Organic Pigment for the Paper and Board Industry
PERGOPAK®

PERGOPAK is a highly dispersed white powder with low bulk density and high surface area, based on micronized polymethyl urea resin. The primary particles with an average size of 0.1-0.15 microns form agglomerates of approximately 4 microns (see 1. stereoscan photograph of PERGOPAK [20,000:1]). As an organic filler PERGOPAK forms almost no ash, the content in paper is analysed with the Kjeldahl N2-evaluation method.

The advantages of PERGOPAK as a filler in paper and board:

In the production process:
- Improved fine fibre and filler retention
- Less solids and ash in the effluent
- Reduced pitch problems

In the finished product:
- Higher opacity
- Enhanced brightness
- More homogeneous structure
- Improved printability
- Less two-sidedness
- Increased bulk value
- Possible grammage reduction

### Product information

<table>
<thead>
<tr>
<th>PERGOPAK</th>
<th>M2</th>
<th>HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance:</td>
<td>Fine, bulky, white powder</td>
<td></td>
</tr>
<tr>
<td>Chemical constitution:</td>
<td>Polymethyl urea resin with approx. 0.6% reactive methylol groups on average.</td>
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</tr>
<tr>
<td>Density:</td>
<td>1.47 g/cm³</td>
<td>1.47 g/cm³</td>
</tr>
<tr>
<td>Bulk Density:</td>
<td>80 g/l</td>
<td>450 g/l</td>
</tr>
<tr>
<td>Shape and size of particles:</td>
<td>Primary particles of 0.1 - 0.15 microns forming agglomerates of about 4 microns diameter on average</td>
<td></td>
</tr>
<tr>
<td>Specific surface area:</td>
<td>apppx. 18m²/g (BET method)</td>
<td></td>
</tr>
<tr>
<td>Pore volume:</td>
<td>about 2.7 cm³/g internal pore volume with an average diameter (as assumed cylindrical capillaries) of 0.3-0.4 microns. Oil absorption (DBP) 300 cm³/100g</td>
<td></td>
</tr>
<tr>
<td>Refractive index:</td>
<td>1.607</td>
<td>1.607</td>
</tr>
<tr>
<td>Specific scattering coefficient:</td>
<td>About 450 m²/kg determined on the pigment (Kubelka and Munk)</td>
<td></td>
</tr>
<tr>
<td>Brightness (TAPPI):</td>
<td>&gt; 96 %</td>
<td>&gt; 96 %</td>
</tr>
<tr>
<td>Zeta potential:</td>
<td>PERGOPAK has a positive zeta potential in a pH range of 4.5-7.5.</td>
<td></td>
</tr>
<tr>
<td>Solids content:</td>
<td>ca. 70%</td>
<td>ca. 28%</td>
</tr>
<tr>
<td>Nitrogen content:</td>
<td>ca. 35% of the dry product</td>
<td></td>
</tr>
<tr>
<td>Residue after ignition:</td>
<td>&lt; 1%</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Storage stability:</td>
<td>Stable for 6 month</td>
<td></td>
</tr>
<tr>
<td>Packaging/handling:</td>
<td>12kg repulpable bags</td>
<td>1.000kg big bags</td>
</tr>
</tbody>
</table>
Characteristic product properties

Specific light scattering coefficient

The light scattering coefficient of Pergopak is comparable to TiO₂. When utilizing Pergopak as a filler, both brightness and opacity of the finished product can be increased.

Zeta potential

Pergopak has a positive zeta potential over a wide pH-range, resulting in a high affinity to the negatively charged cellulose. In practice, Pergopak shows excellent retention (up to 95%), and improves both, the retention of fibres and also other fillers and pigments.

Retention

The retention of Pergopak is mainly achieved through mechanical means and hydrogen bonding. The 4 micron agglomerates are mechanically retained within the fibre structure, and therefore maintain its optical characteristics, contrary to other pigments. The free methylol groups contained in Pergopak react chemically with the fibres, therefore affecting the mechanical strength much less than compared with inorganic fillers.

Filler distribution

As an organic filler, Pergopak disperses in the paper more homogeneously than inorganic fillers.
Characteristic product properties

Absorption capacity

Due to the high specific surface area and a high pore volume, PERGOPAK has an excellent absorption capacity. This absorption value provides rapid take-up of solvents used in printing inks. The subsequent viscosity increase prevents ink strike-through and provides, especially in the halftone area, excellent print definitions (i.e. contour sharpness, brightness and contrasts).

