◆ Registered trademark of yarn produced by very innovative and advanced technology by using the machine newly adopted by Samil Spinning, based on Lenzing’s TENCEL, MODAL, VISCOSERAYON, PREMIUM MODAL etc.

◆ ECOSIL, a compound word of ECO, a shortened word of ECOLOGY, and a Korean word SIL(yarn).
Yarn making process

1. Traditional spun yarn production system – ring yarn

2. ECOSIL spun yarn production system – ECOSIL yarn
Twisting structure

Twisting and Winding are separated

Twisting and Winding are done simultaneously
Rough view of yarn

- Ring yarn
- Rotor yarn
- Ecosil
Comparison of yarn structures

RING - O.E - ECOSIL x20

RING MO 30°

O.E R 30°

ECOSIL MO 30°
1. Less Hairiness & Clear Appearance
2. Resistance to pilling & Abrasion
3. Moisture Absorption & Wash Resistance
4. Stability against Deformation
Pilling mechanism

- Yarn
  - Friction
  - Weaving

- Knit fabric
  - Friction
  - Processing

- Piece dyed

- Garment
  - Friction
  - Washing

- Garment
Pilling test surface by type of yarn

- RING Viscose
- ECOSIL Viscose

Pilling test
## Anti-pilling processing

<table>
<thead>
<tr>
<th>Item</th>
<th>Method</th>
<th>Effect</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Burning                     | Burning fine hairs with flame etc.                                     | 0.5–1 grade improvement | • Temporary effect (fine hairs may recur by friction)  
• Not applicable to spandex mixture |
| Anti-pilling agent treatment| Inhibiting fine hairs by preventing slip between fabrics                | 0.5 grade or little effect |                                                                                               |
| Enzyme treatment            | Removing fine hairs with enzyme                                         | 1 grade at least improvement (for cotton) | • Low practicability by serious decrease of strength  
• High treatment cost            |
Woven & knit pilling

- Woven has relatively higher pilling grade, while knit has lower pilling grade.

Woven

- Knit

Pilling grade

- Pilling grade
Knit pilling by structures

- JERSEY

- RIB
Number of hairs by type of yarn

- Viscose NE 30'

SUM (fine hairs in 1mm or more)

<table>
<thead>
<tr>
<th>Type</th>
<th>Before needle passing</th>
<th>After needle passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring</td>
<td>3000</td>
<td>2000</td>
</tr>
<tr>
<td>Rotor</td>
<td>1500</td>
<td>1000</td>
</tr>
<tr>
<td>ECOSIL</td>
<td>500</td>
<td>400</td>
</tr>
</tbody>
</table>

www.samil-sp.co.kr
- Viscose NE 30’
- Not chemical but physical anti-pilling
- Friendly to the human body
- Without additional cost burden on post processing
- Without influence upon physical properties; without need of additional anti-pilling processing
SAMiL SPiNNiNG CO., LTD.
Let’s view Outlast video.
Not too hot.
Not too cold.
Just right.
Outlast?

Thermo-regulating new material developed and used by NASA.

Outlast, which was developed by NASA for protection from changes in external temperature that cannot be predicted by an astronaut upon space exploration, is being used for a space suit. The effectiveness has already been proven, such that it is being used experimentally for special suits of the U.S. Army as hi-tech material.
◆ (PCM: Phase Change Material) embedded in fiber
_PCM (Phase Change Material)

- Shell wall
- PCM

PCM in 2 ~ 5 Micron as paraffin wax
Theory of Outlas

Theory of PCM

Solid ▲ ▼ Liquid Heat Heat Solid

Diagram showing the process of phase change from solid to liquid and back to solid, with heat input and output.
Theory of Outlast

When external temperature increases, the capsule absorbs heat, causing a cold feel.

When external temperature decreases, the capsule emits heat, making the body warm.

Upon movement from comfortable indoors to warm or cold outdoors, inhibits sharp temperature changes.
Temperature control of the human body

- Heat protection mechanism
  ⇒ Makes the body tremble

- Heat reduction mechanism
  ⇒ Causes sweating
Outlast clothing & normal clothing

- Too hot
- Too cold

Normal Clothing

Outlast Clothing
Merits of Outlast applications

◆ Clothes
  – Keeps comfort all day long.
  – Reduces overheat, sweat or cold.
  – Maintains balance of temperature changes.

