3.04	6.86	2.174	181.741
*excluded*	4.04	22.17	2.884	155.261
39	2.82	6.96	2.016	154.305
40	3.04	7.70	2.172	174.586

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
41	3.14	6.76	2.245	111.846
42	5.06	7.07	3.615	119.581
43	3.87	8.47	2.765	173.859
44	4.52	9.57	3.227	127.484
45	8.14	13.07	5.813	121.750
46	3.71	8.17	2.653	181.088
*excluded*	6.97	11.80	4.975	111.522
48	4.69	11.73	3.349	141.329
49	7.04	9.60	5.026	97.443
50	4.96	12.93	3.541	139.759
51	4.56	11.73	3.257	216.460
52	5.67	7.60	4.051	239.451
53	3.20	7.67	2.285	209.094
*excluded*	0.39	0.06	0.281	184.357
*excluded*	0.39	0.05	0.280	170.510
*excluded*	0.47	2.48	0.335	0.000
57	3.01	5.10	2.152	77.430
Average	3.57	7.42	2.547	132.118
D.S.	1.23	2.23	0.877	49.781
C.V.	34.42	30.05	34.421	37.679
Minimum	1.72	2.97	1.229	53.425
Maximum	8.14	13.07	5.813	239.451

**TEST 738 ENCLOSED N. 4**

UNI EN ISO 5079 (10 mm)

Determination of force and break extension on a single fibre

Test type:	yarn/fibre		Instron Corporation
Operator:	bsm		Series IX Automated Materials Testing System 8.12.00
Identification lot:	655 MC		Data test: Monday, 27 <sup>th</sup> May 2002
Interface:	5500		
Sample speed (pt/s):	50.0000		
Throughput speed:	10.0000	mm/min	Humidity (%): 65
Second speed:	0.0000	mm/min	Temperature: 20 C
Third speed:	0.0000	mm/min	
Campo car. f scala:	0.0100	kN	

SAMPLE classic Modal shiny

Lot comments:

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
1	4.20	13.13	3.003	234.404
2	3.89	12.67	2.781	114.275
3	3.96	13.73	2.832	116.930
*excluded*	0.16	2.48	0.116	0.000
5	4.22	14.17	3.016	206.321
6	3.94	13.83	2.813	68.271
7	4.16	13.68	2.969	143.179
8	4.23	14.57	3.025	125.138
9	4.36	12.10	3.113	183.832
10	4.07	9.23	2.907	99.017
11	3.79	12.63	2.710	77.116
12	4.12	14.60	2.944	172.963
13	3.28	12.87	2.342	192.302
14	4.06	10.46	2.902	140.540
15	4.04	12.63	2.889	64.312
16	4.22	14.43	3.018	140.213
17	4.27	13.80	3.047	116.387
18	4.31	12.17	3.080	122.304
19	3.99	13.33	2.852	177.867
20	5.37	16.03	3.834	137.140
21	4.45	13.03	3.180	96.774
*excluded*	7.53	13.90	5.375	187.186
23	4.50	13.90	3.214	196.982
24	4.36	11.80	3.116	105.574
25	4.29	15.30	3.065	242.167
26	4.44	9.50	3.173	121.713
27	4.11	13.23	2.939	107.161
28	4.30	11.97	3.074	107.874
29	4.14	13.73	2.955	137.580
30	4.04	13.80	2.888	91.589
31	4.36	15.36	3.114	52.948
32	4.32	15.50	3.082	195.443
33	4.21	14.20	3.005	155.373
34	4.75	9.57	3.394	133.547
35	4.51	12.93	3.219	57.885
*excluded*	8.83	15.00	6.308	128.039
37	3.69	12.47	2.636	130.944
38	4.28	13.90	3.061	206.136
39	4.64	13.80	3.314	164.071
40	4.65	15.10	3.324	119.515

41	4.25	10.40	3.037	102.809
42	3.43	13.12	2.447	84.139
43	4.76	13.30	3.402	241.032
44	4.20	13.43	2.999	81.599
45	3.92	8.23	2.799	115.876
*excluded*	1.71	1.90	1.225	146.574
47	4.27	12.53	3.053	88.450
48	4.55	14.43	3.249	125.100
49	4.19	14.36	2.994	268.850
50	4.59	15.73	3.280	130.810
51	5.04	14.16	3.598	157.086
52	4.60	14.07	3.284	206.508
53	4.20	15.26	3.001	175.163
54	3.82	13.53	2.725	96.263
Average	4.25	13.23	3.034	138.590
D.S.	0.36	1.70	0.257	51.507
C.V.	8.45	12.88	8.454	37.165
Minimum	3.28	8.23	2.342	52.948
Maximum	5.37	16.03	3.834	268.850

