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Sustainability in commercial laundering processes

Module 5

Energy in laundries

Chapter 3

Energy saving possibilities - overview

Content

- Introduction
- Influence parameters on energy consumption
- Energy consumption determining properties
- Measures for energy saving
  - Definitions, sequence
  - Organizatorial
  - Technical
  - Technological

Learning targets

After finishing this chapter, you will

- Know the technical processes in laundry
- Know, where within processes energy saving potentials are
- Be able to name energy saving measures and know how to apply in practice
- Be able to differentiate between organizatorial, technical and technological measures and be able to choose the best (economical) sequence for application in practice
- Know how to adopt factors temperature, mechanics, chemistry at their best

Introduction

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- Energy costs in laundry share in total costs about 10%
- Main part is to generate heating energy
- Thus, effective application of heating energy is particularly important
- Following laundry processes need heating energy
  - Washing
  - Drying
  - Mangling
  - Ironing/Pressing/Finishing

Influence parameters on energy consumption

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- Kind and composition of laundry determines water and energy consumption
- Example for composition of hospital laundry
  - ca. 70 – 80 % for mangling
  - ca. 12 –20 % for drying (e.g. terry cloth)
  - ca. 8 –12 % flat work

Measures for energy saving
- definitions

- **Organizatorial measures**
  how to carry out order processing and work processes, respectively

- **Technical measures**
  measures that influence technical processes which are at the same time measures that can be influenced in practice (e.g. washing program)

- **Technological measures**
  measures in construction of machinery, no possibility to influence in laundry practice

Measures
sequence

- Measures shall be introduced according to the sequence on chart no 6
- measures of next level shall not be applied before measures of one level (e.g. the first level, organizatorial measures) are exhausted
- Technical and financial expenditures arise from step to step
- A new machine with technical and technological features maybe can`t improve effectiveness, if there is possibility of improvement in work organization
- But if technical out-dated machinery is applied, optimization of work organization is not enough. Example:
  - Costs caused by waste heat won`t be compensated by optimised work organisation

Measures
- organizatorial

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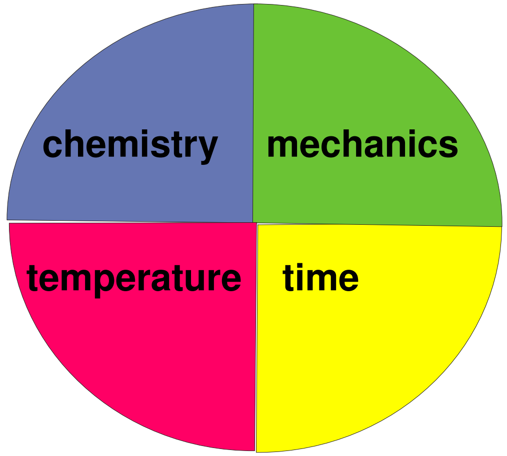
- Sorting of textiles
  (cotton, linen, coloureds, wool) and
- Intelligent combination of washing programmes

  - ⇨ Temperatures/energy demand for heating
  - ⇨ Time for the washing cycles
  - ⇨ Time for loading and unloading
  - ⇨ Exhaustion of machine load
  - ⇨ Avoid overload (check weight), high rejects otherwise
    Consequence: new washing cycle which means a waste of money and time

Measures
organizatorial

- Work processes shall be organized in a way that steam generator can deliver constantly
- Steam consumption shall be continuously all over the day
- Avoidance of “steam spikes”
    - Shifted start of machines

Measures
- technical



- Determination of technical measures means to influence the parameters of Sinner`s Circle
- Factor temperature causes highest energy demand
- It can be minimised by

a) Other adjustment of Sinner factors

- Low temperature washing (more chemistry, more mechanics)
- Reduction of liquor ratio (higher mechanics)
- Optimization of washing times (prolonged time)

b) Optimisation of heat generation

- Re-usage of waste heat

Heat flow volume **Q**

Heating process of washing liquor depends on the following

$$Q \sim K, m_W, T_{max}, t$$

K : heat wastages

m_W : liquor volume

T_{max} : max. liquor temperature

t : washing time

Factors to be influenced to optimize washing process

Optimization of steam generation

By ensuring the following:

