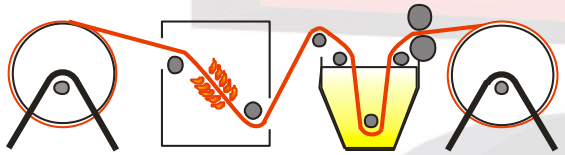
The effects of desizing on the cellulosic substrate preparation process

Matteo Scaburri
F.T.R. Forniture Tessili Riunite SpA

BIO-Preparation of cotton fabrics

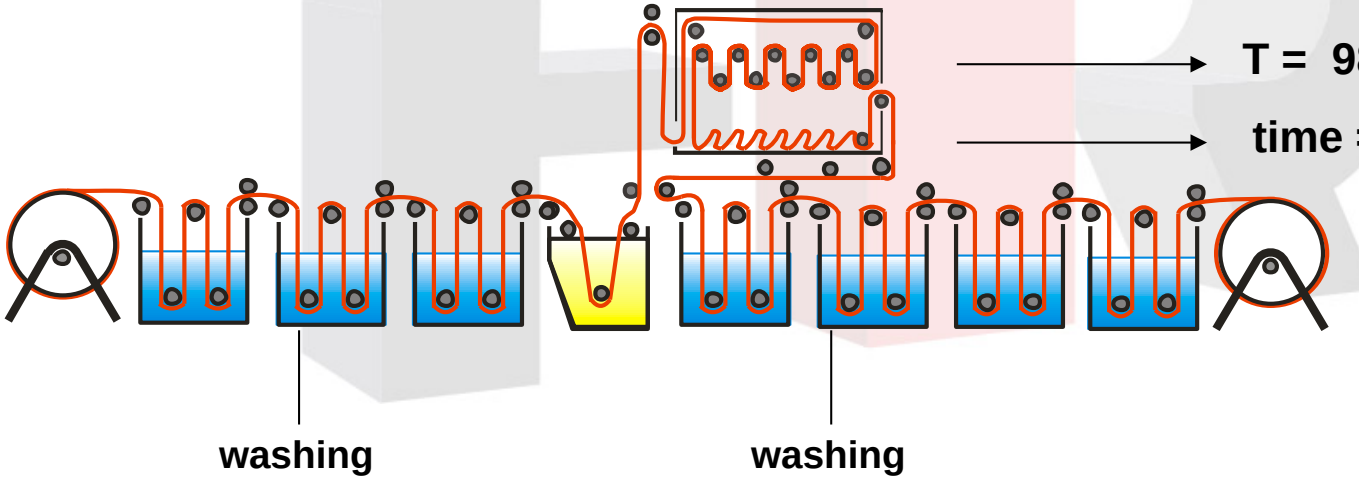
Enzymatic desizing Pad-Batch



T = 20° - 60°C

time = 3-12 hours

Bleaching Pad-Steam



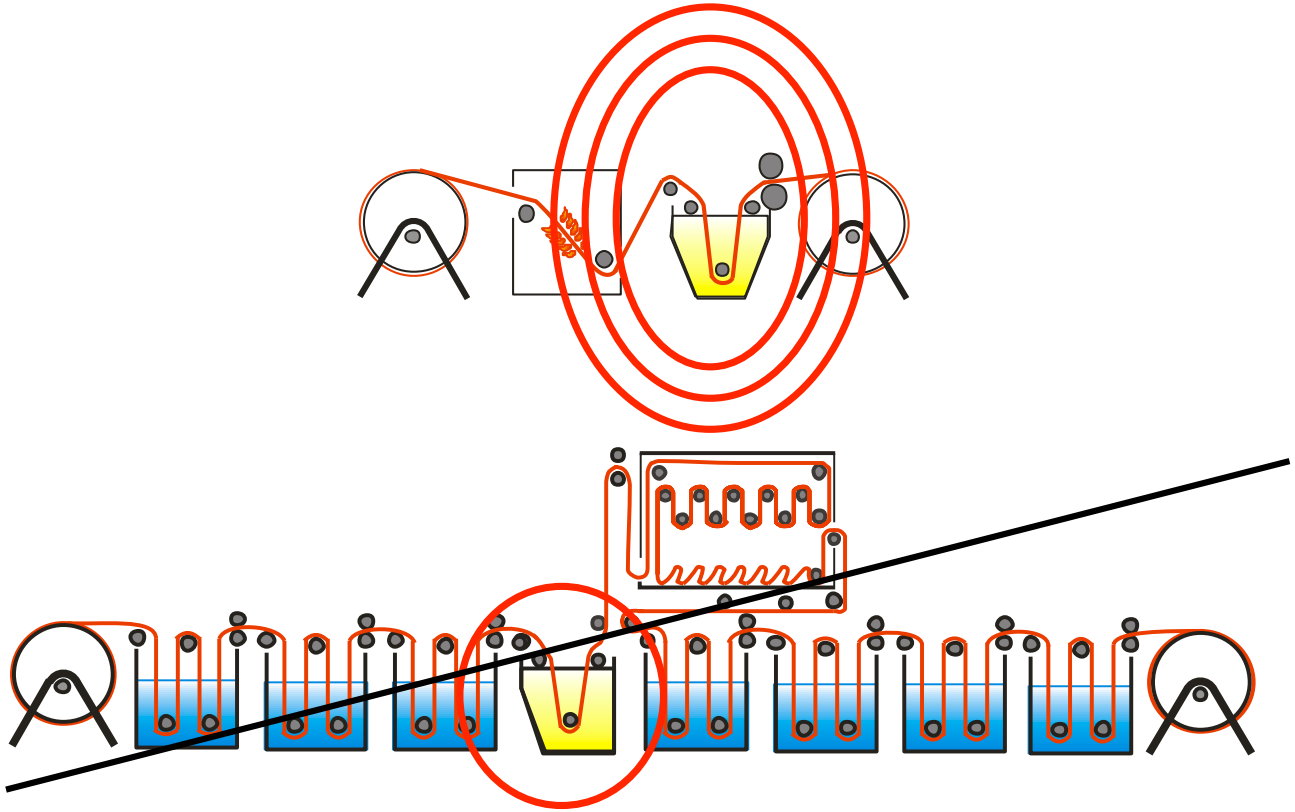
T = 98° - 102°C

time = 3-20 minutes

For our study we used this preparation system
largely applied by cotton companies
because of its