## TEST 738 ENCLOSED N. 5

UNI EN ISO 5079 (10 mm)

Determination of force and break extension on a single fibre

Test type:	yarn/fibre	Instron Corporation
Operator:	bsm	Series IX Automated Materials Testing System 8.12.00
Identification lot:	655 vsw	Data test: Thursday, 30 <sup>th</sup> May 2002
Interface:	5500	
Sample speed (pt/s):	50.0000	
Throughput speed:	10.0000	mm/min Humidity (%): 65
Second speed:	0.0000	mm/min Temperature: 20 C
Third speed:	0.0000	mm/min
Campo car. f scala:	0.0100	kN

SAMPLE                      Viscose shiny (wet)

Lot comments:

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
1	3.52	13.00	2.514	107.046
2	2.33	9.17	1.667	156.820
3	2.36	10.07	1.682	169.851
4	2.37	9.80	1.694	172.067
5	2.13	11.03	1.524	193.875
6	1.91	6.90	1.366	191.256
7	2.26	12.10	1.615	161.514
8	2.23	13.37	1.595	138.969
9	1.66	6.43	1.184	174.858
10	2.08	9.57	1.486	155.562
11	1.86	8.87	1.327	156.842
12	2.21	9.97	1.579	173.343
13	2.47	9.37	1.761	184.782
14	2.46	10.97	1.758	178.747
15	2.88	12.93	2.059	160.999
16	2.84	12.93	2.026	155.679
17	2.36	8.23	1.687	217.425
18	2.08	10.80	1.485	160.356
19	2.96	10.73	2.113	74.425
20	3.40	15.17	2.431	86.311
21	3.18	12.73	2.272	178.264
22	2.93	12.63	2.090	193.196
23	4.41	13.29	3.153	130.195
24	3.06	11.40	2.183	134.503
25	2.78	6.97	1.983	201.477
26	3.18	12.47	2.270	155.641
27	3.00	10.83	2.142	177.276
28	2.77	10.23	1.982	186.418
29	2.60	10.06	1.855	134.964
30	2.09	9.03	1.495	203.123
31	1.90	8.07	1.361	166.779
*excluded*	0.00	0.00	0.000	-
33	1.89	7.17	1.352	130.123
34	2.19	7.97	1.562	209.042
35	2.48	8.90	1.774	84.567
36	3.43	12.50	2.447	76.784
37	2.71	8.23	1.937	168.270
38	2.51	11.91	1.791	78.774
39	3.59	9.90	2.563	76.525
40	2.56	10.73	1.826	217.936

41	2.76	12.11	1.972	71.548
42	1.14	14.85	0.812	45.711
43	2.61	14.33	1.865	67.748
44	2.87	12.67	2.049	155.307
45	2.85	13.82	2.033	44.844
46	2.13	6.73	1.520	234.265
47	3.13	14.43	2.236	180.041
48	2.22	7.97	1.586	175.002
49	1.95	7.43	1.391	187.950
50	3.42	11.37	2.445	193.693
51	2.36	8.93	1.688	157.518
52	2.23	7.58	1.592	187.441
53	2.43	10.70	1.735	138.224
54	2.23	8.47	1.594	172.963
55	2.19	7.43	1.567	147.042
56	2.16	11.77	1.540	191.479
Average	2.55	10.49	1.822	153.188
D.S.	0.57	2.33	0.405	46.144
C.V.	22.22	22.18	22.217	30.123
Minimum	1.14	6.43	0.812	44.844
Maximum	4.41	15.17	3.153	234.265

**TEST 738 ENCLOSED N. 6**

UNI EN ISO 5079 (10 mm)

Determination of force and break extension on a single fibre

Test type:	yarn/fibre		Instron Corporation
Operator:	bsm		Series IX Automated Materials Testing System 8.12.00
Identification lot:	655 Ls		Data test: Tuesday, 28 <sup>th</sup> May 2002
Interface:	5500		
Sample speed (pt/s):	50.0000		
Throughput speed:	10.0000	mm/min	Humidity (%): 65
Second speed:	0.0000	mm/min	Temperature: 20 C
Third speed:	0.0000	mm/min	
Campo car. f scala:	0.0100	kN	

