Latest learning of factors influencing the accuracy of testing alkalinity in washing processes

by
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Including tests and learning done by
IEC SC59D
CENELEC TC59X, WG1
Nordic Ringtest
and inputs from many experts and laboratories

agenda

- definition
- problem (history)
- influencing factors
- relevance of factors
- status today

rinsing - definition

- to do a washing process a detergent is used which is containing chemical or biological active substances
- at the end of the washing process, the textiles should contain as less as possible of these chemical and biological substances
- rinsing is the process of elimination of these chemical and biological substances

- rinsing is also needed to remove the loosened soils out of the fibers

consequences

- to measure rinsing performance one has to measure the elimination (dilution) of these substances which are used in the wash
- if this is not possible, equivalent measures may be used to assess the dilution process
- from a principle point of view following type of substances may be differentiated due to their dilution properties:
  - soluble
  - un-soluble
  - surface active

dilution of soluble: alkalinity method

- alkalinity is a relevant part in the washing process for supporting soil release. It is provided by most detergent.
- alkalinity is a tracer for the dilution of soluble parts of the detergent (and soil) by the rinsing process
- is affected by all parts of the process (machine, load, water, measurement procedure, etc)
- has shown in the past (3rd edition of IEC 60456) a sufficient level of repeatability but high levels of variation between laboratories (reproducibility).
- IEC SC59D - WG 18 (uncertainty) has incorporated relevant refinements of the measurement process to reduce uncertainties into the 5th edition.
- may need to be further optimized to eliminate ambiguities in the process and differences in handling of the test

evaluation of rinsing performance (IEC60456)

The increased alkalinity concentration of spin-extracted water relative to tap water is calculated as:

$$A_r = W_r - W_t$$

Where

A_r **is the increased concentration of alkalinity in extracted water**

W_r is the concentration of alkalinity in extracted water

W_t is the concentration of alkalinity in tap water.

The amount of alkalinity remaining in the textiles **in milliequivalents per kg of base load** is calculated by:

$$A_m = A_r \frac{M_r - M}{M}$$

Where

A_m**is the amount of wash alkali remaining in the textiles;**

A_r is the increased concentration of alkalinity in extracted water;

M is the mass of the **conditioned base load**;

M_r is the mass of **base load** after the completed wash programme.

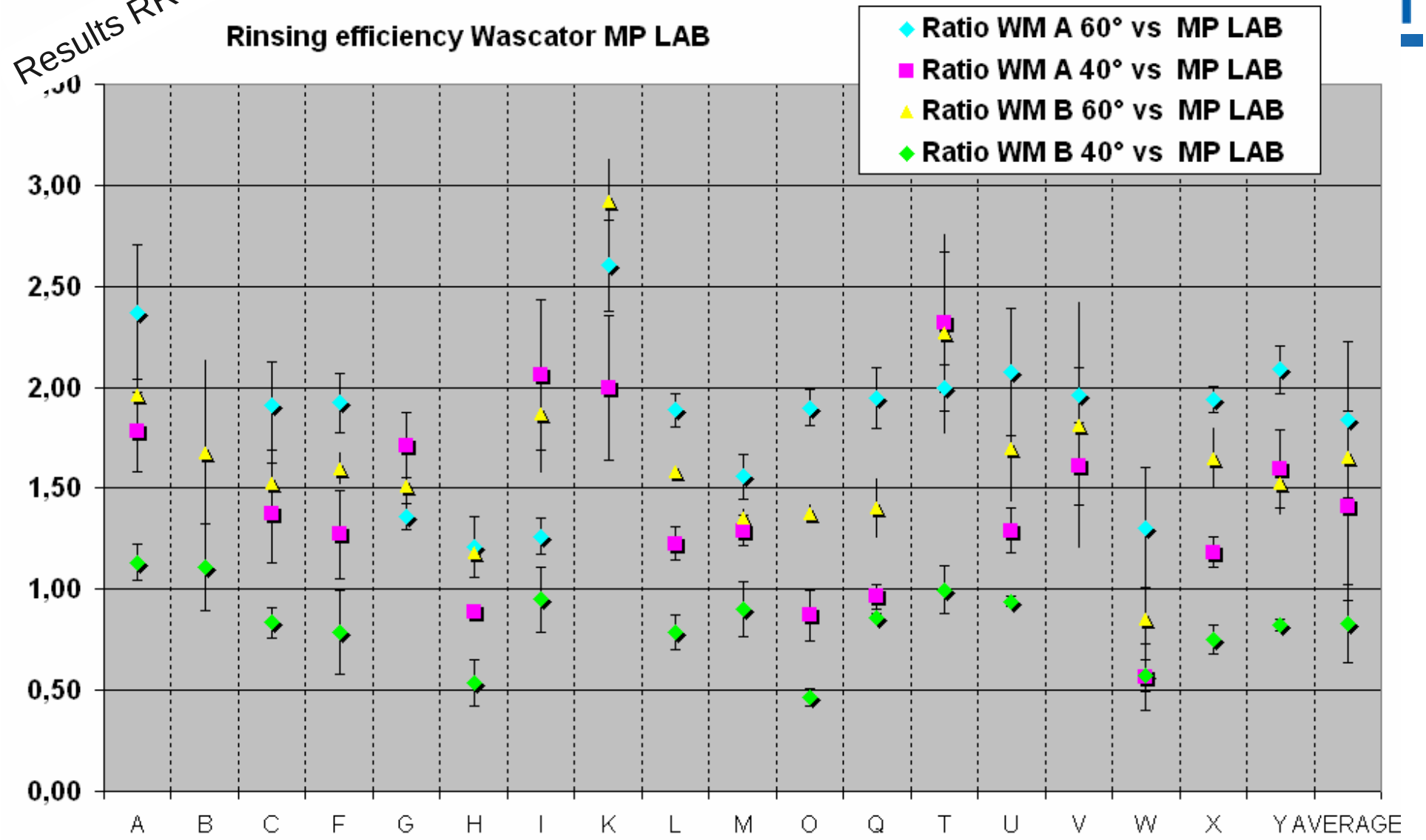
The rinsing index, R, is determined by:

$$R = \frac{A_{m,test}}{A_{m,ref}}$$

where

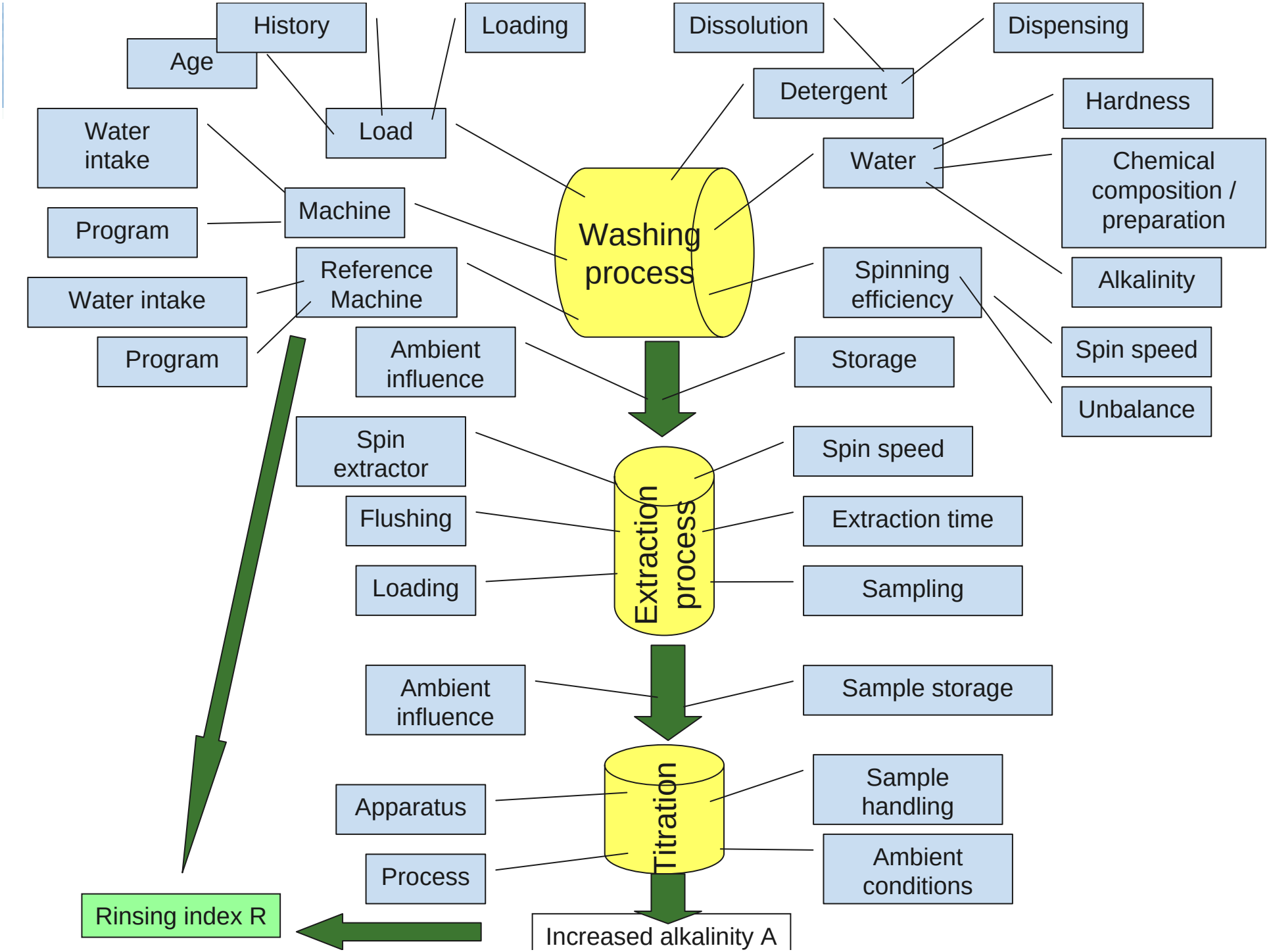
A_m,test is measured in the **washing machine** under test;

