

Sustainability in commercial laundering processes

Module 3 **Washing process**

Chapter 2

Washing process in washer extractors

- Domain of washer extractors
- Kinds of processes
- Design of process
- Efficiency effects
- Reduction of water consumption

Learning targets

After finishing this chapter, you will

- know the domain of washer extractors
- know and be able to differentiate different kinds of washing and cleaning processes
- know the requirements of wet-clean
- be able to differentiate between wet-cleaning and dry-cleaning and know when to apply which kind of process
- know, recognize and be able to name effects on wash program design
- know, recognize and be able to name efficiency effects

Learning targets

- know, recognize and be able to explain important factors to reduce water consumption
- know the possibilities to modify washing and rinsing phases
- know the function of water recovery systems
- know and be able to explain the cascade principle

Domain of washer extractors

- Re-wash of laundry



- Wash of heavily soiled laundry



- Wash of textiles with bleeding colours



Domain of washer extractors



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- Small batches



- Treatment of high quality workwear



Domain of washer extractors

- Infectious laundry
 - Registered machine according to RKI



- Wash of cleanroom laundry



- Wash of medical devices



Domain of washer extractors

- Sensitive laundry: wool blankets, curtains



- Special laundry items (e.g. mattresses)



- Wet clean



Kinds of cleaning process

- Washing
 - Laundering in water with established methods with common usage of temperature, mechanical agitation and detergents

- Dry cleaning
 - Treatment in non-polar-solvents in special machines with adapted programs and detergents

- Wet cleaning
 - Washing of sensitive outerwear with adapted programs (low temperature, low mechanical agitation and adapted detergents)
 - Synonyms for wet-clean: Aquaclean, Aquatex, Permac etc.



- Textiles
 - Fibre substrate
 - Textile construction
 - Colouration, print and special treatments
 - Quality of making up

- Soil
 - Kind and amount

Effects on wash program design

- Water quality

- Detergent/disinfection

- Request on performance
 - Spot free
 - Hygienic clean

Design of washing program

Program steps

- Pre wash
- Main wash
- Rinse with intermediate spin
- Neutralisation, Addition of Aids (starch, textile softener, acid)
- Final spin

Aims of pre washing

- Rapid wetting of laundry
- Swelling of soil
- Removal of heavy soil from the laundry
- Dissolving and swelling of spots

Pre wash parameters



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- Duration
approx. 8 - 12 min
- Temperature
depends on amount and kind of soil
blood 20 – 25 °C (> 30°C denaturation/fixing of proteins)
fat/oil 50 – 60 °C (> 50°C good soil removal)
- Detergents
50 – 70 % of total amount
reuse of rinse water increases detergent concentration
residues of peroxide cause denaturation/fixing of blood
- Drain
in sewage

Aims of main wash

- Removal of remaining soil
- Removal of oxidative spots
- Disinfection (thermal) at temperature $> 85\text{ }^{\circ}\text{C}$
- Disinfection (chemical) at $40\text{ }^{\circ}\text{C}$
(depends on disinfectant)
- Increase of textile whiteness

Main wash parameters

- Duration
 - approx. 10 – 15 min at temperature level

- Temperature
 - adapted to washing process and amount and kind of soil
e.g. thermal disinfection
 - 10 min at 90 °C or
 - 15 min at 85 °C

- Drain
 - in sewage

Aims of rinse

- Removal of soil residues
- Removal of detergent residues
(surfactants, alkali and bleaching agents)

Rinse

- Duration (total) approx. 8 – 12 min
- Temperature approx. 60 – 25 °C (without heating), depends on main wash temperature
- Drain in storage tanks
- Inactivation of bleach agents is needed if extracted water is reused

Neutralisation

- In last rinse
- Reduction of textile pH-value for the purpose of preventing yellowing effect during drying or ironing process
- Duration approx. 2 – 4 min
- Temperature approx. 20 – 25 °C
- Formic or acetic acid in last rinse recommended pH-values

flatwork	6,0-6,5
fully dried laundry	6,0-6,5
garments for tunnel finisher, flat press	5,5-6,5

Spin



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- Mechanical dewatering by centrifugal force
 - g - factor up to 600
 - 5 - 10 min
- Water content of laundry depends on type of fabrics, drum, number of revolution (rpm), duration, temperature of laundry
- Intermediate spin
 - between rinsing baths
 - minimisation of carry over effects of detergent residues in next rinse bath
- **Problematic:** wrinkling of PES/CO textiles at temperatures $> 40\text{ }^{\circ}\text{C}$,
high rpm and/or spin duration

Water saving possibilities: recovery system

- Usage of storage tanks
 - Use of water from last in first rinse
 - Use of water from rinsing in pre- and main wash
 - Last rinse with fresh water quality only
- Savings
 - Water up to 40 %
 - Steam up to 45 %
 - Detergents up to 30 %
- Environmentally friendly
- Economical
 - Quick return on investments