- High efficiency (constantly monitoring of CO_2 – concentration)
  - Management systems (also see 6-7)
- Optimal burner-adjustment
  (soiled heating surfaces decrease heating efficiency)
- Thorough deaeration of heat exchangers
- Functionality check of all steam traps
- Re-usage of condensate
- Installation free from leakages
- Isolation of steam pipes (to avoid waste heat)

Measures
- technical

Application of low-pressure steam (2 to 4 bars)

- Economical more efficiently than high-pressure steam (10 to 16 bars)
- application possible for heating of water for steam for finisher process only
- BUT: Mangling and drying require high-pressure steam or gas (also see module 5-5)

Measures
- technical

Effects of heat exchangers

- Re-usage of heat flow volume Q
- Minimisation of waste heat

Heat reclaiming possible due to

- Waste water of washing process
  (see water recycling, module 1, module 6)
- Waste heat of drying process (also see 5-5)
- Waste heat of finishing and mangling

Re-usage of washing liquor

Saving of water **and** saving of energy

Heat flow volume Q

- Nowadays common process design in tunnel washers
- Application also possible in washer extractors
  - Rinsing baths collected in tanks
  - Application of gathered rinsing liquor in next pre- or main wash
  - Pumping of liquor by exploitation of height differences into machines

Re-usage of washing liquor

- problems-

- Storage demand for tanks
- Technological complex, e.g. pumps, valves
- Isolation of tanks necessary
- Lint generation (filter systems shall avoid carry-over into next compartment)
- Particularly problematic if there will be linen/white laundry after coloureds
    - Even if filter systems are applied, this sequence shall be avoided

Lower temperature of wash liquor (Low temperature washing)
(Increased mechanics and/or chemistry necessary)

- Heating energy can be saved
- Adapted detergents necessary (special ingredients such as PAP)
- Higher prices of those special detergents
- Washing efficiency as like as optimal action of chemicals may be decreased
- Application of low-temperature process shall be individually adapted for each laundry
- Comprising explanations about the low-temperature washing process see 3-4

Measures
- technical

Reduction of liquor ratio at increased mechanics

- In practice often too high liquor ratios
  reasons why:
  - Defective measuring and controlling devices
  - Process controlling "by hand"
  - No consideration of load

- Low liquor ratios enable energy savings without decreased washing efficiency
  exceptions:
  - Blended fibres
  - Mechanically sensitive textiles (wool)
  - Heavily soiled textiles, incontinence goods
  - PES/CO blended fibres tend to crumple

Optimization of washing times

- Optimisation of time also leads to energy saving
- Processes with shorter residence times
  - Higher temperatures
  - Higher machine power/mechanical agitation
- BUT:
  - Washing efficiency may decrease

Measures
- technological

Technological measures are measures that are determined by machine construction, e.g.
Optimization of mechanics by

- Adequate dimensioning and form of paddles (also see module 2)
- Adjustment of revolutions per minute to achieve g-factors of about 0,7 g (also see module 3)
- Rotating drum revolutions instead of oscillating
- Reverse rhythms
  - Longer running times/shorter idle times (e.g. running times 12s, idle time 2s) cause more intensive mechanics than short running times/long idle times (gentle wash)
- Low liquor ratios

Measures
- technological

- One bath
  - Without pre-wash and/or wetting
- 60°C – washing process
  - Alternation of thermal disinfection by chemical-thermal (also se module 3)
- Intermediate spin
  - High number of revolutions per minute between rinsing baths
  - Heating energy demand for drying will decrease
  - Demand of rinsing water will decrease
- Reduce residual moisture
  - By higher dewatering power
  - Also see chapter 4

Measures
- technological

Optimisation of energy consumption – drying

- Adapted air circulation
  - Low waste air
  - Fresh air/recycled air
  - Circulation through textiles (crosswise)
- Adapted controlling of drying time
  - Controlling by time (disadvantageous, because in practice mostly over-drying)
  - Controlling by moisture (measurements of temperature difference in waste heat)
  - IR textile- and surface temperature measurements
- Gas heating