Practicatility
Semplicity
Versatility
Easiness
Cheapness
Safety

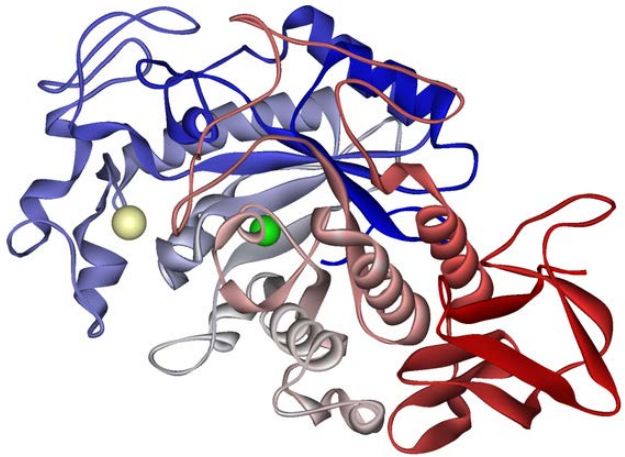
Insufficient degree of preparation



The efficacy of **α-amilase enzymes** could be influenced by different factors

pH value

Temperature



Time

Chemicals compatibility

ENZYMATIC DESIZING PROCESS

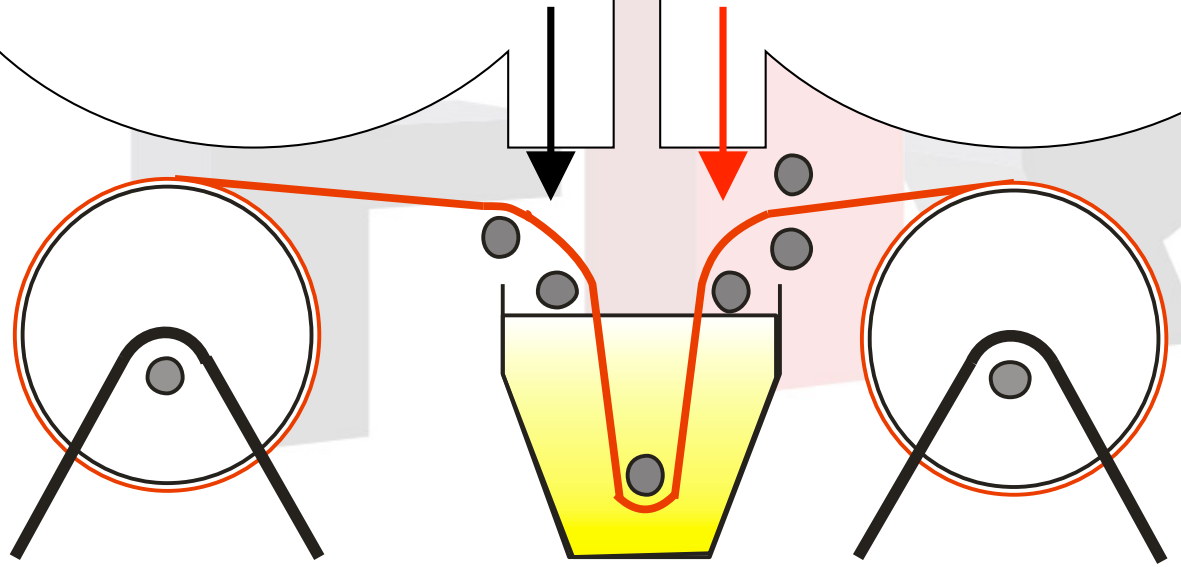
Standard

3 ml/l amilolitic enzyme
(α-amilase batteric 240 KNU)

5 ml/l detergent
(ethoxylated fatty alcohol)

Modification

Acids
Alkali
Reducing agents
Oxidizing agents
Enzymes
N° 2 FTR system

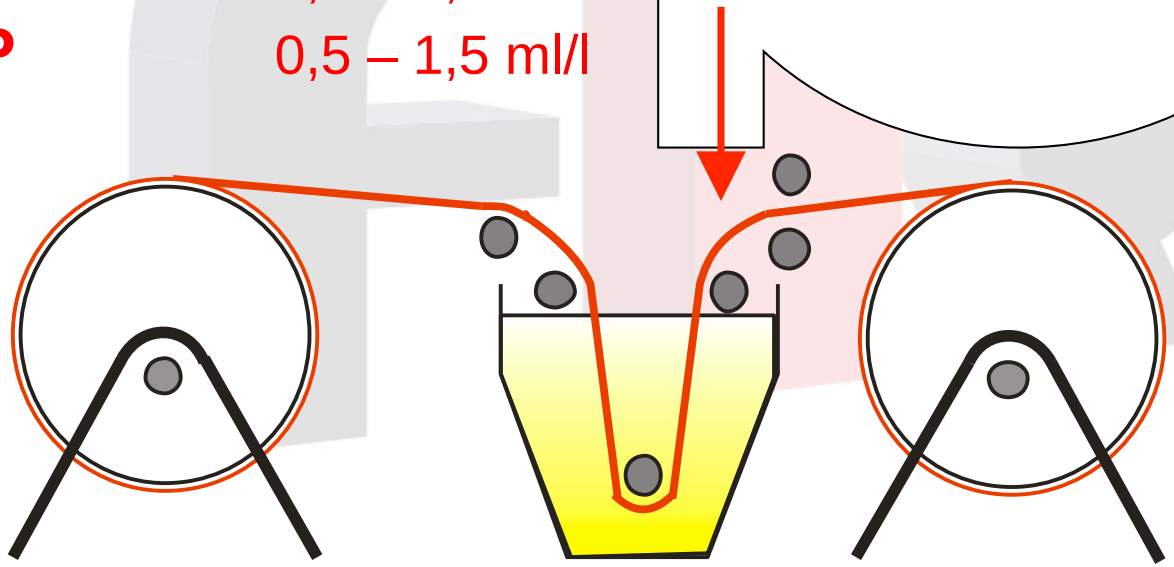


ENZYMATIC DESIZING PROCESS

Hydrochloric	0,5 – 1,5 ml/l
Acetic	1,0 – 3,0 ml/l
Formic	0,5 – 1,5 ml/l
Citric	1,0 – 3,0 g/l
HEDP	0,5 – 1,5 ml/l
DTPMP	0,5 – 1,5 ml/l
ATMP	0,5 – 1,5 ml/l