◆ Bedclothes
  – Helpful for sound sleep.
  – Reduces overheat and sweat upon sleep.

◆ Shoes
  – Minimizes a blister.
  – Reduces overheat and sweat.
  – Keeps the foot dry and comfort.
Active Sports Wear
Casual Out Wear
◆ Inner Wear

Europe

UNDERWEAR & LOUNGEWEAR
THAT STABILIZES THE BODY TEMPERATURE

www.samil-sp.co.kr
Outlast applications

Bedding
Outlast applications

Shoes, Socks
The Performance World of

dri-release®
MICROBLEND PERFORMANCE FABRIC
by Optimer

SAMIL SPINNING CO., LTD.
Dri-release with Fresh Guard?

- Patented special Yarn Technology, keeping a sense of comfortable wear by virtue of excellent moisture discharge performance as well as rapid drying
- Comfortable state kept by limiting creation and growth of smell factors from bacteria without harmful chemical treatment
Dri-release maintains cool & quick dry 4 times faster than cotton by using the patented system of natural fibers and synthetic fibers; natural fibers absorb sweat on the skin, while synthetic fibers are broadly spread and discharged in fabric.
The subject of experiment was directed to attach a humidity sensor and run for 20 minutes after wearing a T-shirt for testing of fabric humidity by time.

As time went by, Dri-release fibers faster approximate the laboratory RH compared to Polyester (Coolmax).

This indicates that Dri-release shows cooler and faster sweat drying during exercise.
Dries fast TEST

After 20 minutes

- **dri-release**
- COOLMAX® EXTREME
- WICKING POLYESTER
- NYLON
- COTTON

Percentage dry
0 10 20 30 40 50

After 60 minutes

- **dri-release**
- COOLMAX® EXTREME
- WICKING POLYESTER
- NYLON
- COTTON

Percentage dry
50 60 70 80 90 100
Absorption speed test

- Make the fabric immersed in water and check the absorption length after 10 minutes.

Diffusion area test

- Drop a certain amount of water onto the fabric and check the area after 10 minutes.
Test of absorption speed and drying speed for knit single jersey

<table>
<thead>
<tr>
<th>Sample</th>
<th>Absorption speed (mm)</th>
<th>Diffusion area (cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Course</td>
<td>Wale</td>
</tr>
<tr>
<td>RING CM 30</td>
<td>130</td>
<td>148</td>
</tr>
<tr>
<td>RING P/C 30</td>
<td>89</td>
<td>93</td>
</tr>
<tr>
<td>Dri-release P/C 30</td>
<td>123</td>
<td>137</td>
</tr>
</tbody>
</table>

Absorption speed (course)

Absorption speed (wale)

Diffusion area
Test of absorption speed and drying speed for knit single jersey

Dryness

Diffusible residual water content (%) vs. Time (min)

- RING CM 30
- RING P/C 30
- Dri-release P/C 30
1. 4 times faster drying speed compared to cotton to keep a comfortable state.
2. Dri-release produces a soft and natural touch on the skin.
3. Dri-release keeps permanent function after washing, contrary to other chemically treated materials.
4. Dri-release causes little wrinkle and pilling.
5. Excellently removes bad smells from sweat by inhibiting smells.
Dri-release uses

Applicable in all fields of clothes

Mans Run T-shirts  Climate T-shirts  Sports Polo T  Plain Y-shirts  Inner Wear

Womens Plain T  Ladys skirt  Night T  Sleepwear slip  Casual

Pillowcase  Cap  Watch cap  Bra  Socks
<table>
<thead>
<tr>
<th>Item</th>
<th>Monthly output (ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING</td>
<td>760</td>
</tr>
<tr>
<td>ECOSIL</td>
<td>780</td>
</tr>
<tr>
<td>Total</td>
<td>1540</td>
</tr>
</tbody>
</table>
### Production item

**Range of yarn count**

<table>
<thead>
<tr>
<th>Ne16</th>
<th>Ne20</th>
<th>Ne30</th>
<th>Ne40</th>
<th>Ne50</th>
<th>Ne60</th>
<th>Ne70</th>
<th>Ne80</th>
<th>Ne90</th>
<th>Ne100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) **ECOSIL**