A_m,ref is measured in the reference **washing machine**



→ Expectation is that the order of treatment 1 to 4 is the same in all labs
→ Ratio WM A 60° should be the worst (43litres) - Ratio WM B 40° should be the best (79litres)

Rinsing
Influencing parameters


History
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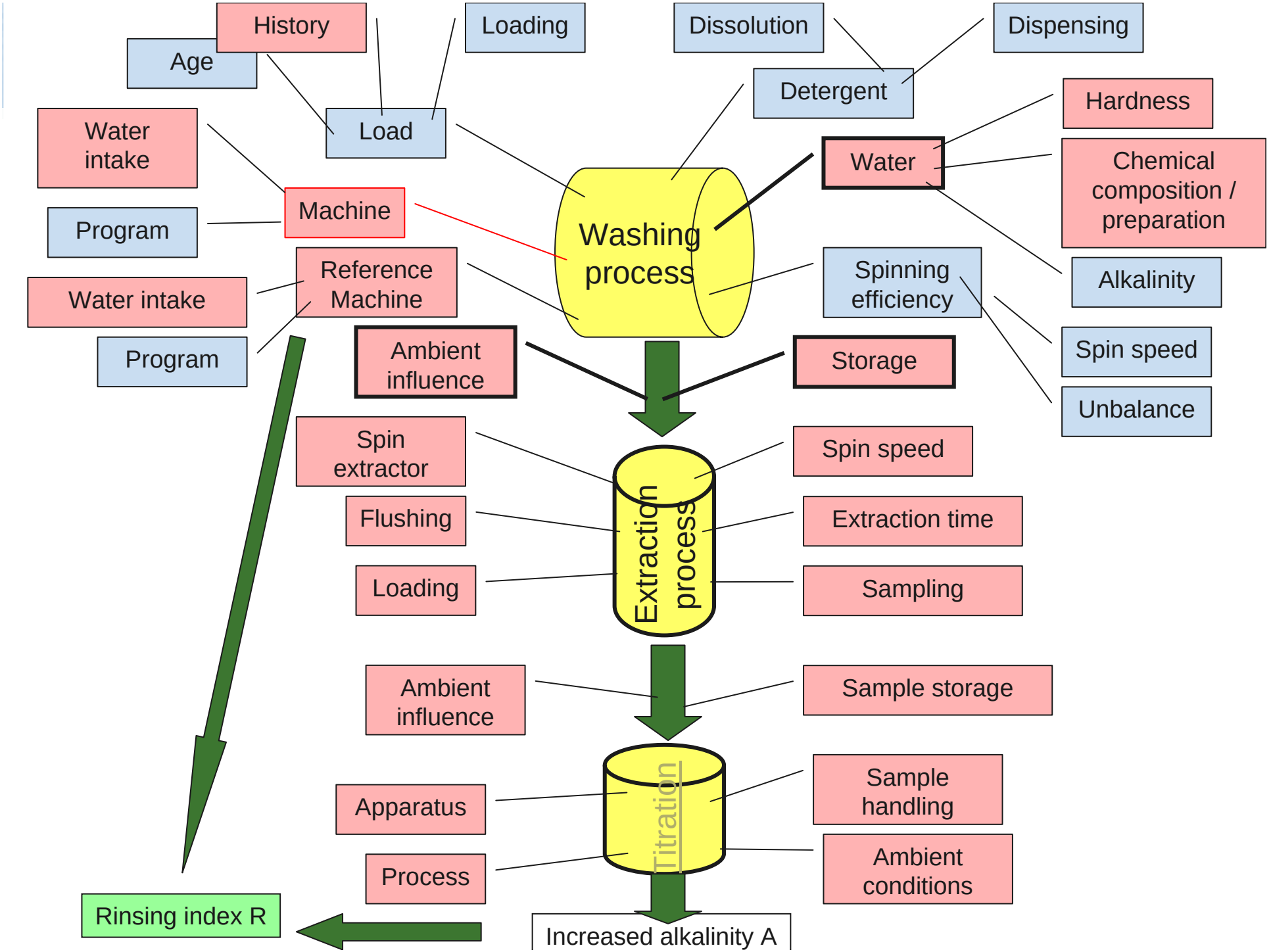
Increased alkalinity A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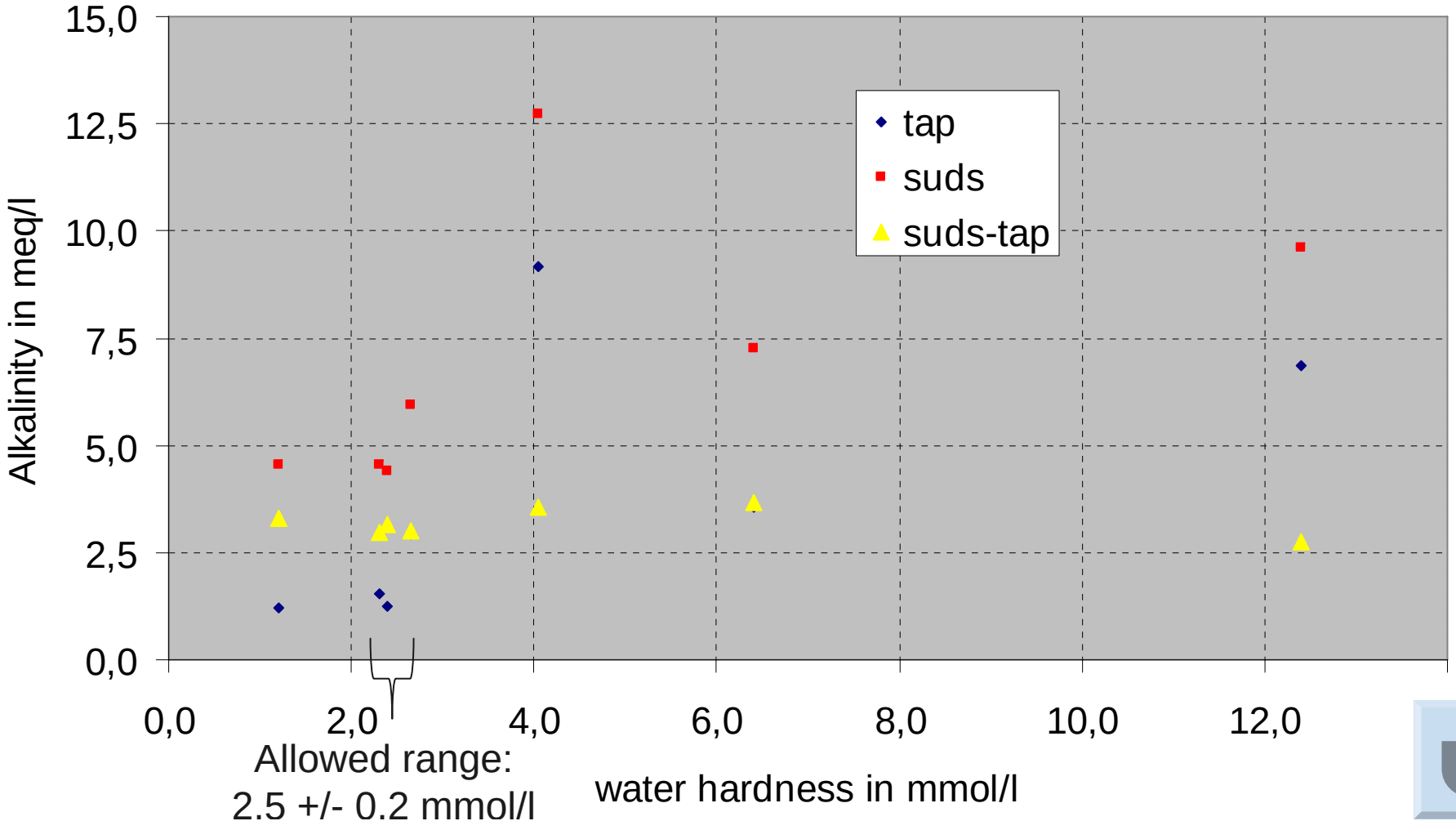
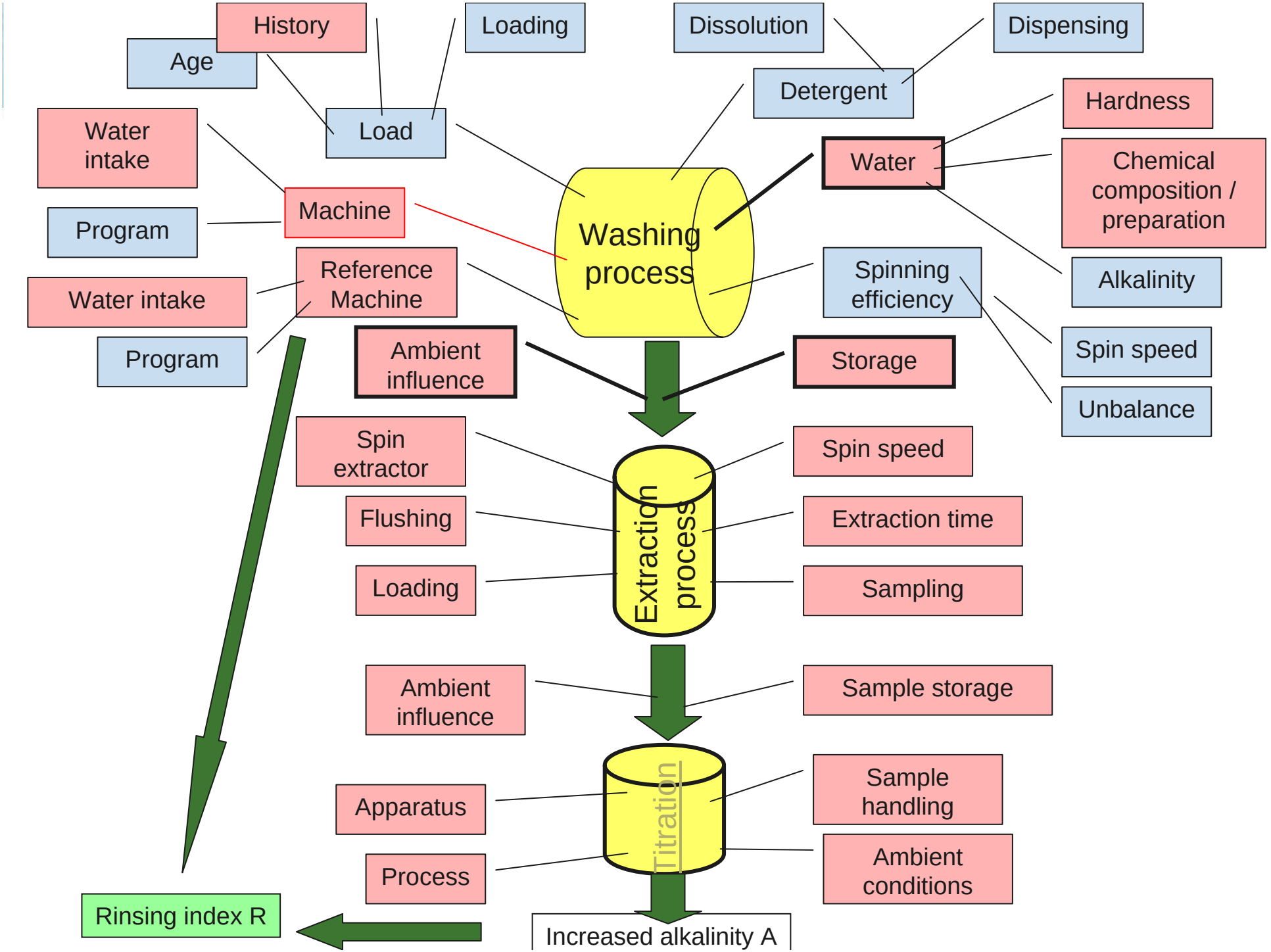
influence of water hardness and preparation