SAMPLE classic Lyocell shiny

Lot comments:

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
1	6.85	22.67	4.892	75.979
2	5.11	14.00	3.647	138.420
3	5.13	6.83	3.661	215.274
4	6.11	20.63	4.366	92.795
5	5.04	19.73	3.597	96.790
6	4.83	18.40	3.450	152.974
7	6.35	20.36	4.538	96.488
8	6.11	16.97	4.364	147.544
9	5.43	13.40	3.882	188.148
10	4.99	14.23	3.564	143.515
11	5.14	17.90	3.675	95.955
12	4.97	16.10	3.553	144.377
13	5.33	16.25	3.809	134.611
14	6.00	17.57	4.285	160.244
*excluded*	8.84	14.13	6.316	150.230
*excluded*	10.87	11.00	7.766	212.668
*excluded*	0.12	2.48	0.088	0.000
18	4.91	16.63	3.505	53.032
19	5.21	12.17	3.722	193.382
20	5.21	16.10	3.718	123.326
21	5.89	15.93	4.205	121.820
22	6.24	17.10	4.460	259.869
23	4.69	17.69	3.350	77.990
24	5.03	18.87	3.593	87.835
25	4.69	16.50	3.350	228.307
26	5.33	8.27	3.807	277.552
27	0.17	0.05	0.124	175.790
28	6.05	20.56	4.322	104.862
29	4.59	12.90	3.277	182.887
30	4.57	15.30	3.264	113.007
31	5.31	16.47	3.791	192.061
32	5.82	16.10	4.156	143.469
33	5.28	16.90	3.771	239.560
34	5.73	20.63	4.093	182.338
35	5.29	13.90	3.776	76.544
36	4.92	17.00	3.516	155.980
*excluded*	7.55	16.96	5.394	173.214
38	5.02	18.23	3.585	94.651
39	6.41	20.97	4.579	202.730



40	5.96	17.87	4.255	215.296
41	3.80	15.00	2.713	227.824
42	5.73	11.83	4.092	125.322
43	5.68	20.30	4.060	156.843
44	4.50	13.83	3.217	143.426
45	3.72	11.70	2.660	58.978
46	5.59	18.86	3.992	100.624
47	6.33	18.56	4.520	93.306
48	4.94	14.00	3.530	123.092
49	4.32	11.17	3.084	128.072
50	4.97	16.80	3.551	122.836
51	5.26	13.03	3.754	118.545
52	6.44	17.33	4.603	182.485
*excluded*	10.22	18.40	7.299	166.127
54	4.70	11.80	3.358	224.217
55	5.11	14.30	3.651	147.670
Average	5.22	15.79	3.726	146.773
D.S.	0.99	3.98	0.705	53.682
C.V.	18.93	25.18	18.928	36.575
Minimum	0.17	0.05	0.124	53.032
Maximum	6.85	22.67	4.892	277.552

## TEST 738 ENCLOSED N. 7

UNI EN ISO 5079 (10 mm)

Determination of force and break extension on a single fibre

Test type: yarn/fibre

Instron Corporation

Operator: bsm

Series IX Automated Materials Testing System 8.12.00

Identification lot: 655 Ls

Data test: Monday, 3<sup>rd</sup> June 2002

Interface: 5500

Sample speed (pt/s): 50.0000

Throughput speed: 10.0000 mm/min

Humidity (%): 65

Second speed: 0.0000 mm/min

Temperature: 20 C

Third speed: 0.0000 mm/min

Campo car. f scala: 0.0100 kN

SAMPLE Lyocell shiny (wet)

Lot comments:

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
1	5.85	18.33	4.181	118.179
2	5.70	18.40	4.071	112.845
3	4.49	11.27	3.205	94.657
4	5.07	19.63	3.623	107.864
5	5.42	22.46	3.868	88.066
6	4.85	17.20	3.467	113.097
*excluded*	10.01	20.90	7.152	109.215
8	5.24	15.03	3.746	109.078
*excluded*	8.69	21.20	6.204	104.995
10	5.33	16.67	3.805	157.144
11	5.07	15.37	3.622	143.191
12	5.33	16.00	3.804	150.706
13	4.39	16.83	3.135	148.365
14	5.50	24.10	3.925	165.514
15	4.31	17.56	3.077	158.490
16	5.64	22.43	4.027	135.619
17	5.07	23.40	3.623	137.422
18	4.47	16.93	3.194	87.669
19	4.75	15.76	3.391	218.985
20	5.53	22.63	3.953	174.705
21	4.90	15.86	3.501	111.398
22	4.64	22.26	3.318	81.803
23	5.67	18.67	4.052	120.088
24	6.46	28.53	4.618	135.109
25	4.57	14.67	3.267	64.163
26	6.26	21.57	4.474	82.550
27	5.74	23.67	4.097	134.319
28	4.84	19.63	3.459	104.023
29	5.65	19.23	4.037	159.972
30	5.09	19.33	3.639	94.538
*excluded*	11.80	19.03	8.429	134.434
32	5.51	20.86	3.936	120.361
33	6.09	23.33	4.351	139.073
34	4.80	11.60	3.427	109.638
35	6.06	17.77	4.329	149.462
36	6.26	22.80	4.469	116.736
37	6.66	21.17	4.758	94.507
38	4.92	14.63	3.513	126.611
39	5.95	17.43	4.249	75.206

40	4.98	16.63	3.557	169.059
41	6.30	23.37	4.503	213.096
*excluded*	10.61	16.96	7.581	138.207
43	6.69	23.83	4.782	148.079
44	5.19	17.50	3.704	200.579
45	5.32	20.86	3.798	93.066
*excluded*	10.13	19.70	7.235	95.406
47	6.39	19.77	4.565	246.210
48	5.84	18.17	4.171	86.828
49	4.86	14.33	3.469	145.989
50	6.16	23.03	4.399	209.810
51	6.04	22.77	4.317	57.338
52	5.22	25.40	3.732	158.121
*excluded*	9.85	17.36	7.034	91.201
54	5.61	17.67	4.007	184.335
55	5.51	18.97	3.937	114.296
56	5.76	19.33	4.111	135.094
Average	5.44	19.29	3.885	132.061
D.S.	0.62	3.60	0.443	41.411
C.V.	11.41	18.67	11.409	31.357
Minimum	4.31	11.27	3.077	57.338
Maximum	6.69	28.53	4.782	246.210

## TEST 738 ENCLOSED N. 8

UNI EN ISO 5079 (10 mm)

Determination of force and break extension on a single fibre

Test type: yarn/fibre

Instron Corporation

Operator: bsm

Series IX Automated Materials Testing System 8.12.00

Identification lot: 655 Vs

Data test: Monday, 27<sup>th</sup> May 2002

Interface: 5500

Sample speed (pt/s): 50.0000

Throughput speed: 10.0000 mm/min

Humidity (%): 65

Second speed: 0.0000 mm/min

Temperature: 20 C

Third speed: 0.0000 mm/min

Campo car. f scala: 0.0100 kN

SAMPLE Viscose shiny 100%

Lot comments:

	Breaking Load (cN)	Extension at break (%)	Peak tenacity (cN/dtex)	Initial modulus (cN/dtex)
1	2.81	14.40	2.008	174.123
2	2.95	23.63	2.110	189.611
3	2.61	16.07	1.862	173.892
4	2.35	16.23	1.679	182.756
5	3.38	23.50	2.417	181.015
6	3.10	19.70	2.213	156.669
7	2.92	17.26	2.082	147.388
8	2.87	17.93	2.048	189.930
9	3.04	19.20	2.171	150.530
10	3.38	21.60	2.414	132.712
11	3.85	18.53	2.751	117.465
12	3.59	21.10	2.564	168.078
13	2.69	17.30	1.925	119.404
14	2.00	12.57	1.426	116.364
15	3.51	21.57	2.509	178.490
16	2.58	16.43	1.840	112.547
17	2.56	10.53	1.830	176.173
18	2.59	13.03	1.849	86.425
*excluded*	0.18	0.05	0.127	47.130
20	3.12	15.90	2.227	163.277
21	2.39	11.66	1.707	72.947
22	2.78	21.39	1.983	88.575
23	3.16	15.37	2.260	187.254
24	3.99	22.78	2.851	100.327
25	2.77	16.10	1.976	92.188
26	2.68	16.61	1.911	91.247
27	3.73	22.40	2.661	153.270
28	2.84	14.20	2.030	207.812
29	3.57	20.27	2.549	86.452
30	3.41	9.60	2.438	221.943
31	2.35	15.94	1.678	70.155
32	1.89	14.44	1.350	109.969
33	3.11	18.26	2.220	174.917
34	3.13	19.10	2.237	56.540
35	3.05	17.57	2.178	33.715
36	3.37	18.37	2.410	69.900
37	2.14	9.64	1.531	175.941
38	3.53	16.41	2.524	137.100
39	3.47	22.23	2.479	153.966