Chart 5 shows the different printing results achieved on untreated printing paper without PERGOPAK (see 5a) and with PERGOPAK (2.4%; see 5b), under otherwise identical printing conditions.

Pore volumes

PERGOPAK agglomerates have a high pore volume with an average pore size equal to half the wave length of visible light. This results in an excellent opacity. The low density of PERGOPAK increases the bulk value (see 6).

Reduced grammage

The above mentioned product properties also offer the possibility to reduce the grammage by approx. 10-15%, without significant changes in the optical properties.

Absorption capacity

\[
\begin{array}{c|c|c|c|c|c}
\text{Characteristic product properties} & \text{TiO}_2 & \text{Filler in the paper (%)} & \text{specific volume} & \text{PEROPAK M2 (1%)} & \text{Increase of bulk} \\
\hline
\text{specific volume} & 0 & 2.3 & 2.1 & 1.9 & 1.7 & 1.5 \\
\text{Filter in the paper (%)} & 0 & 5 & 10 & 15 & \text{Increase of bulk 2.35%} \\
\end{array}
\]

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Chart 5 shows the different printing results achieved on untreated printing paper without PERGOPAK (see 5a) and with PERGOPAK (2.4%; see 5b), under otherwise identical printing conditions.
**Application areas**

**TiO2-Extender**

PERGOPAK provides TiO2 extending and replacing properties in the production of unwaxed and non-resin-impregnated papers. Therefore, in the paper containing small amounts of TiO2 (up to approx. 3%), this part can be totally replaced by PERGOPAK (see Table 1). With larger amounts of TiO2 a partial substitution with PERGOPAK is possible. Experience has shown the combination of TiO2 and PERGOPAK offers the highest possible opacity. Compared to paper containing only TiO2 (i.e. 5 parts), an opacity increase of approximately 2 points can be reached by using 2.5 parts TiO2 and 3 parts PERGOPAK. Additionally, the use of PERGOPAK offers an economical advantage. Due to the low absorption of light by PERGOPAK in the UV-range, the efficiency of optical brighteners is not affected as with TiO2. The combination with PERGOPAK therefore, provides a possible reduction of the optical brightener quantity.

**Low grammage papers**

Based on the product properties listed below, PERGOPAK, when used in low grammage papers, provides better opacity, brightness and printability (control of printing ink penetration):

- Very high light scattering coefficient
- More homogeneous dispersion in the paper compared with inorganic fillers
- Excellent absorption capacity
- Very high self-retention (PERGOPAK also improves the retention of additionally used fillers).

These advantages of PERGOPAK are valid for wood containing (i.e. newsprint, telephone book, etc.) as well as for wood-free paper (i.e. bible print, airmail paper, etc.).

**White board topliner**

For board production, recyclingpaper is often used as a secondary low cost fibre, however, this can result in problems for the board covering. The use of PERGOPAK is advantageous in providing additional covering power of darker filler stock. The use of 2-4 %PERGOPAK in the white cellulose cover will significantly improve the topliner opacity and brightness. Reduction of topliner weight is also possible in the range of 10-15%.

**Security and banknote paper**

An important quality aspect of this paper is high opacity combined with a limited ash content (approx. 3%). Contrary to standard formulations, the use of PERGOPAK improves opacity without increasing the ash content.

**Speciality papers**

- **Ink-Jet Paper**
  In coated Ink-Jet paper, the high absorption capacity of PERGOPAK prevents ink flow (spread) and provides clear, sharp prints. In comparison with finely precipitated silicas, PERGOPAK reduces the binder demand and therefore offers an additional economical advantage. Uncoated papers, produced with approximately 2% PERGOPAK as a filler and less resin size can also be used as Ink-Jet papers.

- **One-Time Carbon Copy Paper (OTC-Paper)**
  Through the addition of approximately 2.0-2.5% PERGOPAK in carbon copy paper, two-sidedness, curl tendency and uneven penetration of the carbon paste will be prevented. At carbonization, a reduction of carbon paste up to 20% can be additionally realized.
Technical application references

**PERGOPAK against pitch difficulties**

In addition to the foregoing specific application areas, PERGOPAK is also known as a pitch control agent. Due to its excellent surface and retention properties, the pitch particles can be adsorptively bound and therefore, retained within the paper structure. Deposits within the white water system are minimized. PERGOPAK M2 addition levels are in the range of 0.2 - 1.0 %, based on dry fibre.

**Application points**

The following table shows practical points for the addition of PERGOPAK after the desired amounts are known.