<table>
<thead>
<tr>
<th>MO, TENCEL</th>
<th>COMPOSITION</th>
<th>Range Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODAL</td>
<td>100%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td>Premium MODAL</td>
<td>100%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td>Micro MODAL</td>
<td>100%</td>
<td>Nec 20° ~ 80°</td>
</tr>
<tr>
<td>TENCEL</td>
<td>100%</td>
<td>Nec 20° ~ 60°</td>
</tr>
<tr>
<td>Micro TENCEL</td>
<td>100%</td>
<td>Nec 100°</td>
</tr>
<tr>
<td></td>
<td>COMPOSITION</td>
<td>Range Count</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>RAYON</td>
<td>100%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td>BAMBOO</td>
<td>100%</td>
<td>Nec 16° ~ 40°</td>
</tr>
<tr>
<td>Cotton Blend</td>
<td>70%/30%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td>Silk Blend</td>
<td>STANDARD 90%/10%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td></td>
<td>ORDER-MADE 94%/6%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td>Wool Blend</td>
<td>STANDARD 90%/10%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td></td>
<td>ORDER-MADE 94%/6%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td>The Others Blend</td>
<td>70%/30%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td>R/P</td>
<td>65%/35%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td>P/R</td>
<td>60%/40%</td>
<td>Nec 20° ~ 40°</td>
</tr>
<tr>
<td>Order Made</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production item</td>
<td>COMPOSITION</td>
<td>Range Count</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Melange Yarn</td>
<td>MODAL, RAYON TENCEL</td>
<td>3%~100% (Any Color)</td>
</tr>
<tr>
<td>Splash Yarn</td>
<td>MODAL, RAYON TENCEL</td>
<td></td>
</tr>
<tr>
<td>Lenzing FR</td>
<td>Lenzing FR</td>
<td>100%</td>
</tr>
<tr>
<td>Outlast</td>
<td>MODAL/Outlast TENCEL, PET Micro-TEN</td>
<td>70%/30%</td>
</tr>
<tr>
<td>Dri-release</td>
<td>P/C P/W</td>
<td>85%/15%</td>
</tr>
</tbody>
</table>
## Production item

### 2) RING

<table>
<thead>
<tr>
<th>MO, TENCEL</th>
<th>COMPOSITION</th>
<th>Range Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODAL</td>
<td>100%</td>
<td>Nec 20’ ~ 60’</td>
</tr>
<tr>
<td>Premium MODAL</td>
<td>100%</td>
<td>Nec 20’ ~ 58’</td>
</tr>
<tr>
<td>Micro MODAL</td>
<td>100%</td>
<td>Nec 20’ ~ 100’</td>
</tr>
<tr>
<td>TENCEL</td>
<td>100%</td>
<td>Nec 20’ ~ 60’</td>
</tr>
<tr>
<td>Micro TENCEL</td>
<td>100%</td>
<td>Nec 50’ ~ 100’</td>
</tr>
<tr>
<td>Production item</td>
<td>COMPOSITION</td>
<td>Range Count</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Cotton Blend MODAL/COTTON (TENCEL)</td>
<td>70%/30% 60%/40% 50%/50%</td>
<td>Nec 20’ ~ 50’</td>
</tr>
<tr>
<td>Wool Blend MODAL/WOOL (TENCEL)</td>
<td>70%/30%</td>
<td>Nec 20’ ~ 40’</td>
</tr>
<tr>
<td>Core yarn MODAL,TENCEL MO/CM</td>
<td>Spandex core Hard core</td>
<td>Nec 20’ ~ 40’ Nec 20’ ~ 45’</td>
</tr>
<tr>
<td>Slub yarn MODAL,TENCEL MO/CM</td>
<td>100% Any composition</td>
<td>Nec 20’ ~ 40’</td>
</tr>
<tr>
<td>Aramid</td>
<td>100</td>
<td>Nec 20’ ~ 40’</td>
</tr>
<tr>
<td>FR/Aramid</td>
<td>70%/30%</td>
<td>Nec 20’ ~ 40’</td>
</tr>
<tr>
<td>The Others Blend MO/P Order Made</td>
<td>70%/30%</td>
<td>Nec 20’ ~ 40’</td>
</tr>
</tbody>
</table>
Samil Spinning CO., LTD.

Thank You!