Modification

Acids



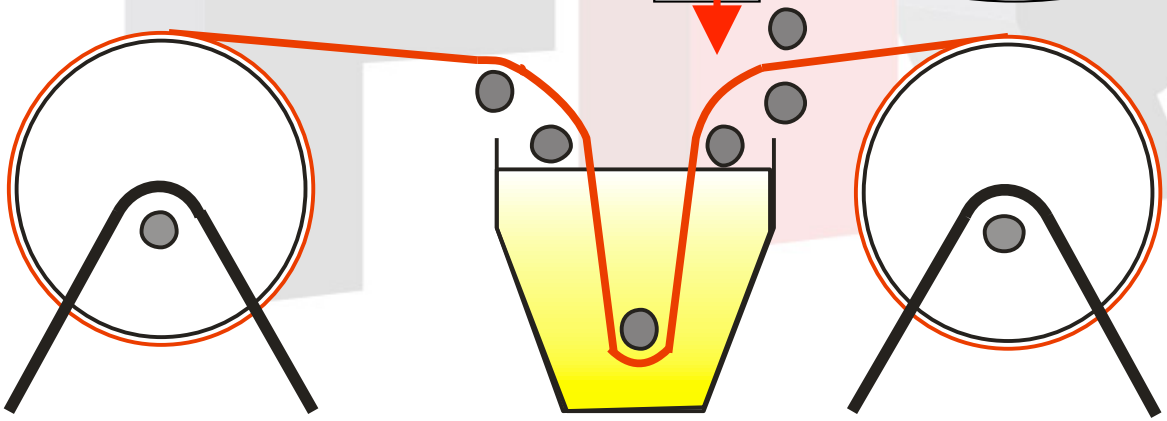
ENZYMATIC DESIZING PROCESS

Modification

NaOH 36°Bè 10-20-30-50 ml/l
+ 5 g/l Sodium persulphate

KOH 38°Bè 10-20-30-50 ml/l
+ 5 g/l Sodium persulphate

Alkali



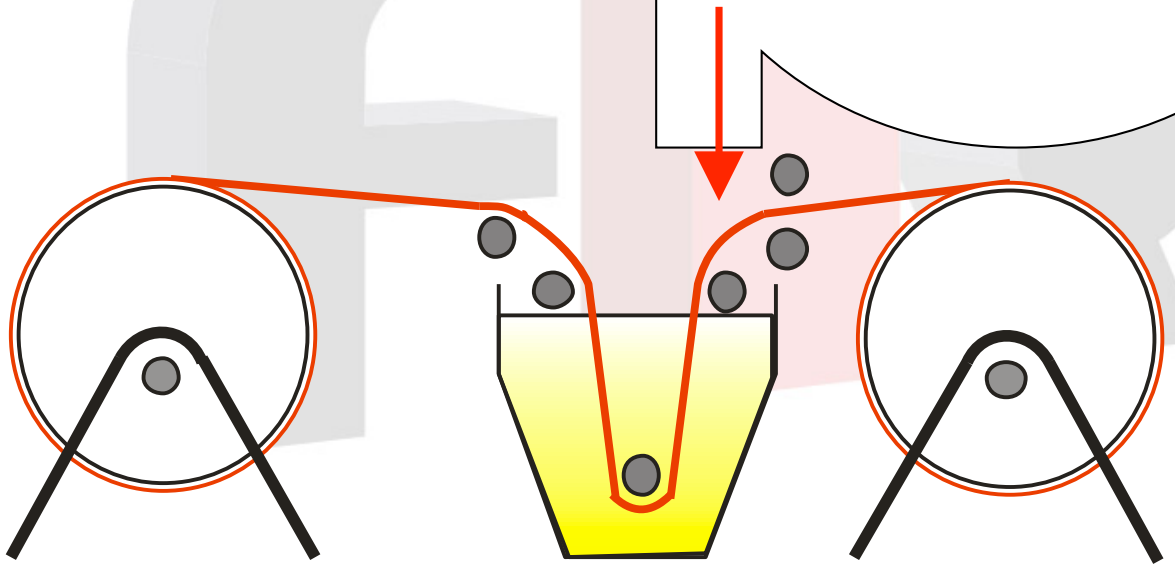
ENZYMATIC DESIZING PROCESS

