PAPER MAKING EFFECT ON LONGEVITY OF FINEART PRINTS

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Technical Support Manager
THE NEXT 20 Minutes

PAPER MAKING

COATING
Longevity - Ageing
all organic and unorganic...
all organic and unorganic...

see it every morning...
How to increase Longevity of FineArt Prints as a Papermanufacturer....
How to increase Longevity of FineArt Prints as a Paper manufacturer....

Slowdown aging Process
PAPER BASICS

Raw materials / components of Hahnemühle paper
RAW MATERIALS IN PAPER MAKING

Main resources – Water, Fibres, Additives and Energy

• Water - our own spring
• Hahnemühle uses approximately 30 different fibres
• Electricity, gas and oil will be bought, steam will be self-produced in the factory
• We are using green Energy
RAW MATERIAL WATER

Qualities of our Spring

• Purity
• Low Ion components (Water Hardness) – soft Water
• Temperature
• Low initial levels regarding COD*, AOX** and other solids
• HFA has the water rights since 27. Feb. 1584 (Duke of Braunschweig)

*chemical oxygen demand
**absorbable organic halogene
TYPES OF FIBRES

Short Fibres (0.6 – 3.5 mm)

- Hardwood trees: birch, beech, eucalyptus, acacia and aspen/poplar
- For specific volume (thickness / basis weight) < 1, opacity, smoothness and printability, better transparency
TYPES OF FIBRES

Long Fibres (2.6 – 5 mm)

• Softwood trees: spruce, pine and larch
• For strength and good operating characteristics
• Annual plants
TYPES OF FIBRES

Long Fibres (2.6 – 5 mm)

- Linters (cotton plant)
PULP / CELLULOSE

- Through chemical decomposition, fibres are worked out
- The non-cellulose components are dissolved away by a big part (Kappa number)
- Yield approx. 38 ... 55 %

<table>
<thead>
<tr>
<th>Kappa-number</th>
<th>Residual lignin</th>
<th>Pulp hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - 7</td>
<td>0,5 - 1,0</td>
<td>extra soft</td>
</tr>
<tr>
<td>11 - 15</td>
<td>1,5 - 2,5</td>
<td>soft</td>
</tr>
<tr>
<td>23 - 31</td>
<td>3,0 - 4,0</td>
<td>normal</td>
</tr>
</tbody>
</table>

Selected Types of Wood

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Spruce</th>
<th>Pine</th>
<th>Larch</th>
<th>Poplar, Aspen</th>
<th>Birch</th>
<th>Beech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose in %</td>
<td>42 ... 47</td>
<td>48 ... 55</td>
<td>46</td>
<td>44 ... 52</td>
<td>38 ... 51</td>
<td>38 ... 53</td>
</tr>
<tr>
<td>Lignin in %</td>
<td>28 ... 29</td>
<td>26 ... 29</td>
<td>29 ... 30</td>
<td>20 ... 23</td>
<td>19 ... 27</td>
<td>22 ... 25</td>
</tr>
<tr>
<td>Hemicellulose in %</td>
<td>19 ... 24</td>
<td>17 ... 22</td>
<td></td>
<td>18 ... 26</td>
<td>27 ... 28</td>
<td>22 ... 35</td>
</tr>
<tr>
<td>Hexosane in %</td>
<td>13,3</td>
<td></td>
<td></td>
<td>3</td>
<td>4,8</td>
<td>4,4</td>
</tr>
<tr>
<td>Pentosane in %</td>
<td>9 ... 11</td>
<td></td>
<td>9</td>
<td>15 ... 24</td>
<td>22 ... 27</td>
<td>18 ... 25</td>
</tr>
<tr>
<td>Resin, Fat in %</td>
<td>2,3</td>
<td>3,0 ... 6,0</td>
<td></td>
<td>3,2</td>
<td>1,8</td>
<td>1,8</td>
</tr>
<tr>
<td>Ash in %</td>
<td>0,23 ... 0,77</td>
<td>0,2 ... 0,5</td>
<td>0,17 ... 1,0</td>
<td>0,7 ... 1,0</td>
<td>0,2 ... 0,6</td>
<td>0,4 ... 1,2</td>
</tr>
</tbody>
</table>
**AUXILIARIES**

- **Fillers**
  - Smoothness, calendering, opacity, whiteness, softness, ink receptivity, flatness, regulation of pH value
  - Rigidity, thickness, dusting & lifting, turbidity

- **Sizing (Glue)**
  - Internal sizing and surface sizing
  - Ink and etching properties
  - Hydrophobizing

- **Wet strength agents**
  - The wet strength increases without changing the absorbancy

- **Binder**
  - Fibre-to-fibre binding / surface stability / Stiffness
  - Paper hardness, stiffness
  - Wastewater pollution
AUXILIARIES

• Retention agents
  • Increased yield

• Fixing agents
  • Supports chemical precipitation, binding and addition processes with other components

• Optical Brighteners
  • Increase in whiteness

• Colourant

• Ventilators / Defoamers
PAPER MACHINES IN COMPARISON
CYLINDER MOULD PAPER MACHINE
PAPER SIZING

• Goals of sizing

• Sizing serves to hydrophobize cellulose fibre so it prevents or slows down penetration of water into the fibre fleece and guarantees dimensional stability.