The highly bleached multiwall cellulose PERGOPAK M2 bags are almost free from optical brightener and therefore dissolve totally speck-free.

The 10 % water dispersion can be made in the following ways:
- Addition of the closed PERGOPAK M2 bags into water filled pulper.
- Addition of the PERGOPAK M2/HP without bags/big bags into the filler dissolver.

When first using PERGOPAK, we recommend determining the retention of the inorganic filler, as well as PERGOPAK. Since the entire retention is generally increased, samples should be taken at regular intervals, after the addition of PERGOPAK, at the following locations during the production process:
- Stock Chest
- Headbox
- White Water Tray
- Finished Paper

For all samples collected, a quantitative evaluation of solids, ash and PERGOPAK (i.e. Kjeldahl) should be done, from which the total retention can be calculated. From these results, the PERGOPAK quantity in the formulation will be determined.

<table>
<thead>
<tr>
<th>Application points</th>
<th>Free Location</th>
<th>Dosage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Pulper per bag / big-bag</td>
<td>easiest possibility</td>
<td>addition at time of highest turbulence (approx 1/3 of pulper filled)</td>
<td></td>
</tr>
<tr>
<td>B Broke Pulper per bag / big-bag</td>
<td>when cellulose pulper is not available (i.e. at integrated plants)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C Mixing Chest 10% water dispersion</td>
<td>when A and B are not feasible</td>
<td>when beating with 60° SR and higher is foreseen</td>
<td></td>
</tr>
<tr>
<td>D Stuff Chest 10% water dispersion</td>
<td>alternative to C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For all samples collected, a quantitative evaluation of solids, ash and PERGOPAK (i.e. Kjeldahl) should be done, from which the total retention can be calculated. From these results, the PERGOPAK quantity in the formulation will be determined.
Summary of functional application areas

In close cooperation with paper and board manufacturers in all areas of the world, special solutions and new forward oriented applications have been developed using PERGOPAK. The chart below indicates areas of improvement when PERGOPAK is used. Should you not have found the solution to your particular problem in this brochure, please give us a call. Our technical service department will gladly advise you.

<table>
<thead>
<tr>
<th>Application Functions:</th>
<th>Brightness, comp., with PWA</th>
<th>opacity</th>
<th>tear-strength</th>
<th>smoothness, thin-throw</th>
<th>flatness</th>
<th>specific volume</th>
<th>initial wet strength</th>
<th>dimensional stability</th>
<th>rigidity</th>
<th>printability</th>
<th>ability to carbon</th>
<th>water absorbence</th>
<th>folding strength</th>
<th>pitch stability</th>
<th>retention, white water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map paper, untreated</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
<td>2-4%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>2-4%</td>
<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Black note paper</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
<td>2-4%</td>
<td>+++</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Unbleached offset paper, wood-free, up to 75 g/m²</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
<td>2-4%</td>
<td>+++</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Coating base paper, wood-free, up to 100 g/m²</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
<td>2-4%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Unbleached integral paper, improved, high wood content, up to 75 g/m², 20-25% china clay</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Diatom paper, wood-free, up to 100 g/m²</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Writing, gray letter, printing paper, wood-free, 70-90 g/m²</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Bills paper, simply paper, high opacity, white and cardboard</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
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<tr>
<td>DCP paper, wood free, up to 75 g/m²</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Direct copying paper, paper for forms, carbonising base paper, 40-60 g/m²</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Table cloth and decorative paper, wood-free, 40-70 g/m², opaqued, white</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
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<td>3-6%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
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</tr>
<tr>
<td>Deck diary paper, untreated, wood-free, 35-50 g/m²</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
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<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Copy paper, 50g/m², opaqued, white or pastel</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
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<td>3-6%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Absorbent papers, (beer mats, creped paper for towels)</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Greaseproof paper, high filler content, medium calcined or above 30 g/m²</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
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<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
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<tr>
<td>One-time carbon paper, wood-free to slightly woody, 17.24 g/m², little ash</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
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<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
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<tr>
<td>Newsprint, time-table and telephone directory paper, &lt; 45 g/m²</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
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<td>2-4%</td>
<td>3-6%</td>
<td>3-6%</td>
<td>+++</td>
</tr>
<tr>
<td>Top liner for board and wall paper (to reduce grammage or improve brightness)</td>
<td>+++</td>
<td>1-6%</td>
<td>+++</td>
<td>2-4%</td>
<td>+++</td>
<td>3-6%</td>
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<td>3-6%</td>
<td>+++</td>
</tr>
</tbody>
</table>
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