Modification

Na Hydrosulphite 1 – 3 g/l

Reducing agents

Na Metabisulphite 1 – 3 g/l

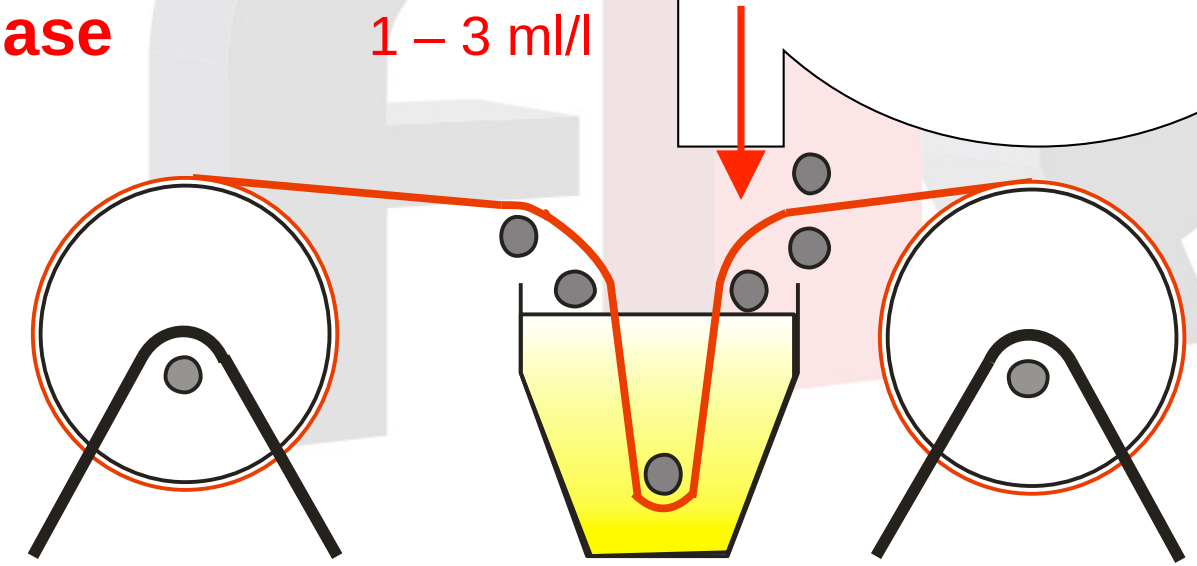


ENZYMATIC DESIZING PROCESS

Pectinase	acid	1 – 3 ml/l
Pectinase	alkaline	1 – 3 ml/l
Xylanase		1 – 3 ml/l
Laccase		1 – 3 ml/l
Cellulase		1 – 3 ml/l