• Sizing should increase paper strength as change surface properties regarding liquid absorption during printing, writing or painting.

• Sizing can be achieved by mass addition or surface sizing with inorganic or organic colloid sizing agents.
PAPER SIZING

• Sizing agents
  • Inorganic or organic colloid sizing agents
  • Resin glue (pH 4.5)
  • Synthetic sizing agents
    • AKD alkyl ketene dimers (pH neutral)
    • ASA alkenyl succinic anhydrides
    • stearic acid
    • FC fluoroorganic compounds
    • polymer size
  • Swellable in water and colloidally dissolved substances
    • Animal glue
    • Strength
    • Casein
COATING

• Details of our Coating!
COATING SYSTEMS HFA USES

<table>
<thead>
<tr>
<th>Coating circulation</th>
<th>Coating circulation</th>
<th>No coating circulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Contactless</td>
<td>Contactless</td>
<td>Contactless</td>
</tr>
<tr>
<td>Application via blade</td>
<td>Application via air burst</td>
<td>Application via pump capacity</td>
</tr>
</tbody>
</table>
FINEART PAPER – TECHNICAL DETERMINATIONS AND REQUIREMENTS

• As natural or coating base paper, wood-free, produced with 100% bleached

• pH value: 7.5 – 9

• Calcium carbonate portion of at least 3%
FINEART PAPER –
TECHNICAL DETERMINATIONS AND REQUIREMENTS

- High whiteness possible without use of OBA
- High opacity
- Slightly smooth textured surface, good feel
- High grammage
- Excellent printability with pigment ink
FINEART PAPER - TECHNICAL DETERMINATIONS AND REQUIREMENTS

... and that’s how Hahnemühle FineArt meets the requirements:

• As pure as possible raw material (100% Linters or 100 % Cellulose)
• Calcium carbonat at least 4%
• Neutral sizing
• Little or no OBA
OBA
Options for increasing whiteness of paper
**OBA**

Options for increasing whiteness of paper

1. White fibres
2. White filler
3. Tinting dye
4. Coating with white pigment
5. Whitener in paper pulp or coating
OBA
Options for increasing whiteness of paper

1. White fibres

   • Wood or cotton contains up to 30% lignin and other incrustations.
   • These are more or less yellow.
   • Largely extracted by chemical pulping ingredients.
**OBA**
Options for increasing whiteness of paper

2. Preferably white filler material

- White pigments can improve brightness of paper.
- The reflection is increased by white pigments throughout the spectrum.
- White pigments can not reduce yellowness
- The human eye reacts much more to color changes in the light than to brightness change
Remission curve – add-on from white pigments
OBA
Options for increasing whiteness of paper
3. Tinting dye (shading dye)

• Yellowness reduction by dye (blue or violet FS).

• Shading dye absorbs long-wave yellow and red light
  => straightening of remission curve

• Disadvantage of shading dye is absorption of light
  => Brightness reduction (shaded paper looks gray)
Remission curve – add-on from shading dye
OBA

Options for increasing whiteness of paper

4. Coating with white pigment

• Surface coating with white pigments can reduce the color cast by covering

• At low coating paper shines through

• Too much coating => loss of surface texture
OBA
Options for increasing whiteness of paper

5. OBA in paper pulp or coating

- In order to eliminate yellow color of a bleached pulp without causing a reduction in brightness, absorption of short-wave light component must be compensated without reducing the reflection in another visible spectral range.
- Whiteners meet this requirement.
OBA
Options for increasing whiteness of paper

• Whiteners, blankophors or OBAs (Optical Brightening Agents)

• Whiteners are able to convert invisible ultraviolet light into visible blue light

• Fluorescent light is adding itself to the light which is reflected by the pulp in the blue area. It is compensating for the absorption part
What are Brighteners?

Optical brighteners change the appearance of the papers in two ways:
- First, they increase reflection and thus brightness.
- Second, they shift color from yellow to blue, which is perceived by the human eye as whiter.
OBA
Options for increasing whiteness of paper

Disadvantages of Brighteners

• Effect decreases
  • depending on incident energy double bonds break down in the molecule
  • Paper looks yellowish (no yellowing - lignin)

• Paper has a misty effect on the fibers when spinned up poorly

• Color change when dosage is too high
OBA
Options for increasing whiteness of paper

Brighteners can be used meaningfully:

- in markets calling for neutral white papers
- Brightness of paper is a quality criterion
- customer is aware of acquiring an age-resistant paper whose brightness is decreasing and which has a tendency to yellow (this is not yellowing)
Thank You
For Your Attention!