40	2.82	14.51	2.014	40.242
41	3.03	14.60	2.163	144.424
42	2.98	17.10	2.128	65.520
43	2.22	9.54	1.589	102.175
44	2.59	13.14	1.849	142.309
*excluded*	0.91	18.51	0.651	78.028
46	2.80	16.67	2.000	72.112
47	2.76	19.47	1.970	156.117
48	3.14	18.77	2.244	150.528
49	2.67	15.51	1.910	93.511
*excluded*	0.12	0.03	0.084	89.545
*excluded*	-0.00	0.00	-0.001	-
*excluded*	0.15	0.04	0.109	193.932
53	3.28	11.27	2.343	224.587
54	3.52	19.47	2.517	148.707
55	2.08	10.58	1.486	201.703
56	3.17	20.30	2.264	204.123
Average	2.95	16.86	2.105	136.218
D.S.	0.48	3.79	0.346	49.125
C.V.	16.45	22.46	16.446	36.063
Minimum	1.89	9.54	1.350	33.715
Maximum	3.99	23.63	2.851	224.587

# LENPUR COMPARED WITH OTHER CELLULOSE FIBRES: VISCOSE, MODAL AND LYOCELL

Test Nr. 919 dated 06/09/2002

## DETERMINATION OF PILLING RESISTANCE IN ICI FABRICS

Product: samples of yarn and fibre

Re: Your letter dated 28/06/2002 which we received 01/07/2002 plus telephone agreements 16/07-04/09/2002

Test Requested: various tests

Protocol: 696/801

---

- **DETERMINATION OF PILLING RESISTANCE IN ICI FABRICS**

### SAMPLE IDENTIFICATION

4 Fabrics: Lenpur – Viscose - Modal - Lyocell

### EQUIPMENT USED

Pill Testing Box

### NORM USED

BS 5811

### TESTING PARAMETERS

Test time: 2 hours ( equal to 7200 revolutions) and 4 hours ( equal to 14,400 revolutions)

### ENVIRONMENTAL CONDITIONS

Temperature 20 °C Relative Humidity 65%

### SAMPLE

RESULTS	Lenpur	Viscose	Modal	Lyocell
Test Time	2 h 4 h	2 h 4 h	2 h 4 h	2 h 4 h
Level of pilling	3 2	3 2-3	2-3 2	3 2-3

### NOTES

Tests performed on material as it arrived

Level 1: maximum pill formation

Level 5: no pills

Samples enclosed.

Date of end of test: 08/08/2002

**DIMENSIONAL STABILITY TO DOMESTIC WASHING (UNI EN)  
MEASUREMENT OF RESISTANCE TO AUUEOUS STEAM**

- **DIMENSIONAL STABILITY TO DOMESTIC WASHING (UNI EN)**

SAMPLE IDENTIFICATION

As above  
NORM APPLIED  
UNI EN 25077- Uni EN 26330  
EQUIPMENT USED  
Wascator FOM 71 MP- Lab washing machine

TEST PARAMETERS

Wash cycle 7A: - 1  
Drying: Type C  
Detergent: ECE

ENVIRONMENTAL CONDITIONS

Temp. 20°C Relative humidity 65%

RESULTS

Percentage variation in dimensions

	LENPUR	VISCOSE	MODAL	LYOCELL
Width	+ 0.7	+14.4	+4.8	/
Length	-21.5	-31.4	-20.5	-16.1

NOTES

Date of end of test: 08/08/2002

- **MEASUREMENT OF RESISTANCE TO AQUEOUS STEAM**

IDENTIFICATION OF SAMPLE

As above  
EQUIPMENT USED  
Sweating guarded hotplate m259b  
NORM APPLIED  
ISO 11092

TEST PARAMETERS

Air speed = 1m/s  
Plate temperature = 35°C

ENVIRONMENTAL CONDITIONS

Air temperature = 35 °C  
Relative humidity = 40%

RESULTS

Samples:	LENPUR	LYOCELL	MODAL	VISCOSE
Ret [m <sup>2</sup> Pa/W]	7.27	4.25	5.25	4.16