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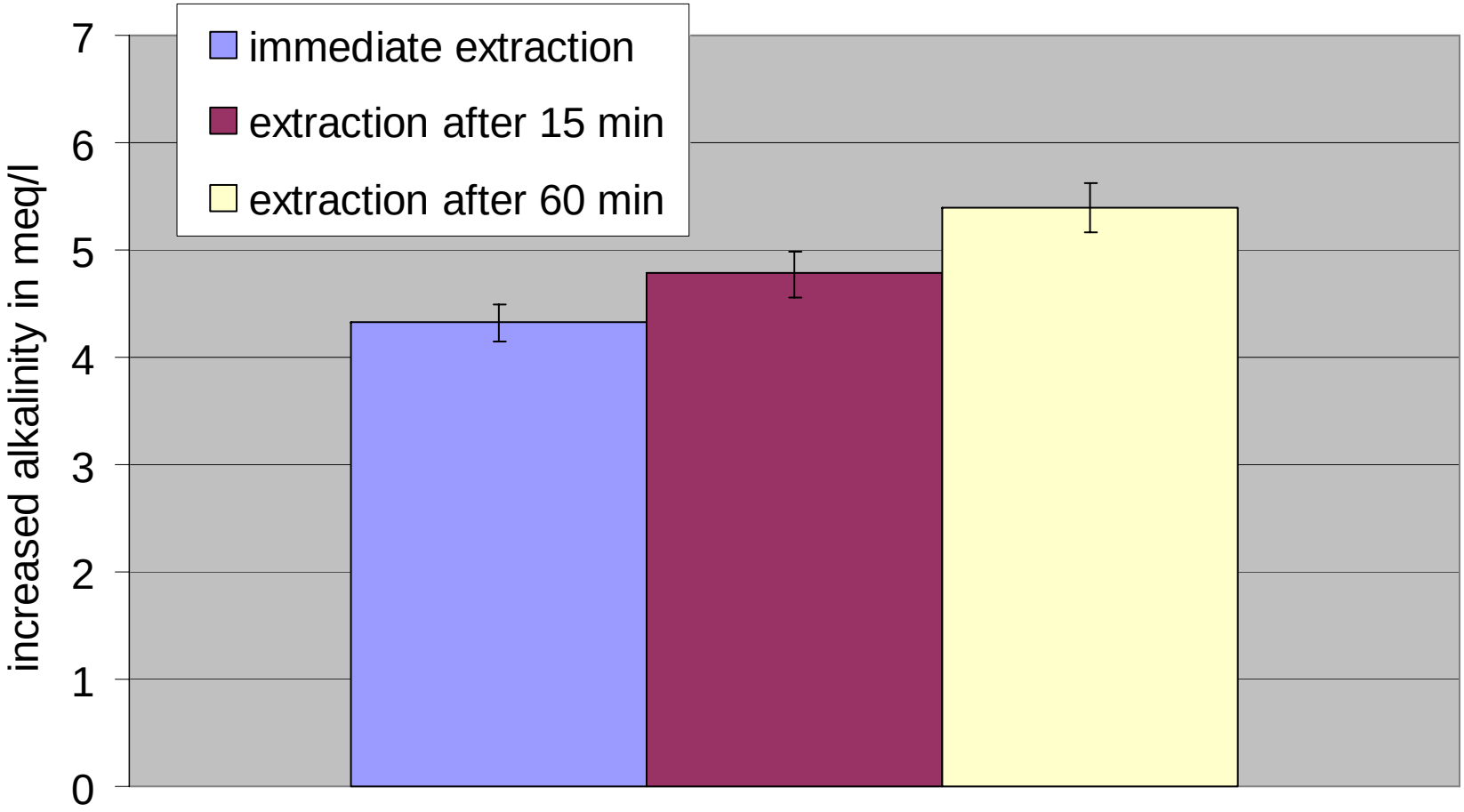
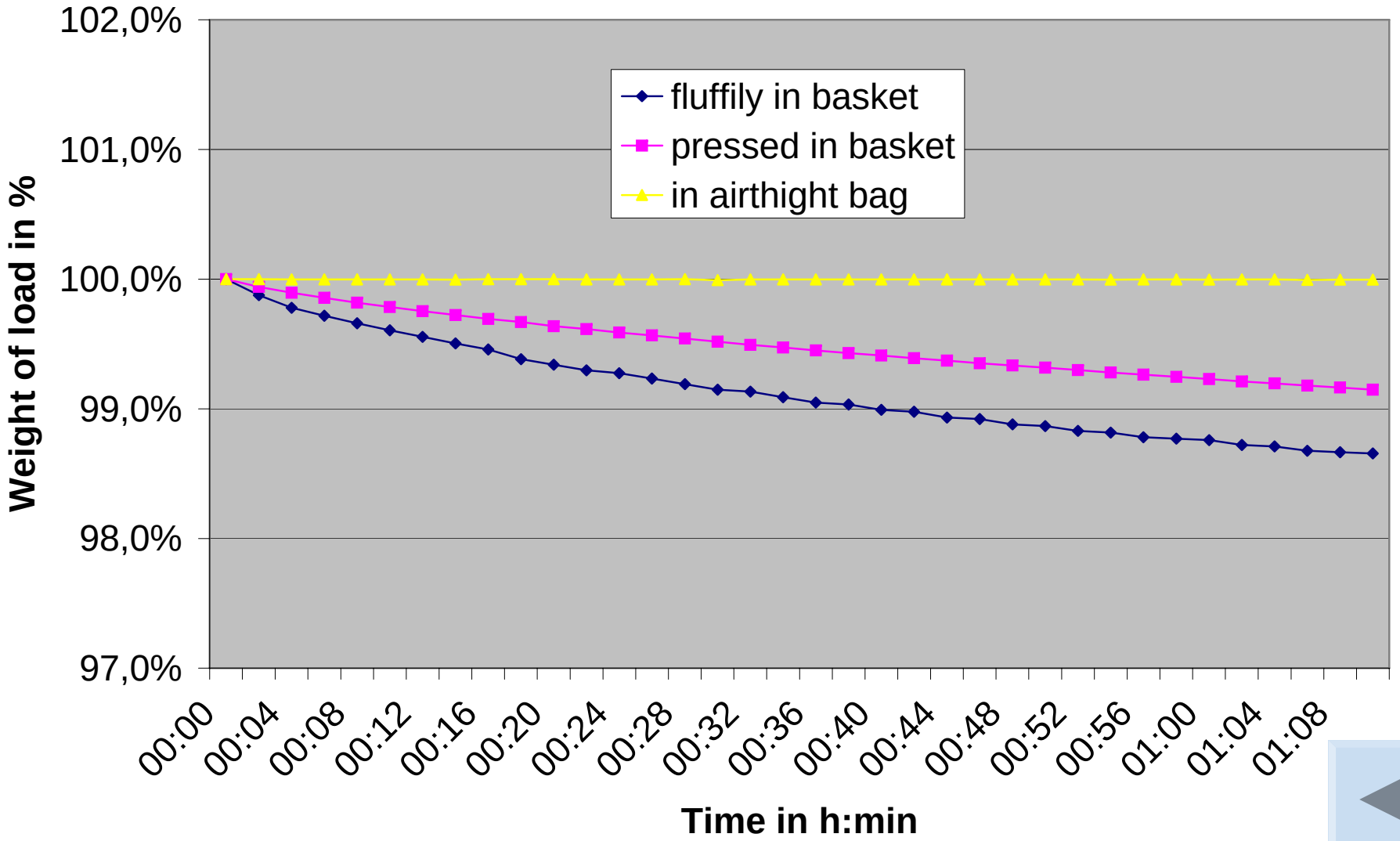
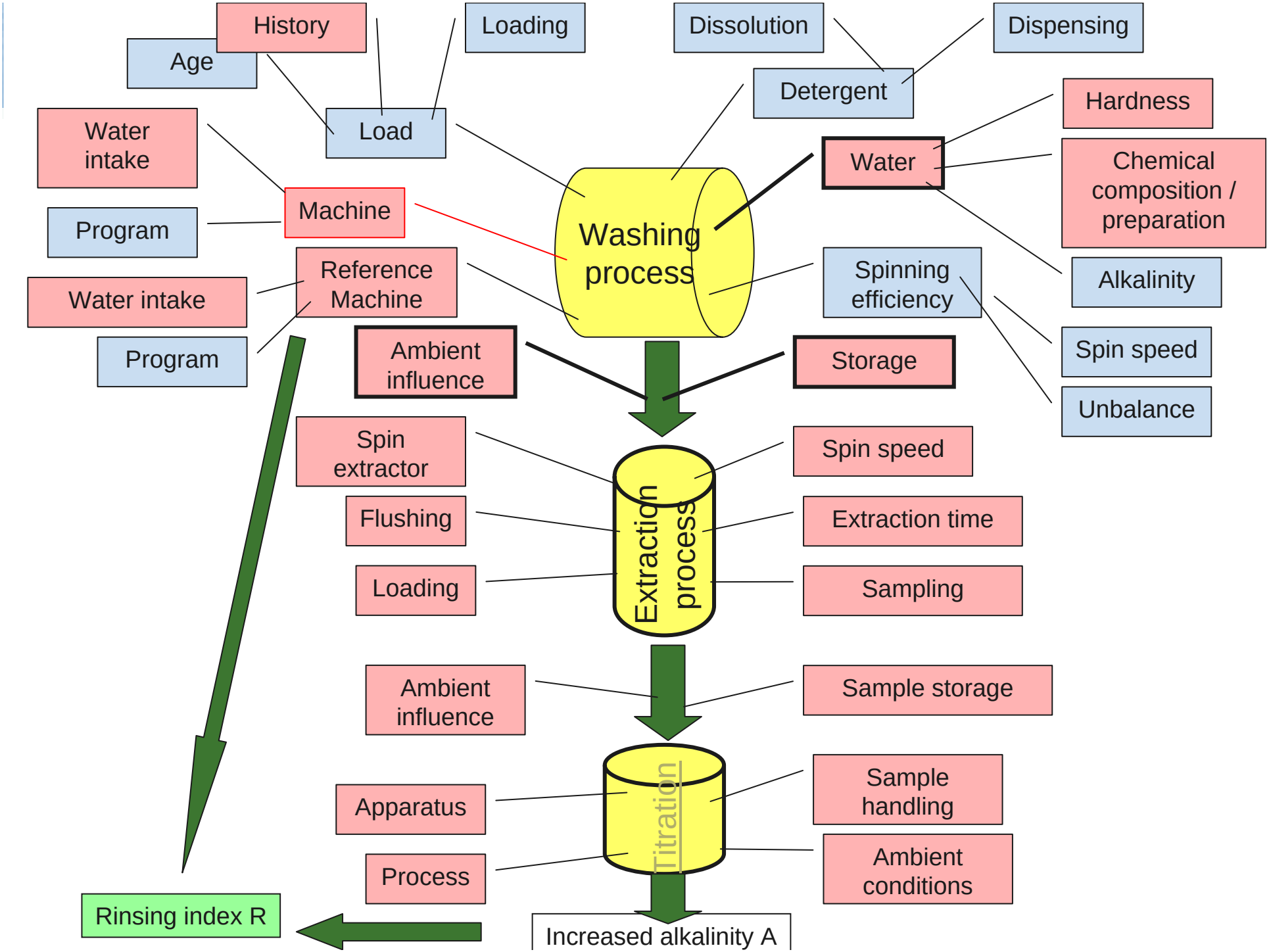
influence of time between end of programme and extraction



