Recent developments in printing
Introduction

- pigment printing
  - guiding recipe
  - fastness properties
- printing with natural thickeners
  - natural thickeners
  - printing of cotton with reactive dyes
  - printing of polyester with disperse dyes
  - printing of polyamide with acid or metal-complex dyes
  - printing of acrylic with basic dyes
Introduction

• special printing effects
  ➢ white discharge printing
  ➢ burn-out printing of PET-velour
Pigment printing

- PERICOAT VA 110
  - self-crosslinking copolymer of vinyl acetate and ethylene
  - soft handle
  - no yellowing
  - very good fastness properties
  - more than 165 to sold for pigment printing
## Pigment printing

### Recipe:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Unit</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERICOAT VA 110</td>
<td>g/kg</td>
<td>120 - 200</td>
</tr>
<tr>
<td>PERIFOAM NSI NEW</td>
<td>g/kg</td>
<td>3</td>
</tr>
<tr>
<td>urea</td>
<td>g/kg</td>
<td>20</td>
</tr>
<tr>
<td>PERISOFT SE or PERISOFT MSN</td>
<td>g/kg</td>
<td>20</td>
</tr>
<tr>
<td>PERICOAT CROSSLINKER MV or PERILINK NF NEW</td>
<td>g/kg</td>
<td>20 - 30</td>
</tr>
<tr>
<td>pigment</td>
<td>g/kg</td>
<td>x</td>
</tr>
<tr>
<td>PERIPRINT TN/PF</td>
<td>g/kg</td>
<td>20 - 25</td>
</tr>
</tbody>
</table>

1000
Pigment printing

Fastness properties:

Printed fabric
20 % PERICOAT VA 110
3 % PERICOAT CROSSLINKER MV
6.5 % black pigment

Fastness to rubbing according to DIN EN ISO 105-x-12
Natural thickeners

- alginate
- guar gum
- tamarind
- starch ether
Natural thickeners

- polysaccharides
- distinct swelling capacity
- dispersed in water they are forming stable colloidal systems

PERIGUM A .... (alginate)
PERIGUM G .... (guar gum)
PERIGUM T .... (tamarind)
PERIGUM S .... (starch ether)
Natural thickeners

- to vary water solubility, sensitivity to chemicals, adhesion or filming properties they are chemically modified
- chemical modification e.g.:
  - depolymerisation
  - hydroxypropylation
  - carboxymethylation
  - cationisation
Printing pastes

- printable
- pumpable
- shear thinning behavior
  - flowable while printing
  - immovable to achieve a high acuity
Alginate

- obtained from brown algae
- composed of two types of uronic acids
- these alginic acids are converted into water-soluble salts (commonly sodium)
- sensitive to water hardness
- containing no primary hydroxyl groups and therefore only natural thickeners which do not react with reactive dyes
Guar gum

- galactomannan

main chain consisting of mannose, short side chain consisting of galactose

- obtained from guar seeds. Therefore the endosperms (splits) are separated by a thermo-mechanical process from the germs and husks and milled to guar gum
Tamarind

- heteropolysaccharide (D-galactose, D-glucose, D-xylose)
- structure not fully clarified yet
- obtained from tamarind seeds. The seeds are dehusked by a thermo-mechanical process subsequently sorted by hand and milled to produce tamarind gum
Starch ether

- obtained from e.g. corn, potatoes, wheat
- free hydroxyl groups are modified by introducing functional ether groups
- leads to distinct surface printing, high dyestuff yield and acuity
- no levelling properties
- often used in blends with other natural thickeners
Natural thickeners

- depolymerisation leads from high viscous (high molecular) thickeners to middle or low viscous thickeners.
- Due to depolymerisation, higher quantities of thickeners are required.

**Stock paste:**

- High molecular thickener: 2 – 4%
- Middle molecular thickener: 4 – 8%
- Low molecular thickener: 8 – 12%
Natural thickeners

High molecular thickener

- Price
- Required quantity
- Print through
- Print sharpness
- Acuity
- Levelness
- Mesh size
- Print speed

Low molecular thickener
Printing of cotton with reactive dyes

Recipe (all-in method):

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>g/kg</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERIGUM A ...(stock thickener)</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>PERISTAL OX</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Urea</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Reactive dye</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Balance (water/stock thickener)</td>
<td>y</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1000 g</strong></td>
<td></td>
</tr>
</tbody>
</table>
Printing of cotton with reactive dyes