Modification

Enzymes



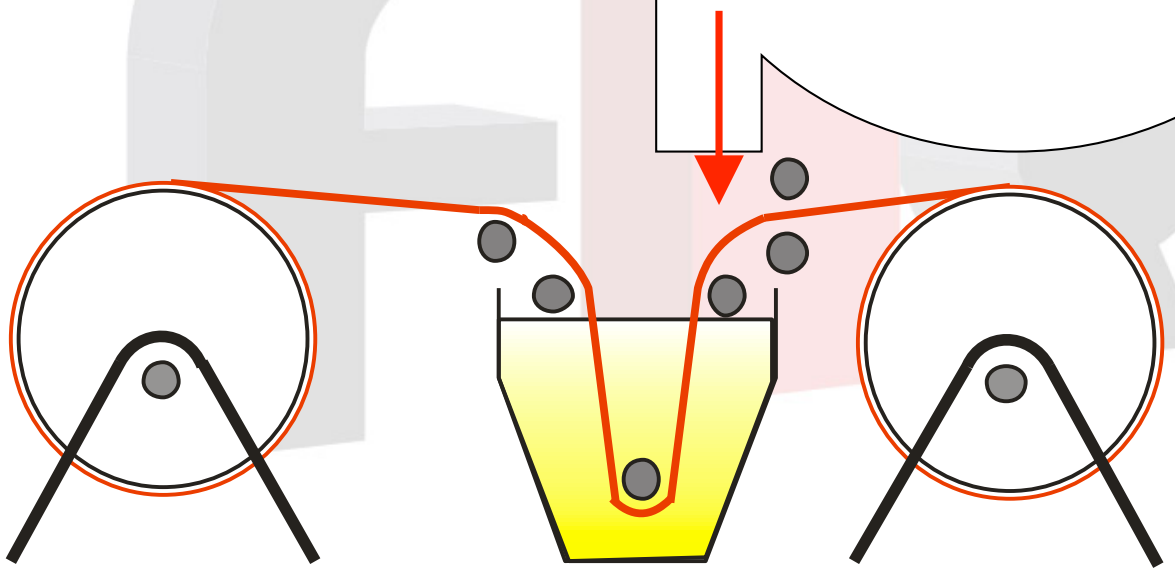
ENZYMATIC DESIZING PROCESS

Modification

COMPLEX IRON NEU	5 ml/l
COMPLEX CA	2 ml/l

FTR 1 system

COMPLEX IRON



ENZYMATIC DESIZING PROCESS

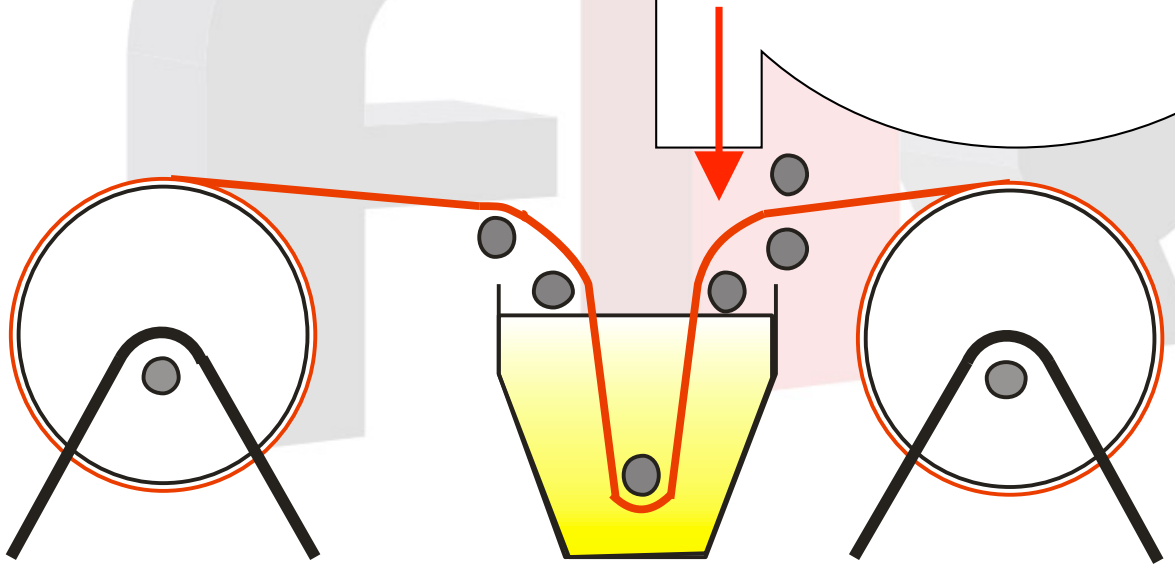
Modification

NaOH 36°Bè 10-20-30-50 ml/l