water loss in load after unloading

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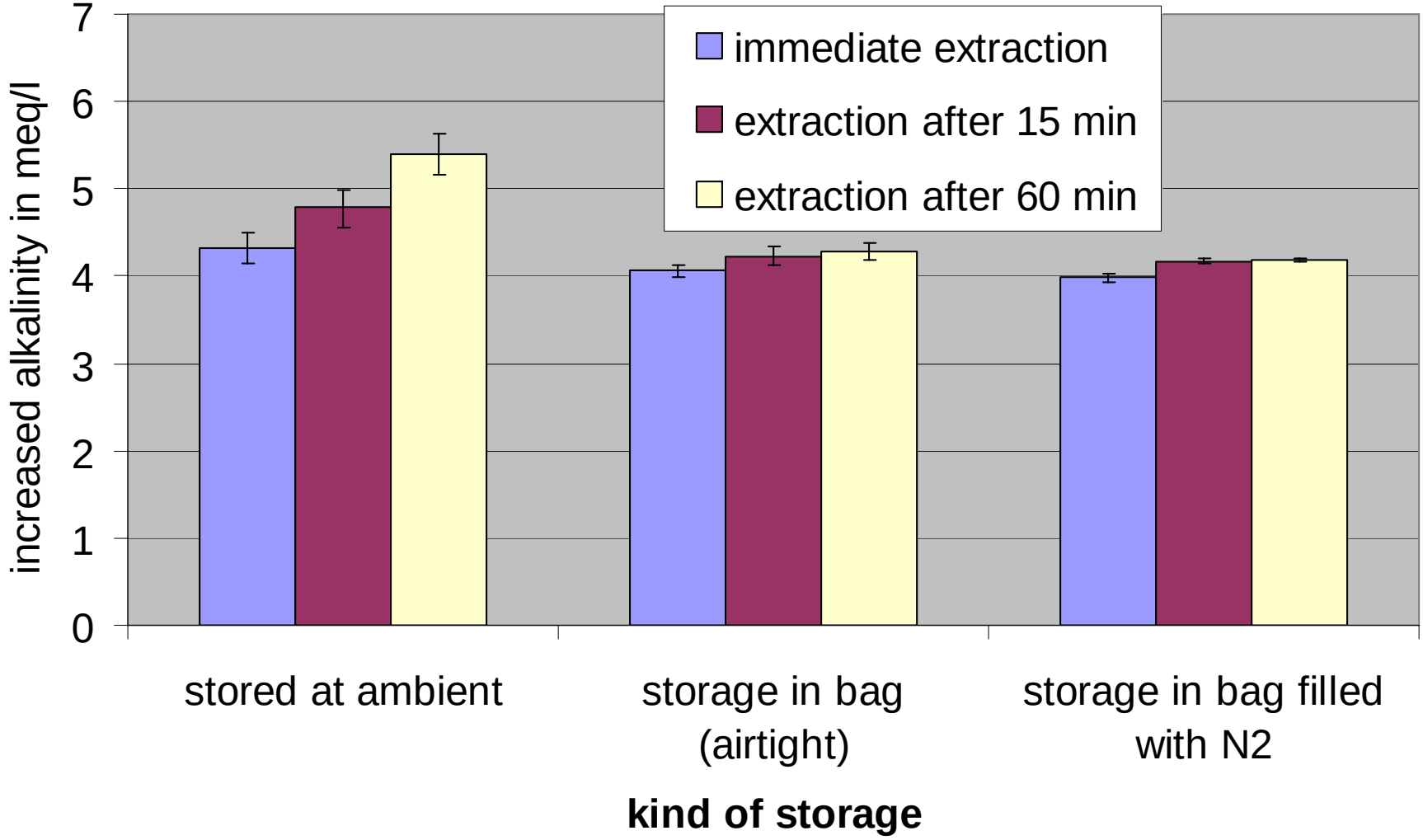
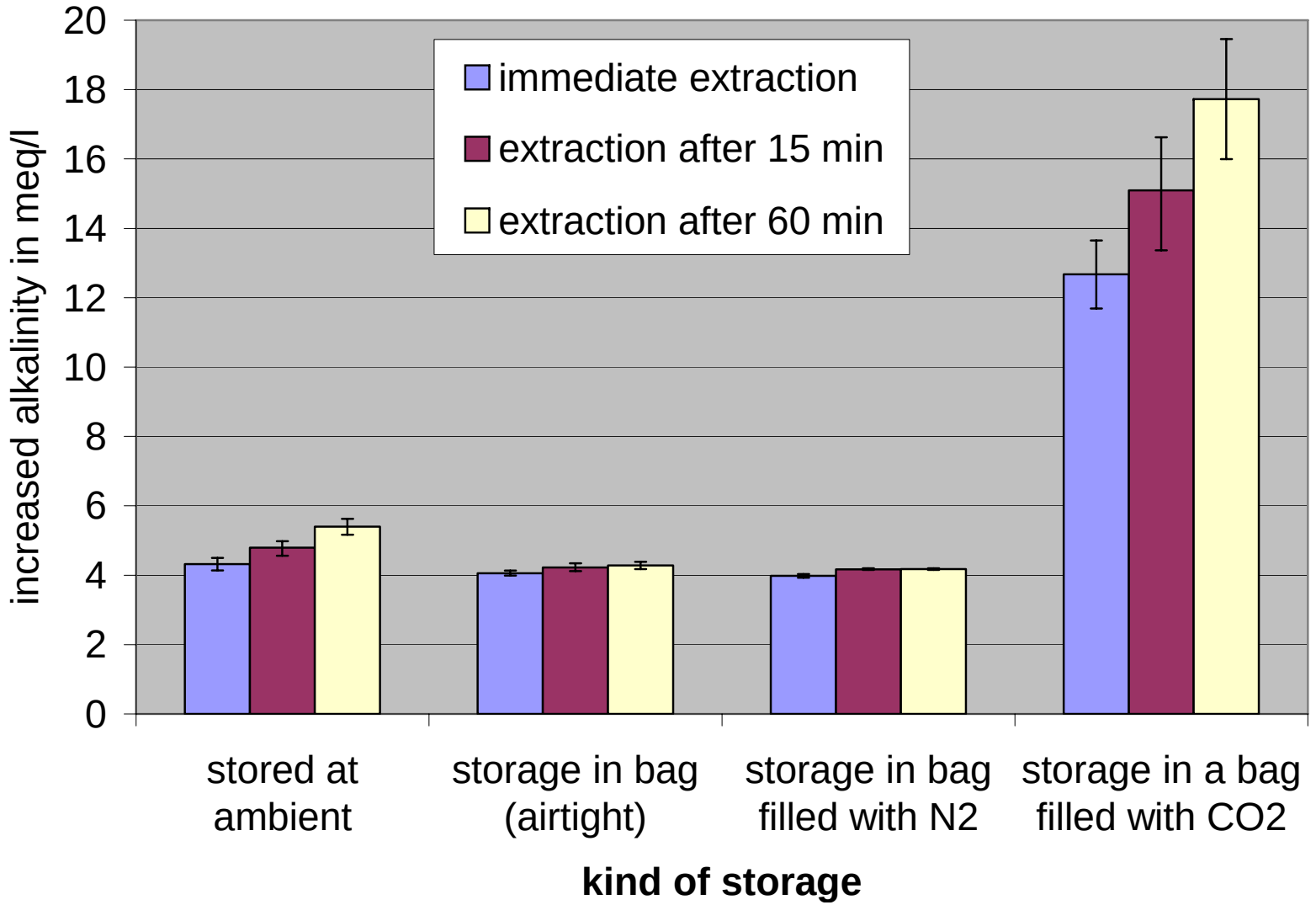
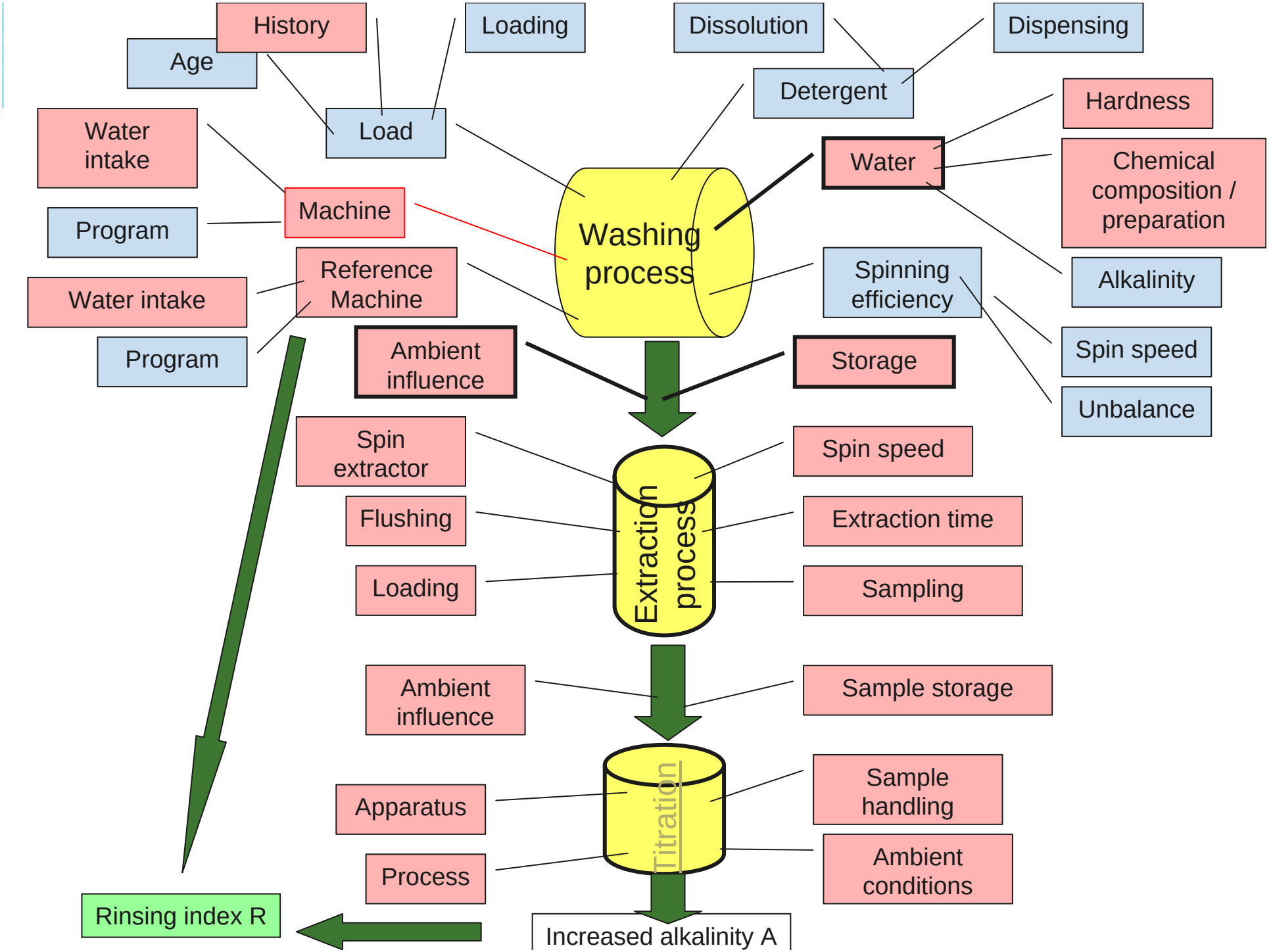
storage of load after program end