Arithmetical average of three tests

NOTES

End test date 31/07/2002

## MEASUREMENT OF THERMAL RESISTANCE

- MEASUREMENT OF THERMAL RESISTANCE

### SAMPLE IDENTIFICATION

As above

### EQUIPMENT USED

Sweating guarded hotplate m259b

### NORM APPLIED

ISO 11092

### TEST PARAMETERS

Speed of air = 1m/s

Plate temperature = 35°C

### ENVIRONMENTAL CONDITIONS

Air temperature = 20 °C

Relative humidity = 65%

### RESULTS

Samples:	LENPUR	LYOCELL	MODAL	VISCOSE
----------	--------	---------	-------	---------

Ret [m <sup>2</sup> Pa/W]	0.004	0.009	0.004	0.015
---------------------------	-------	-------	-------	-------

Arithmetical average of three tests

### NOTES

End test date 31/07/2002



## LENPUR COMPARED WITH OTHER CELLULOSE FIBRES: VISCOSE, MODAL AND LYOCELL

Test Nr. 920 dated 06/09/2002

### CALCULATION OF LOSS OF MASS AND OF CORRECTIVE FACTOR DIFFERENTIATION OF LENPUR AND VISCOSE FIBRE THROUGH DYEING REACTION

Product: samples of fibre

Re: Your reference dated 09/07/2002

Test Requested: various tests

Protocol: 729/825

---

#### • VARIOUS TESTS

##### SAMPLE IDENTIFICATION

Samples of fibre

NORM USED

Law 26<sup>th</sup> November 1973 – N° 883 “Rule of denomination and labelling of textile products”

##### RESULTS

##### Calculation of loss of mass and of corrective factor in the principal reactants used in the blending of textile fibres

Sodium hypochlorite	Loss %	Corrective factor
Classic Modal shiny	0.26	1.003
Classic Viscose	1.02	1.019
Classic Lyocell	1.14	1.135
Lenpur	0.93	1.009

Formic Acid	Loss %	Corrective factor
Classic Modal shiny	0.69	1.007
Classic Viscose	/	1.0
Classic Lyocell	/	1.0
Lenpur	0.83	1.008

Dimethylformamide	Loss %	Corrective factor
Classic Modal shiny	0.59	1.006
Classic Viscose	0.71	1.007
Classic Lyocell	0.53	1.005
Lenpur	0.51	1.005

Xylene	Loss %	Corrective factor
Classic Modal shiny	/	1.0
Classic Viscose	/	1.0
Classic Lyocell	/	1.0
Lenpur	/	1.0

##### Differentiation of LENPUR and VISCOSE fibre through dyeing reaction (staining test)

The two fibres were treated with a dye mixture SHIRLASTAIN A following to the standard use conditions advised by the producer. The results show that the two fibres are not distinguished in a particular way.

##### NOTES

Enclosed samples of dyed fibres.

Data end test 22/08/2002

# LENPUR COMPARED WITH OTHER CELLULOSE FIBRES: VISCOSE, MODAL AND LYOCELL

**Test Nr. 1217 dated 05/12/2002**

## QUALITATIVE ANALYSIS

Product: 10 samples of cellulose fibre

Re: Your letter date 25/10/2002 delivered 25/10/2002

Test Requested: Qualitative analysis

Protocol: 1157/1254

---

- **QUALITATIVE ANALYSIS**

### SAMPLE IDENTIFICATION

10 samples of cellulose fibre

### NOTES ON SAMPLES

The samples arrived in signed and sealed envelopes numbered from 1 to 10

### EQUIPMENT USED

Axioskop Zeiss optical microscope for use with transmitted light

### NORM APPLIED

The methods of analysis were agreed in advance with the client and verified on known samples of lenpur and viscose. The samples were prepared on a slide base, imbibed in an iodine reagent, dried, then imbibed in a sulphuric reagent, covered with the slide cover. The analysis was performed at 200x using a polarising lens. Two test tubes were analysed for each sample taken from different zones of the sample mass.

The Lenpur fibres were distinguished from the viscose by means of the analysis of the longitudinal section, and, in particular, observing the presence (Lenpur) or absence ( viscose) of changes of orientation along the axis of the above cited reagent in the presence of polarised light.

