DR. PETRY
TEXTILE AUXILIARIES

Recent developments in printing

Introduction

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- 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

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- special printing effects
  - white discharge printing
  - burn-out printing of PET-velour

Pigment printing

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- 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

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Recipe:

PERICOAT VA 110	g/kg	120 - 200
PERIFOAM NSI NEW	g/kg	3
urea	g/kg	20
PERISOFT SE or PERISOFT MSN	g/kg	20
PERICOAT CROSSLINKER MV or PERILINK NF NEW	g/kg	20 - 30
pigment	g/kg	x
PERIPRINT TN/PF	g/kg	20 - 25
		1000

Pigment printing

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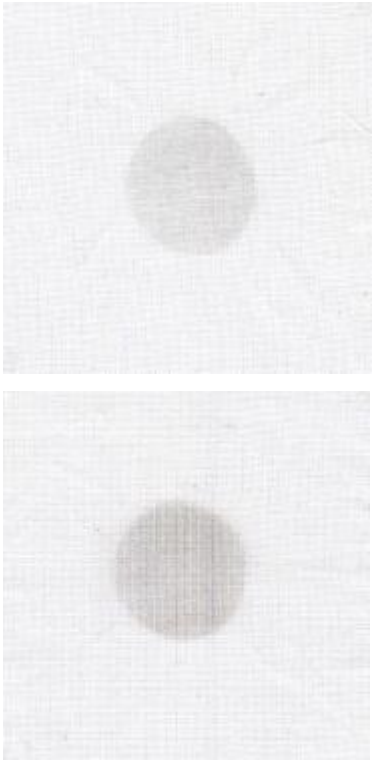
Fastness properties:

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



dry

wet

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

Natural thickeners

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- alginate
- guar gum
- tamarind
- starch ether

Natural thickeners

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- 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

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- 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

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

Alginate

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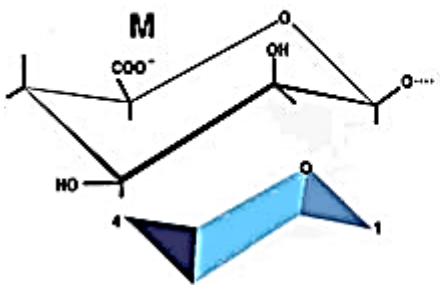
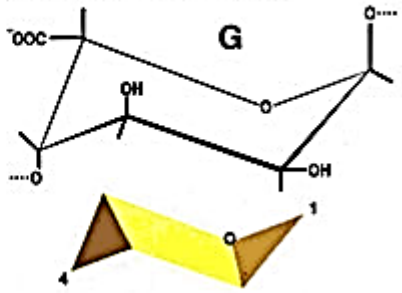
- obtained from brown algae
- composed of two types of uronic acids

β-(1-4)-D-Mannuronic Acid



α-(1-4)-L-Guluronic Acid



- 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

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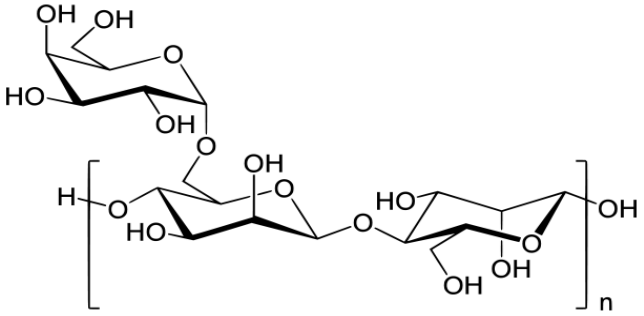
- galactomannan



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

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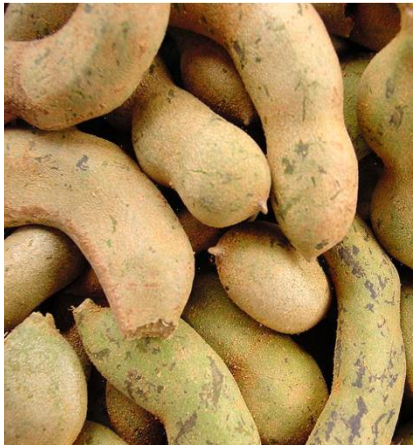
- heteropolysaccharide (D-galactose, D- glucose, D-xylose)
- structure not fully clarified yet
- obtained from tamarind seeds. The seeds are dehusked by a thermo-mechanical process subsequently sorted by hand and milled to produce tamarind gum