storage of load after program end (2)

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spin extractor

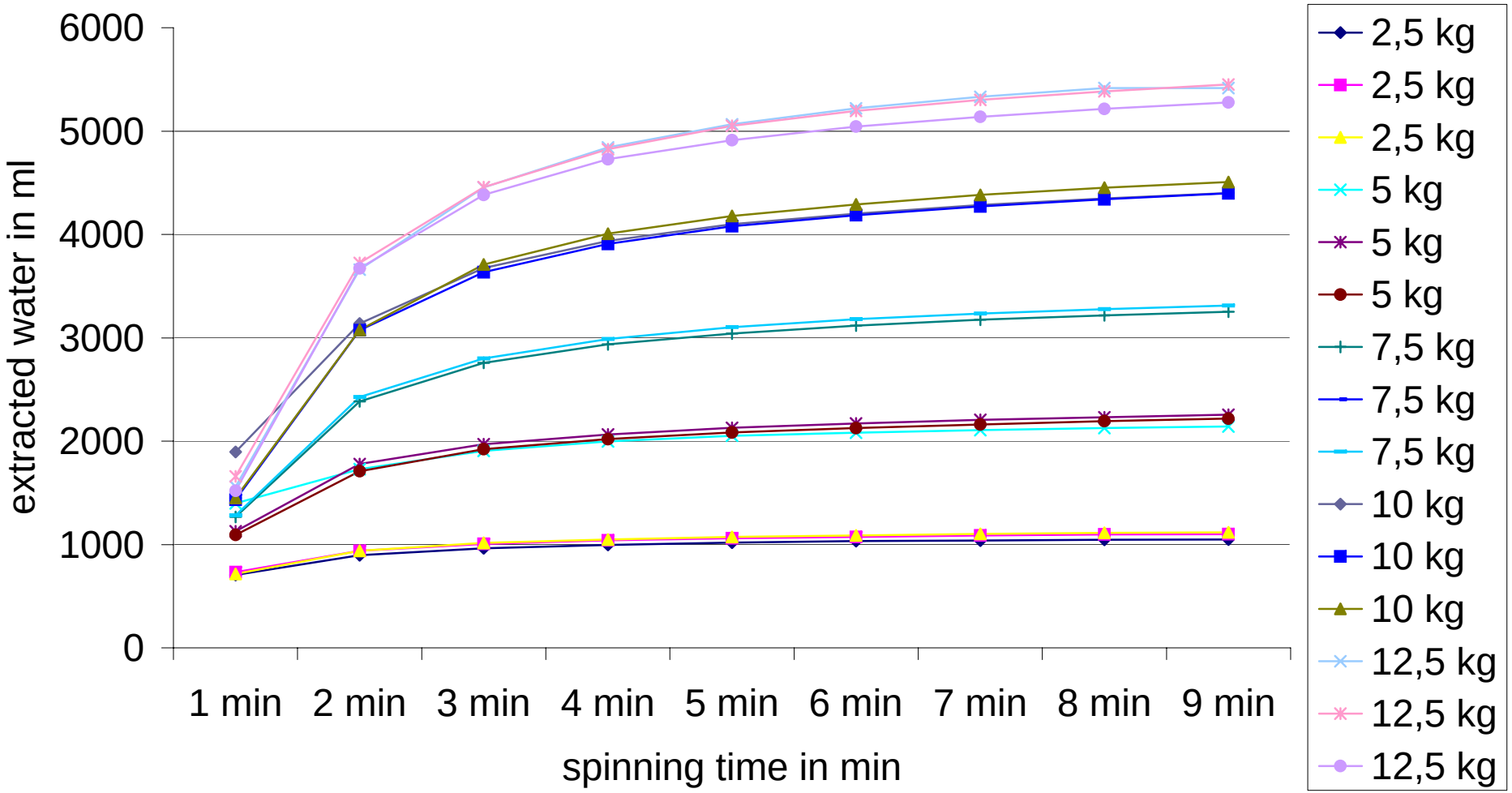
- Small extractor

- for one bundle
(one sheet, two pillowcases, six towels)
- special loading scheme

- Large extractor

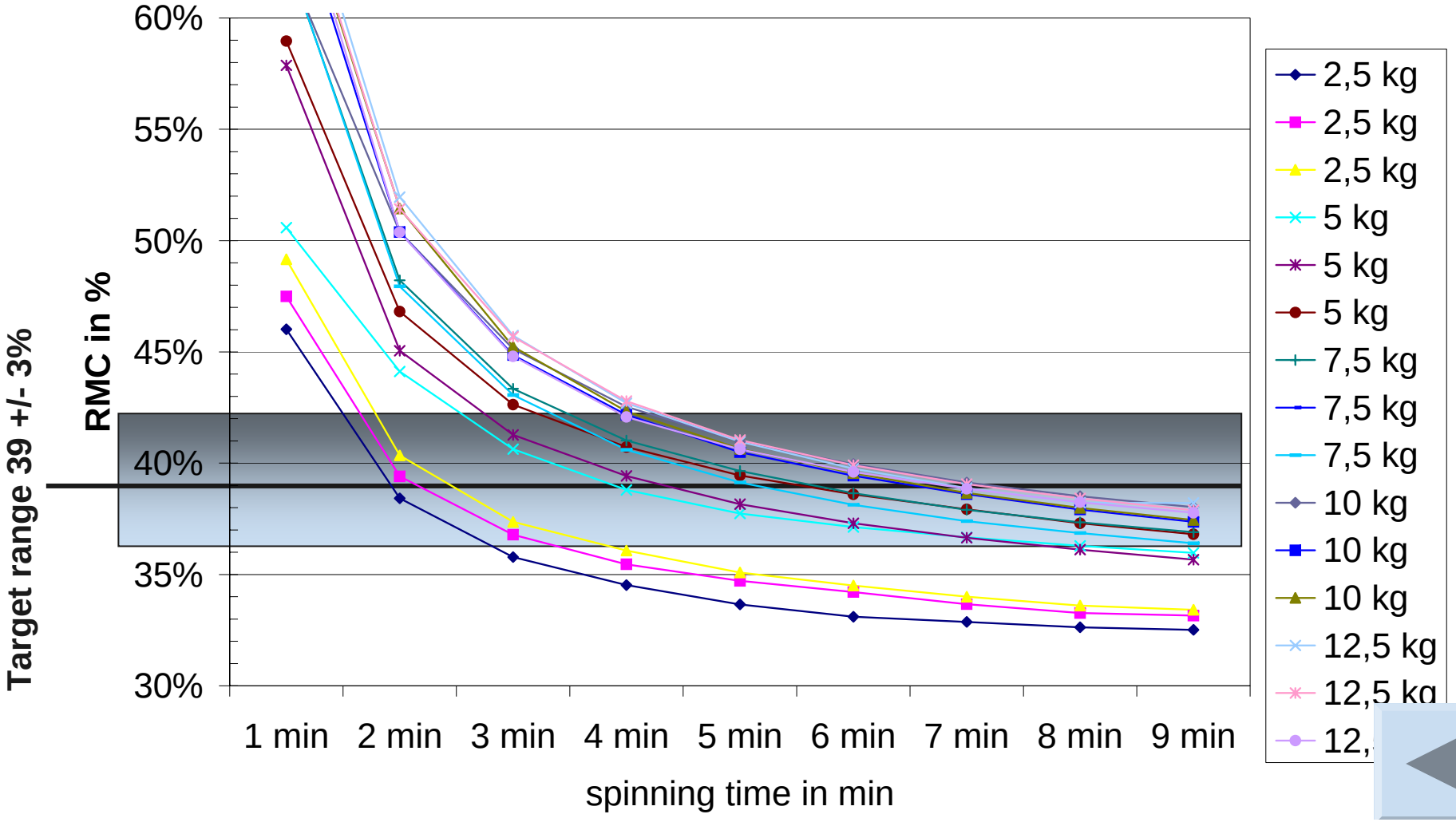
Electrolux
Model Typ C940
- for up to 12,5 kg
- special loading scheme