- only alginate as a natural thickener can be used
- dyestuff is sprinkled into the paste followed by high-speed stirring
- for fixing the dyestuff alkali is necessary. Sodium bicarbonate is normally used
- fixation:
  - saturated steam: 5 – 10 min at 100 – 103 °C
  - superheated steam: 3 – 5 min at 140 – 160°C
  - hot air: 3 – 5 min at 150 °C
    1 min at 190 °C
Printing of cotton with reactive dyes

- washing-off:
  - rinse cold
  - rinse hot (80 – 90 °C)
  - soaping with 3 g/l PERLAVIN SRD at the boiling point
  - rinse warm
  - rinse cold
  - neutralise
## Printing of polyester with disperse dyes

### Recipe:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Unit/kg</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERIGUM ... (stock thickener)</td>
<td>g/kg</td>
<td>750</td>
</tr>
<tr>
<td>PERISTAL DC conc.</td>
<td>g/kg</td>
<td>pH 5 – 6</td>
</tr>
<tr>
<td>PERISTAL OX</td>
<td>g/kg</td>
<td>0 – 5</td>
</tr>
<tr>
<td>PERIGEN EC</td>
<td>g/kg</td>
<td>0 – 5</td>
</tr>
<tr>
<td>Disperse dye</td>
<td>g/kg</td>
<td>x</td>
</tr>
<tr>
<td>Balance (water/stock thickener)</td>
<td>g/kg</td>
<td>y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 g</td>
</tr>
</tbody>
</table>
Printing of polyester with disperse dyes

• guar gum or tamarind are normally used. Blends with starch ether or alginate are common to optimize levelness, dyestuff yield or washability

• depending on the disperse dyestuff it can be sprinkled directly into the paste or pre-dispersed with water (40 °C)

• to prevent disperse dyes from destruction during fixation, an oxidising agent like PERISTAL OX is recommended

• depending on the disperse dye and the fixation conditions a fixation accelerator like PERIGEN EC could be added to increase the dye sorption
Printing of polyester with disperse dyes

- fixation:
  - superheated steam: 6 – 8 min at 165 – 180°C
  - hot air: 1 – 2 min at 180 – 210 °C
Printing of polyester with disperse dyes

- washing off:
  - rinse cold
  - rinse warm
  - reductive clearing at 50 – 70 °C with
    - 1 – 3 g/l sodium hydrosulphite
    - 1 – 2 ml/l NaOH 50 %
    - 1 g/l PERISOL RIO
  - rinse warm
  - rinse cold
  - neutralise
Printing of polyamide with acid or metal-complex dyes

Recipe:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>g/kg</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid dye</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>PERISOL BG</td>
<td>g/kg</td>
<td>20 – 50</td>
</tr>
<tr>
<td>Hot water</td>
<td>g/kg</td>
<td>y</td>
</tr>
<tr>
<td>PERIGUM ... (stock thickener)</td>
<td>g/kg</td>
<td>600</td>
</tr>
<tr>
<td>Urea</td>
<td>g/kg</td>
<td>50</td>
</tr>
<tr>
<td>Ammonium sulphate (33%)</td>
<td>g/kg</td>
<td>30 – 60</td>
</tr>
<tr>
<td>PERIFOAM NSI NEW</td>
<td>g/kg</td>
<td>0.5 – 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 g</td>
</tr>
</tbody>
</table>
Printing of polyamide with acid or metal-complex dyes

- dyestuff must be pre-dissolved with PERISOL BG and hot water
- guar gum or tamarind are normally used. Blends with starch ether or alginate are common to optimize levelness, dyestuff yield or washability
- urea is primarily used as an auxiliary for the dyestuff fixation
- for fixing the dyestuff ammonium sulphate as acid donor is used

- fixation:
  - saturated steam: 20 – 30 min at 100 – 103 °C
Printing of polyamide with acid or metal-complex dyes

- washing off:
  - rinse cold with 1 g/l PERLAVIN SRS
  - soap at 30 – 40 °C with 2 g/l PERLAVIN SRS at pH 9.5 – 10.0 (at least for 5 min)
  - soap at 40 – 50 °C with 2 g/l PERLAVIN SRS at pH 9.5 – 10.0 (at least for 5 min)
  - rinse cold
  - neutralise
## Printing of acrylic with basic dyes