Water saving possibilities: Cascade principle

Hotel linen

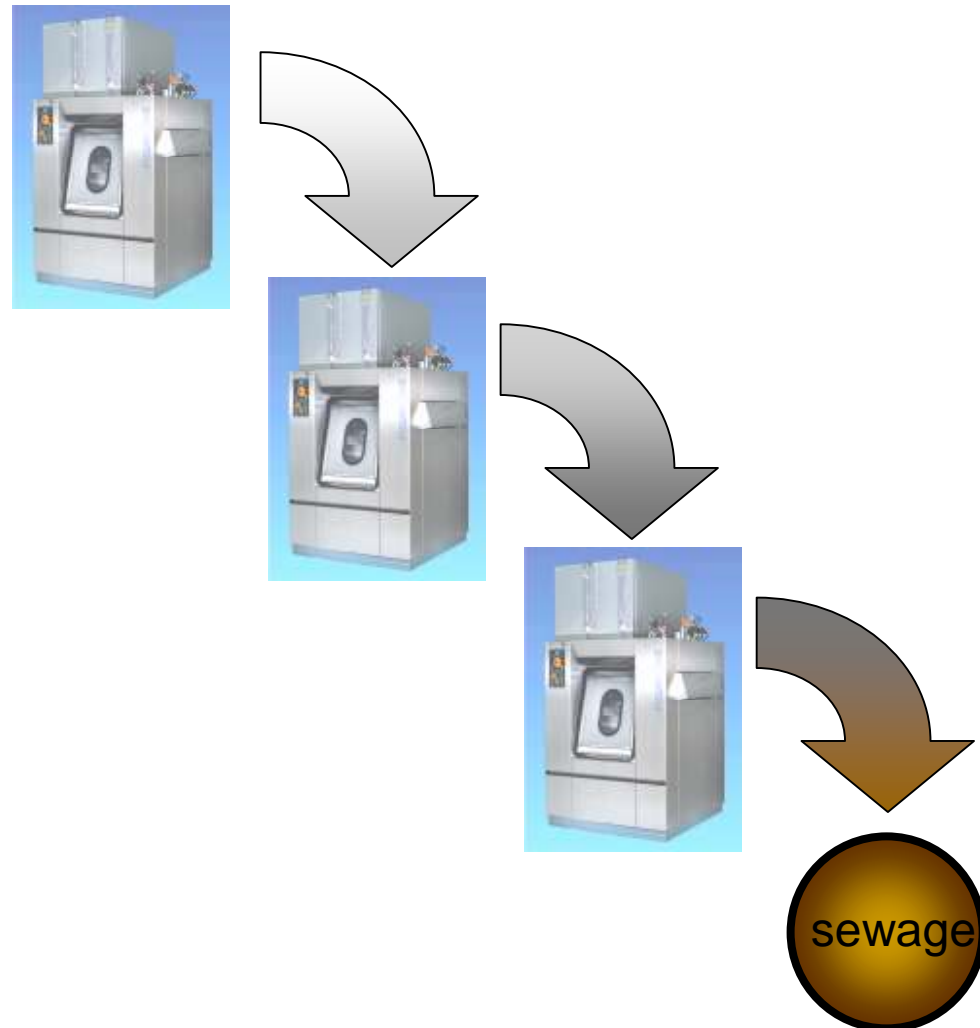
- Hygienic sensitive laundry
- High demands on quality
- Low soiled

Work wear

- Hygienically non sensitive wear only
- Average demands on quality

Wiping cloths, mops etc.

- Hygienically non sensitive Laundry only
- Low demands on quality



- Low friction between textiles among each other and between textiles and drum

- Low mechanical agitation of laundry
 - No intensive falling movement of laundry
 - Decreased movement in washing liquor

- Usage of adapted detergents to guarantee wash performance
 - Compensation of low mechanics by more efficient detergents, see Sinner`s circle
 - Protection of wool fibres against felting and shrinkage

Requirements for wet-clean

Demands on machinery

- Big drum volume (more than 120 L)

- Possibility of free program design
 - Rotation speed
 - Reversing
 - Washing liquor level

- Exact control of temperature (30 – 35 °C)

Wet-cleaning effects vs. dry-cleaning effects








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	Dry-cleaning	Wet cleaning
Soil	2	2.5
Sweat	5	1
Spots	3	2
Greying	3	2
Shrinkage	2.5	2.5
Odour	4	1

1 = very good **5** = insufficient

Textile care labelling – wet clean

	— do not dry clean
	— professional wet cleaning — normal process
	— professional wet cleaning — mild process
	— professional wet cleaning — very mild process
	— do not wet clean

ISO/DIS 3758

Wet-cleanable textiles



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1. Coats, trousers, jackets
2. Sport and water repellent textiles
3. Pullover (e. g. wool, angora, etc.)
4. Silk and viscose textiles
5. Cotton textiles with non solvent
6. Compatible colourations or prints
7. Evening wear
8. Blankets, curtains
9. Quilts filled with wool, down or feathers
10. Bathroom mats