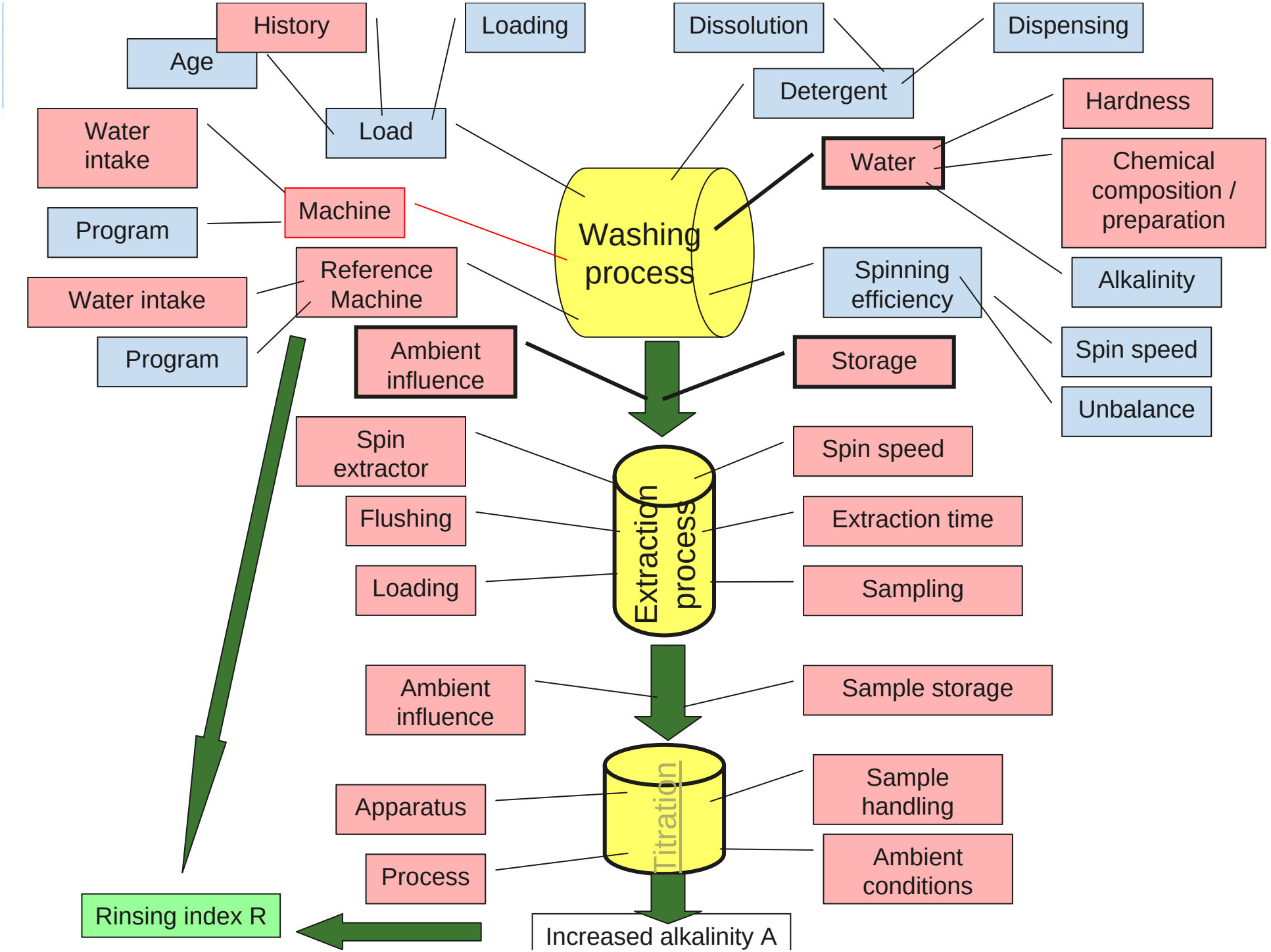
time dependency of extraction – big extractor



big extractor – RMC v time

(RMC re-calculated from collected water during spinning)

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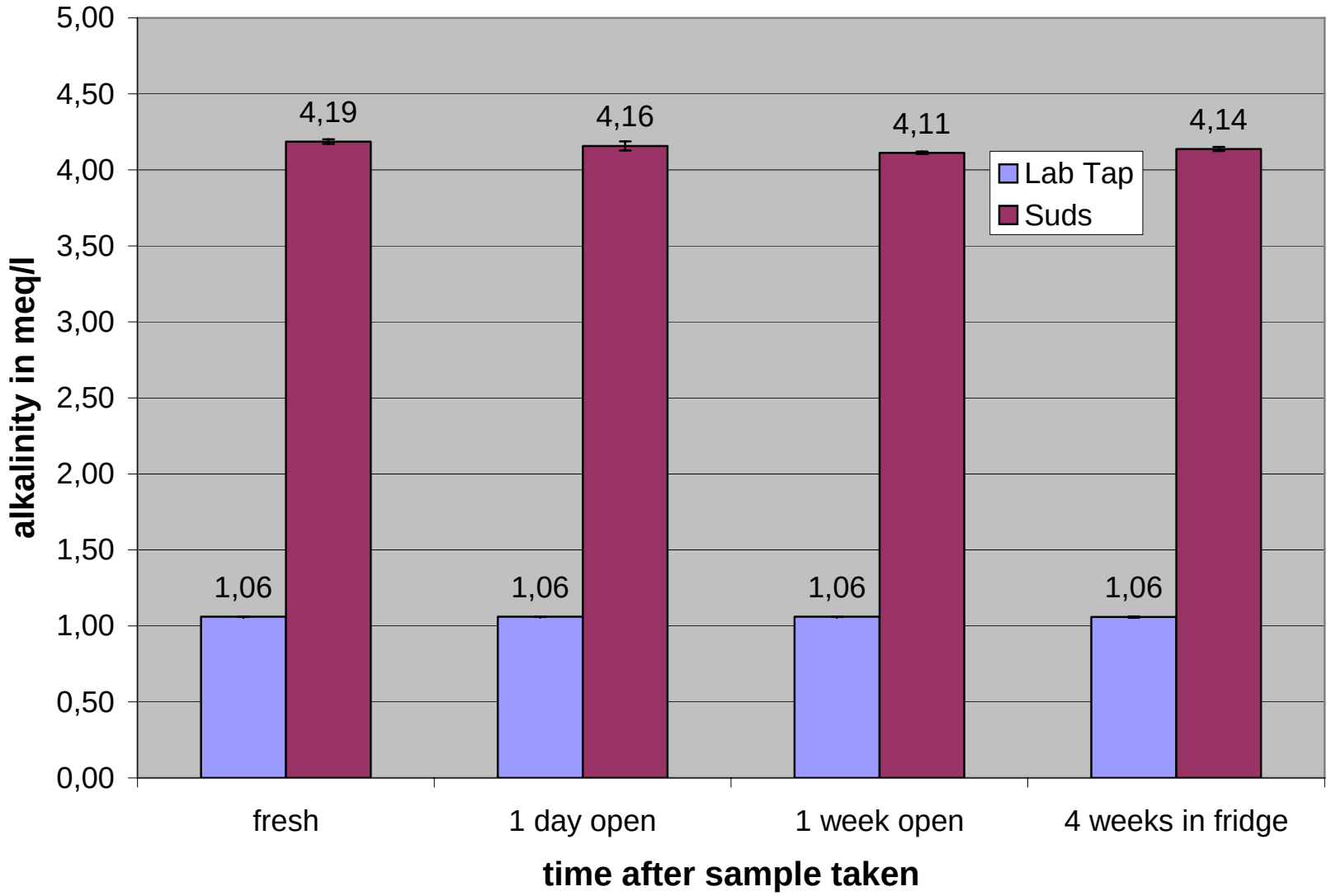
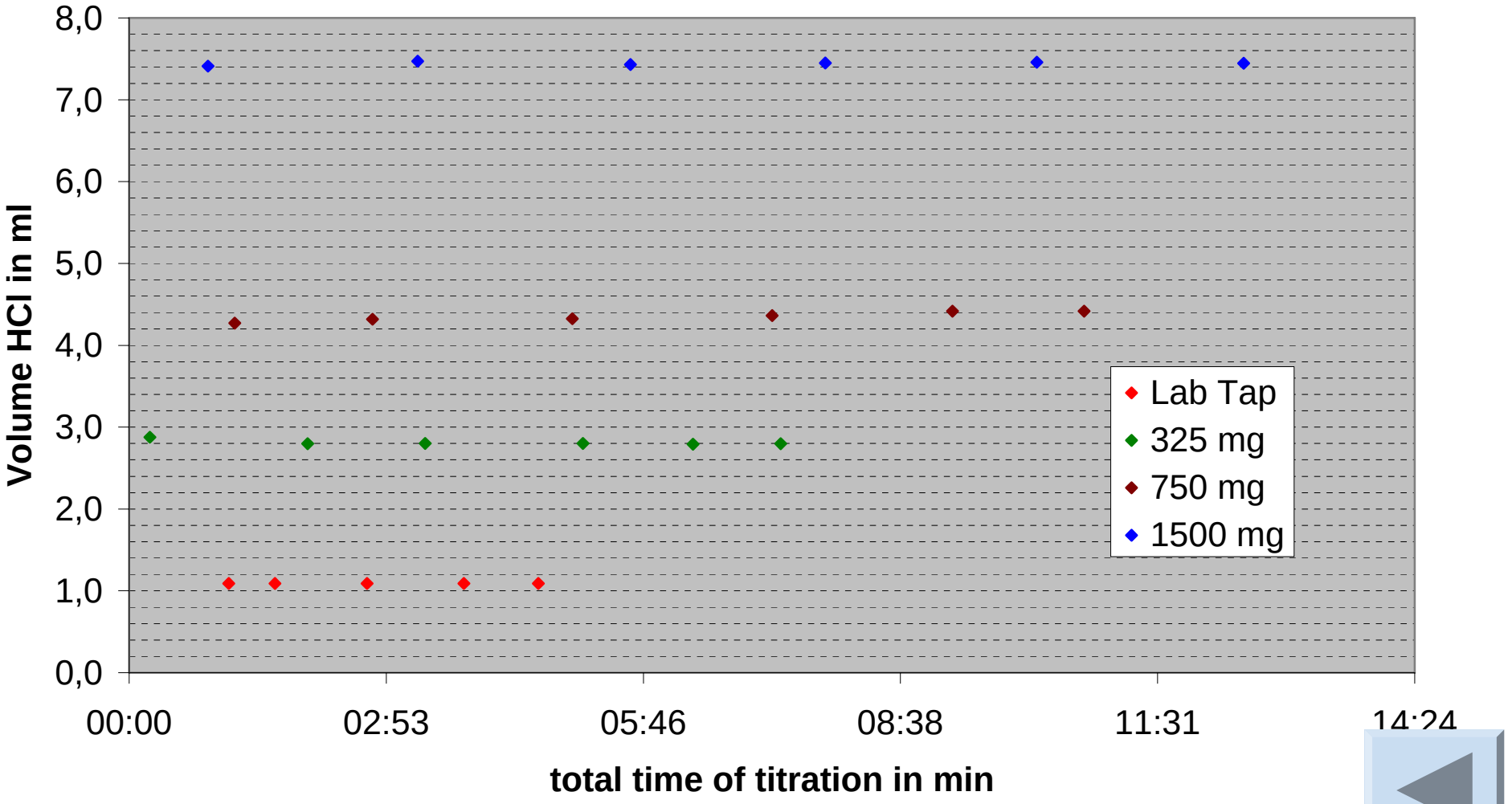
titration parameters investigated