Starch ether

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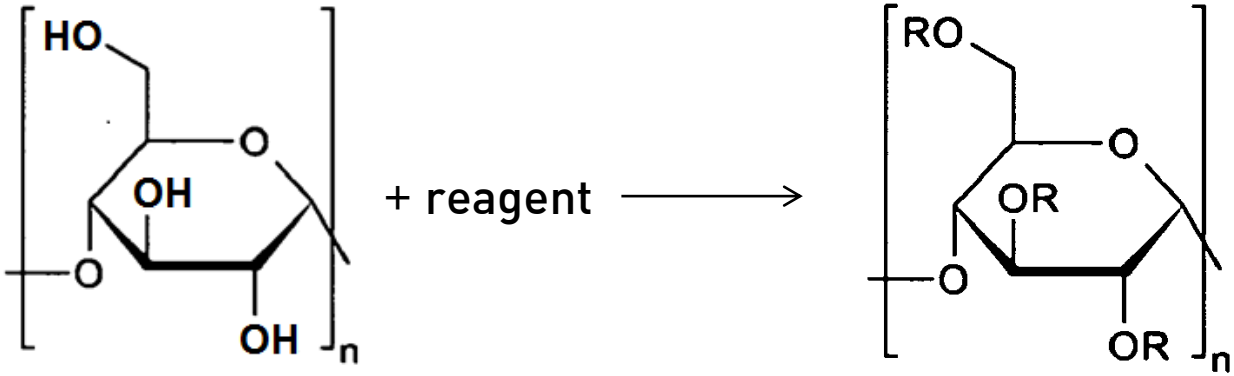
- obtained from e.g. corn, potatoes, wheat
- free hydroxyl groups are modified by introducing functional ether groups



- leads to distinct surface printing, high dyestuff yield and acuity
- no levelling properties
- often used in blends with other natural thickeners

Natural thickeners

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- depolymerisation leads from high viscous (high molecular) thickeners to of middle or low viscous thickeners
- due to depolymerisation higher quantities of thickeners a required

stock paste:

high molecular thickener:	2 – 4 %
middle molecular thickener:	4 – 8 %
low molecular thickener:	8 – 12 %

Natural thickeners

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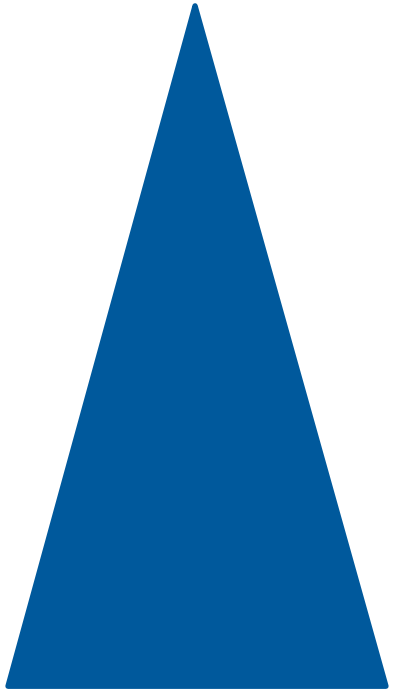
High molecular thickener

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



Low molecular thickener

Printing of cotton with reactive dyes

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Recipe (all-in method):

PERIGUM A ... (stock thickener)	g/kg	700
Sodium bicarbonate	g/kg	20
PERISTAL OX	g/kg	13
Urea	g/kg	100
Reactive dye	g/kg	x
Balance (water/stock thickener)	g/kg	y
		1000 g

Printing of cotton with reactive dyes

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- 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 bicarbonat 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

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- 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

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Recipe:

PERIGUM … (stock thickener)	g/kg	750
PERISTAL DC conc.	g/kg	pH 5 – 6
PERISTAL OX	g/kg	0 – 5
PERIGEN EC	g/kg	0 – 5
Disperse dye	g/kg	x
Balance (water/stock thickener)	g/kg	y
		1000 g

Printing of polyester with disperse dyes

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- 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

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- 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

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- 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

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Recipe:

Acid dye	g/kg	x
PERISOL BG	g/kg	20 – 50
Hot water	g/kg	y
PERIGUM ... (stock thickener)	g/kg	600
Urea	g/kg	50
Ammonium sulphate (33%)	g/kg	30 – 60
PERIFOAM NSI NEW	g/kg	0.5 – 2
		1000 g

Printing of polyamide with acid or metal-complex dyes

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- 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

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- 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

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Recipe:

Basic dye	g/kg	x
PERISOL BG	g/kg	20 – 30
Acetic acid (30 %)	g/kg	20 - 30
Boiling hot demineralised water	g/kg	200 - 300
Formic acid	g/kg	10
PERIGEN EC	g/kg	20
PERIGUM .... (stock thickening)	g/kg	500
Balance (water/stock thickening)	g/kg	y
		1000 g

Printing of acrylic with basic dyes

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- 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

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- 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

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Recipe for steaming with saturated steam:

PERIGUM T/9F stock thickener (8 %)	g/kg	550
PERISTAL MC/P	g/kg	100
water	g/kg	350
		1000 g

Saturated steam conditions:

10 min at 100 – 103 °C

White discharge printing

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Recipe for hot air curing:

PERIGUM T/9F stock thickener (8 %)	g/kg	510
Urea	g/kg	100
Glycerol	g/kg	40
PERISTAL MC/P	g/kg	100
PERICOAT VA 110	g/kg	150
White pigment (e.g. Helizarin White RTN)	g/kg	50
Solution of diammonium phosphate (25 %)	g/kg	10
Balance (water/stock paste)	g/kg	40
		1000 g

Hot air curing:

5 min at 150 °C

White discharge printing

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- 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

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Recipe:

PERIPRINT BOP	g/kg	1000

Drying: 110 – 120 °C

Curing: 160 – 170 °C

Rinse: cold
warm
hot
warm
cold

Neutralise

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Sources of photographs:

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- J. Zimmer Maschinenbau GmbH
- Wikipedia