### RESULTS

The samples examined were classified as follows:

n°1 = viscose  
n°2 = viscose  
n°3 = viscose  
n°4 = viscose  
n°5 = viscose  
n°6 = Lenpur  
n°7 = Lenpur  
n°8 = Lenpur  
n°9 = Lenpur  
n°10 = Lenpur

### NOTES

Test date end 4/12/2002

**LENPUR COMPARED WITH OTHER CELLULOSE FIBRES: VISCOSE, MODAL AND  
LYOCELL**

**Test Nr. 281 dated 02/04/2003**

**DETERMINATION OF ASH CONTENT**



CONSIGLIO NAZIONALE DELLE RICERCHE



**Istituto per lo Studio delle Macromolecole**

SEZIONE DI BIELLA

I - 13900 BIELLA - Corso G. Pella 16 - Tel. 39 - 015 - 8493043 - Fax 39 - 015 - 8408387

Codice Fiscale 800543130586 - Partita IVA 02118311006

---

**RAPPORTO DI PROVA N° 281** del 02/04/2003  
Prodotto : N° 4 samples fibres  
Riferimento : Your letter dated 21/03/2003 received 26/03/2003  
Esame richiesto : Ash content  
Prot. N : 267/286

Spett.le Ditta  
TEXINPRO S.R.L.  
Via Rovato 4/a  
25030 ERBUSCO (BS)

Page 1 of 1

---

**• DETERMINATION OF ASH CONTENT**

**SAMPLE IDENTIFICATION**

Samples n° 1 and 7 received 28/10/2002  
Samples n° 16 and 25 received 26/03/2003

**REMARKS ON THE SAMPLE**

The samples were received in sealed plastic bags.  
The seals refer to the examination of Dr. Danilo Mainetti as stated by Texinpro.

**STANDARD USED**

UNI 8047

**RESULTS**

SAMPLE : N° 1 DANUFIL VISCOSE TYPE F (OPACA) D TEX 1,3 40 mm BALLA N° 325 34 064

Ash content = 0.71 %

SAMPLE : N° 7 WOOD FIBER FLOCK LENPUR BALLA 87

Ash content = 0.21 %

SAMPLE : N° 16 LENZING LYOCELL LF D TEX 1,3 38 mm BALLA N° 1100045

Ash content = 0.37 %

SAMPLES : N° 25 LENZING MODAL CLASSIC BRIGHT RAWWHITE D TEX 1,3 40 mm  
(LUCIDO) BALLA N° 02 51442

Ash content = 0.28 %

**GENERAL REMARKS**

Here enclosed the samples analysed.

Test end date: 02/04/2003

Il Responsabile di Sezione

---

N.B. I risultati indicati sul RAPPORTO DI PROVA si riferiscono esclusivamente ai campioni sottoposti a prova. Se si intende ritirare il residuo dei campioni dopo le prove, si prega indicarlo nella lettera di richiesta di analisi. I campioni verranno conservati per un mese dall'emissione del RAPPORTO DI PROVA; trascorso questo tempo, o dopo il ritiro del residuo, non verranno presi in considerazione eventuali contestazioni sui risultati.

**Il presente RAPPORTO DI PROVA è redatto in conformità alle norme europee EN SERIE 45000.  
E' vietata la riproduzione parziale salvo approvazione scritta dell'Istituto.**

## **LENPUR COMPARED WITH OTHER CELLULOSE FIBRES: VISCOSE, MODAL AND LYOCELL**

### **TEST ABOUT THE HUMIDITY RECOVERY**



<b>TEST REPORT N°</b>	<b>TEXINPRO</b> 003-2343-0703
<b>EMISSION DATE</b>	21-07-2003
<b>SAMPLING</b>	by customer
<b>Date of samples receipt</b>	16-07-2003
<b>Date of acceptance and test beginning</b>	17-07-2003
<b>Date of test ending</b>	21-07-2003

Spett.

TEXINPRO S.R.L.  
Via Rovato, 4/A

25030 ERBUSCO (BS)  
Alla c.a. Sig.ra Elena Perazzolo

Identification of the sample: **test on TUFT OF LENPUR**

### TEST REPORT

#### **Determination of rate of humidity recovery**

(Applied method: drying at 105°C for 4 hour – weighing – conditioning at 20°C – 65% R.H. untill constant weight).

**Value**                      **13,2%**

Direzione Tecnica e Generale  
(Fausto Albonico)

Enclosed: /

The results contained in this report refer only to the sample submitted to a test. The partial reproducing of this report is forbidden without any authorization by Studio Albonico S.A.S.

Pagina 1 di 1