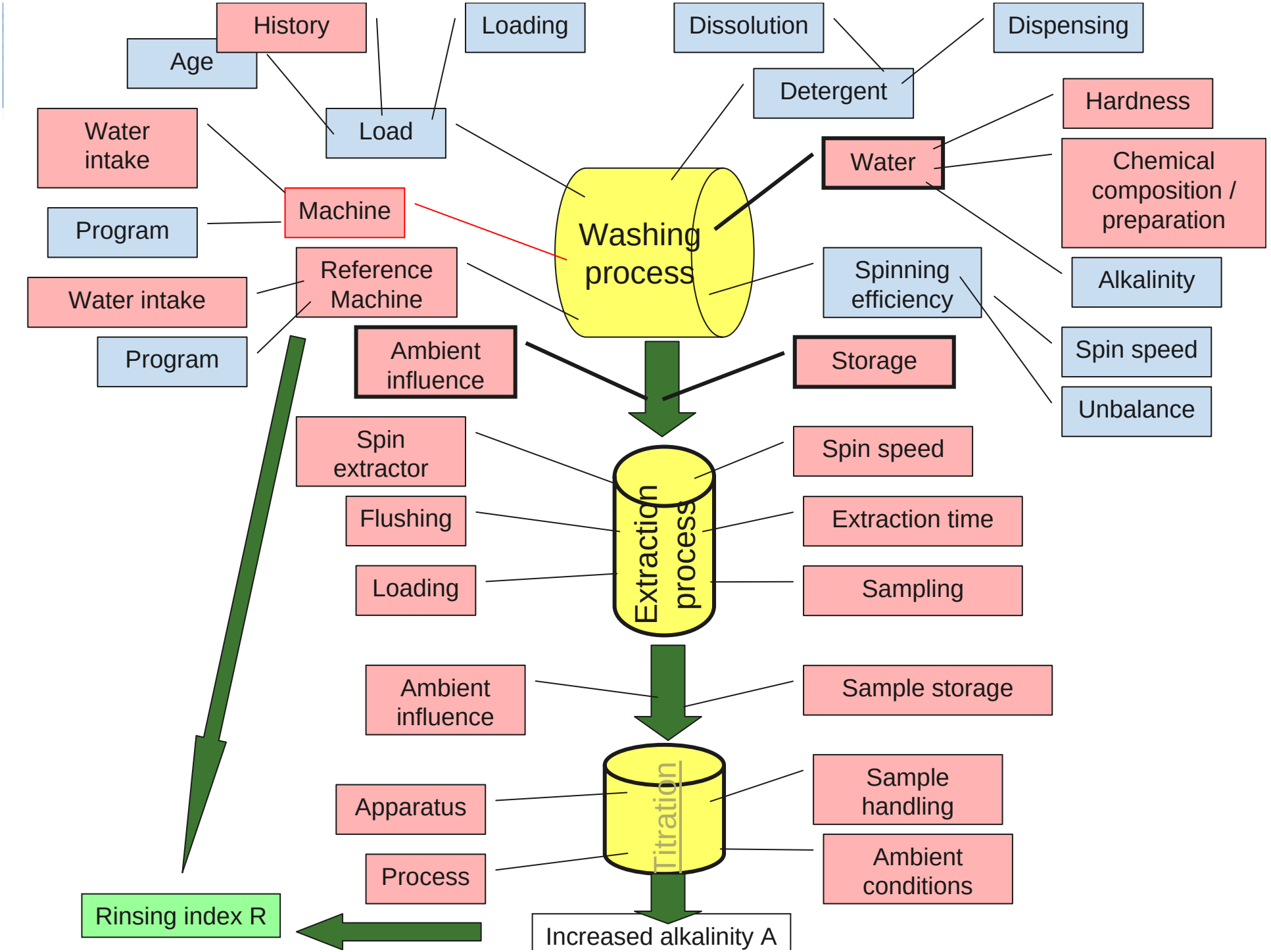
- Type of titrator
- Titration speed
- Temperature of samples and titrator
- Storage of samples
- Speed of stirring

storage of extracted water samples



time to finish titration

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refined alkalinity measurement for rinsing performance

Difference as included in IEC60456 ed. 5 version 5

- bundles of same content -> as many bundles as possible + rest treated similar but not analysed
- storage of bundles not titrated in bag to limit effect of time/ambient
- extractor to be cleaned before each spinning (in case of use of only one extractor clean between 1st-2nd extraction too!)
- loading procedure of small extractor
- large spin extractor defined with diameter and speed but RMC requirement (39% +/- 3% for cotton) - loading procedure defined
- collect all water or per bundle (recommended per bundle as a control measure)
- end point 4,5 (without nitrogen)
- pH calibration once a day
- result of two samples titrated need to be within 2%
- sample size 50 g - 100 g
- reduce speed of titration close to endpoint

- Allow no storage of samples, but extract in parallel

Thank you for your attention

Special thanks to
all who contributed to the work of IEC and CENELEC regarding rinsing

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