### Recipe:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Units</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic dye</td>
<td>g/kg</td>
<td>x</td>
</tr>
<tr>
<td>PERISOL BG</td>
<td>g/kg</td>
<td>20 - 30</td>
</tr>
<tr>
<td>Acetic acid (30 %)</td>
<td>g/kg</td>
<td>20 - 30</td>
</tr>
<tr>
<td>Boiling hot demineralised water</td>
<td>g/kg</td>
<td>200 - 300</td>
</tr>
<tr>
<td>Formic acid</td>
<td>g/kg</td>
<td>10</td>
</tr>
<tr>
<td>PERIGEN EC</td>
<td>g/kg</td>
<td>20</td>
</tr>
<tr>
<td>PERIGUM .... (stock thickening)</td>
<td>g/kg</td>
<td>500</td>
</tr>
<tr>
<td>Balance (water/stock thickening)</td>
<td>g/kg</td>
<td>y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 g</td>
</tr>
</tbody>
</table>

Total: 1000 g
Printing of acrylic with basic dyes

- dyestuff must be pre-dissolved with PERISOL BG and hot water
- nonionic etherified, low molecular guar gum or tamarind are normally used. The addition of an anionic thickener may cause a levelling effect on the prints
- it is important that during the whole printing process the print is kept on an acid pH
- depending on the basic dye and the fixation conditions a fixation accelerator like PERIGEN EC could be added to increase the dye sorption
- fixation:  
  - saturated steam: 30 min at 100 – 103 °C
  - pressurized steam: 30 min at 1.2 – 1.5 bar
Printing of acrylic with basic dyes

- washing off:
  - rinse cold with 0.5 g/l soda ash
  - rinse cold with 0.5 g/l soda ash
  - soap at 30 – 40 °C with 0.5 g/l soda ash
    - 1 g/l sodium hydrosulphite
    - 1 g/l PERISOL RIO
  - soap at 50 – 60 °C with 0.5 g/l soda ash
    - 1 g/l sodium hydrosulphite
    - 1 g/l PERISOL RIO
  - rinse warm
  - rinse cold
  - neutralise
White discharge printing

Recipe for steaming with saturated steam:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>g/kg</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERIGUM T/9F stock thickener (8 %)</td>
<td></td>
<td>550</td>
</tr>
<tr>
<td>PERISTAL MC/P</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>water</td>
<td></td>
<td>350</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 g</td>
</tr>
</tbody>
</table>

Saturated steam conditions: 10 min at 100 – 103 °C
# White discharge printing

## Recipe for hot air curing:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERIGUM T/9F stock thickener (8 %)</td>
<td>510</td>
<td>g/kg</td>
</tr>
<tr>
<td>Urea</td>
<td>100</td>
<td>g/kg</td>
</tr>
<tr>
<td>Glycerol</td>
<td>40</td>
<td>g/kg</td>
</tr>
<tr>
<td>PERISTAL MC/P</td>
<td>100</td>
<td>g/kg</td>
</tr>
<tr>
<td>PERICOAT VA 110</td>
<td>150</td>
<td>g/kg</td>
</tr>
<tr>
<td>White pigment (e.g. Helizarin White RTN)</td>
<td>50</td>
<td>g/kg</td>
</tr>
<tr>
<td>Solution of diammonium phosphate (25 %)</td>
<td>10</td>
<td>g/kg</td>
</tr>
<tr>
<td>Balance (water/stock paste)</td>
<td>40</td>
<td>g/kg</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1000 g</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Hot air curing:**

5 min at 150 °C
White discharge printing

- dischargeable dyed basic fabrics are required
- tamarind gum is best suitable
- PERISTAL MC/P is a highly effective reductive agent
- for hot air curing additional additives are necessary:
  - urea and glycerol to achieve the desired humidity on the fabric
  - white pigment and pigment binder to attain a white discharge
Burn-out printing

Recipe:

<table>
<thead>
<tr>
<th>PERIPRINT BOP</th>
<th>g/kg</th>
<th>1000</th>
</tr>
</thead>
</table>

Drying: 110 – 120 °C
Curing: 160 – 170 °C
Rinse: cold
          warm
          hot
            warm
            cold
Neutralise
The above indications are based on the latest state of our knowledge. Due to different operational conditions and requirements these are guidelines only. A legally binding assurance cannot be drawn from our indications. Our technical staff will always be at your disposal to support you in testing our auxiliaries and to answer further technical questions.

05/2014

Sources of photographs:
- Anke Marburger, Alginate und Carrageenane – Eigenschaften, Gewinnung und Anwendungen in Schule und Hochschule
- J. Zimmer Maschinenbau GmbH
- Wikipedia