Innovative Wet Strength Technology
Giluton®
Giluton® Technology – Introduction

Wet strength is the mechanical strength of paper remaining after complete soaking in water.

**Wet Strength Agents** are synthetic resins dedicated to maintain paper strength in aqueous medium:

- **Wet Strengthening**
  - Prevent swelling of the fibers to conserve the stiffness of the fibrils
  - Forming of additional water resistant bonds between the fibers

- **Sizing**
  - Prevention of water penetration
### Giluton® Technology – Introduction / Targets

**«New Generation»**

Products with extremely low byproduct concentration

<table>
<thead>
<tr>
<th>Improved dry &amp; wet breaking length</th>
<th>Better ash content of paper</th>
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<tr>
<td>Increase in paper machine efficiency</td>
<td>Reduced total cost of ownership</td>
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Wet strength agents are applied in various paper grades such as:

- Tissue
- Packaging papers (liquid packaging board, cooling house board, vegetable board)
- Specialty papers (bank note paper, filter paper, label paper, decorative laminating paper, wall paper etc.)
<table>
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<tr>
<th>Model</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Model A</strong></td>
<td>No chemical bonding, only physical entanglement of fibers and resin</td>
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<tr>
<td><strong>Model B</strong></td>
<td>Chemical bonding only between the wet strength resin polymers (Homo-cross linking)</td>
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<tr>
<td><strong>Model C</strong></td>
<td>Chemical bonding only between the wet strength resin polymers and fibers (Co-cross linking)</td>
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<tr>
<td><strong>Model D</strong></td>
<td>Chemical bonding between all components</td>
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WSA accumulates during drying process near fibers’ crossing points: WSA is crosslinking within curing time.

Drying procedure: Water content
Giluton® Technology – Type of Wet Strength Agents

1. Temporary wet strength resins
   - Polyamines
     - Polyethylene imines, polyvinyl amines
   - Aldehydes
     - Glyoxal, dialdehyde starch, glyoxylated polyacrylamide

2. Permanent wet strength resins
   - Formaldehyde resin
     - Urea-Formaldehyde, Melamine-Formaldehyde
   - Epichlorhydrine-resin
     - Polyamine-epichlorhydrine, Polyamidoamine epichlorhydrine (PAAE)

- Market share of PAAE resins in Europe
  - PAAE Resins 85%
  - Other 15%
Epichlorhydrine-resins

Byproducts:
- Dichloropropanol (DCP)
- Monochloropropanediol (MCPD)
- Glycerin

- Classified as WGK 1 (low hazard to water)
- Byproducts limits (BfR XXXVI): DCP < 2 ppb, MCPD < 12 ppb for food contact papers.

![Concentration in product [ppm]](chart)

- 1. Generation: DCP < 10,000 ppm, MCPD < 3,500 ppm
- 2. Generation: DCP < 1,000 ppm, MCPD < 500 ppm
- 3. Generation: DCP < 5 ppm, MCPD < 100 ppm
Giluton® Technology – Product Range

2nd generation products

- Giluton® WS 12, Giluton WS 16
  Cost effective products for specialty papers and tissue
- Giluton® 14 XP
  Higher filler retention and lower AOX for specialty papers
- Giluton® 14 NW, Giluton 20 XP
  Lower AOX and Nordic Swan compliance for specialty papers and tissue
- Giluton® 3640
  For high strength requirements with lower DCP & MCPD content for specialty papers and tissue

3rd generation products

- Giluton® 18 LO, Giluton® 15 NW
  Low level of DCP & MCPD for food process applications
- Giluton® 1100/37N, Giluton® SP
  Very low level of DCP & MCPD for hot filter papers
Giluton® Technology – Benefits

- Excellent filler retention
- Very low AOX, DCP & MCPD contribution
- High strength performance on recycled and virgin fiber
- Less sensitive at high system conductivities
- Applicable in a broad pH range (pH 5.5 – 8.5)
- BfR, FDA and Nordic Swan compliance

Efficient paper production process
Giluton® Technology – Supporting Documents

More than 100 global application references available

- including industries like – tissue and specialty paper manufacturers
- including case studies
- including reference list
Learn more about the production process of wet strengthened paper

With wet strength agent
Without wet strength agent

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