

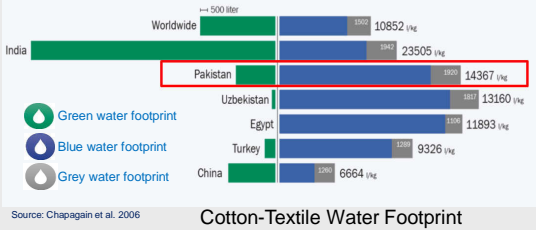
Reducing the Water Footprint of the Cotton-Textile Industry in Pakistan: Application of Advanced Dyeing Chemicals, Technologies and Efficient Wastewater Treatments

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Introduction

German demand of cotton-textile products is responsible for substantial water consumption and wastewater effluents in Pakistan.

Within this collaborative project InoCottonGROW Pakistani and German research and industry partners intend to contribute to sustainable water resources management in Pakistan by implementing various case studies and demonstration projects. Here different approaches are shown to reduce water consumption and effluents along the cotton-textile value chain by the use of efficient process chemicals, advanced technologies and suitable wastewater treatment methods in textile dyeing processes.



Course of Industrial Reactive Dyeing Processes

	TRIAL	P0	P1	P2	P3	P4
Recipe/Auxiliaries	STANDARD	STANDARD (imitated)	1st Improvement	2nd Improvement	3rd Improvement	
Liquor ratio	1:6	1:6	1:5	1:5	1:6	
Baths (A-C)	Three	Three	Three	Three	ONE	
A Bleaching				Without Bleaching	Without Bleaching	
A Pre-treatment						
B Neutralisation						
C Dye-Process						
D/E Neutralisation	Neutralisation	Neutralisation	Neutralisation	Soaping	Soaping	Soaping
E/D Soaping	Soaping	Soaping	Soaping	Neutralisation	Neutralisation	Neutralisation
F Fixing bath & softener						

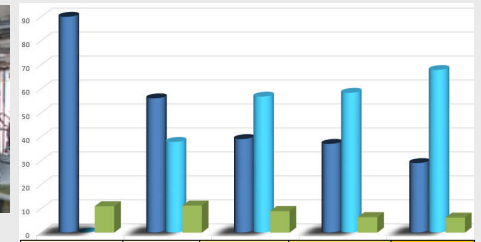
- Trial P0: project partner STYLE TEXTILE (Lahore/Pakistan)
- Trials P1 - P4: project partners THIES Textilmaschinen and CHT (chemicals)
- Fabric: 100 % cotton single jersey
- Technique: jet dyeing
- Dye colour: BLACK



Results of Industrial Reactive Dyeing Processes



Source: <http://www.styletextile.com>



- Water use: reduction > 50 l/kg and more appear possible
- Water saving: > 55 % and more appear possible
- Process time: reduction > 40 % (as side effect)

Test Methods for the Comparability of Dyeing Results

Trial	Colourimetry				Colour Fastness			
	ΔE	Lightness	Saturation	Hue	Strength of colour (%)	Perspiration ff DIN EN ISO 105-E04 (grade)	Domestic & commercial laundering ff EN ISO 105-C06: 2010-A1M (grade)	Rubbing ff EN ISO 105-X12:2016 (grade)
P1	1,49	darker	less saturated	greener	104,7	5	5(5-4)	4-5 2
P2	3,15	darker	less saturated	redder	138,97	5	5	4-5 1-2
P3	2,68	darker	less saturated	greener	132,88	5	5	5 1-2
P4	1,31	darker	more saturated	redder	101,32	5	5	4-5 1-2

Using colourimetric methods:

- difference in colour (ΔE value, CMC/D65) to defined standard trial P0
- comparison of colour in lightness, saturation, hue and strength

Using colour fastness tests:

- industrial quality management and controlling tool

➡ Due to a ΔE > 1, differences in lightness, saturation, hue, strength of colour, dyeing trials are not equal to black colour of trial P0

Next Steps in InoCottonGROW

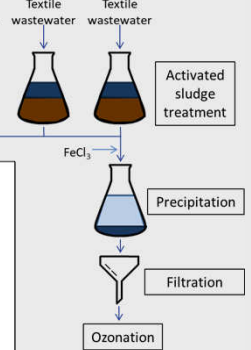
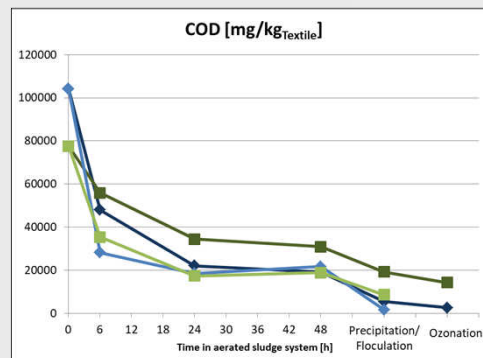
Onsite trials: The optimized processes will be demonstrated on full-scale dyeing machines at STYLE TEXTILE to proof their water- and energy saving potential.

Wastewater treatment: Two wastewater treatment pilot plants will be operated at textile mills in Pakistan to demonstrate efficient and cost-effective technologies to reduce wastewater emissions.

Water footprint: The gathered data will be added to the InoCottonGROW database and thereby help to calculate the water footprint of the Pakistani textile industry.



Laboratory-Scale Wastewater Treatment



- Measured parameters:
- Conductivity, pH
 - COD, BOD₅
 - NH₄-N, NO₃-N, TNb
 - PO₄-P,
 - SAK₄₃₆,
 - TOC and DOC

- ◆ Wastewater from trial P1
- ◆ Wastewater from trial P2 (optimized process)
- ◆ Wastewater from trial P1 mixed with municipal wastewater (50/50 Vol%)
- ◆ Wastewater from trial P2 mixed with municipal wastewater (50/50 Vol%)

Results: The experiments suggest that implementing the optimized process in a textile finishing plant will only improve wastewater emissions in cases where no wastewater treatment plant is in operation (most Pakistani finishing plants). At plants with operating wastewater treatment, the measured parameters suggest no improvements or even higher emissions in the optimized than in the standard process for producing the same amount of textiles.

Acknowledgement

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