+ 5 ml/l **INNOVA 2000**

FTR 2 system

INNOVA



Tests have been carried out on **100% cotton fabric 20/24 cloth 156 g/m²**

1) Padding at 60°C
with desizing recipes

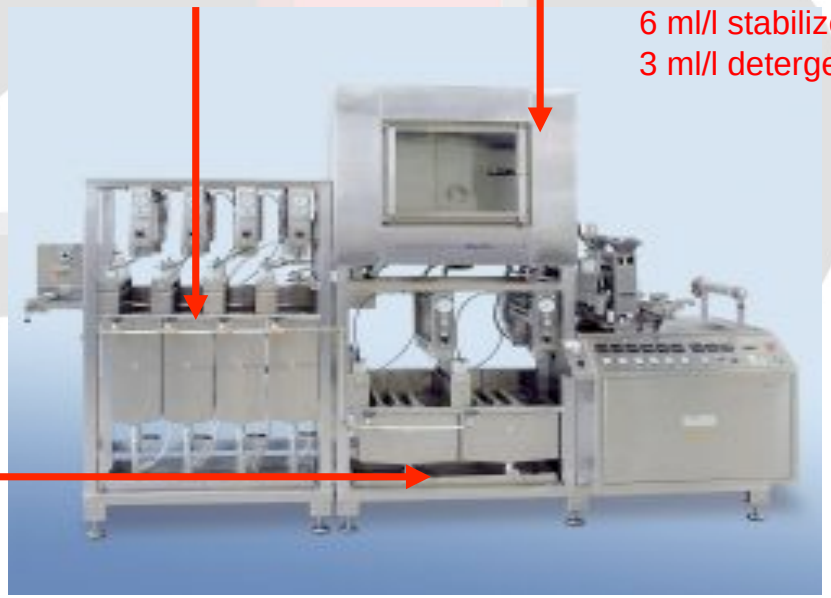
2) Stock for 6 hours at 60°C

3) Continuous washing

4) Pad-Steam bleaching
15 minutes at 99°C

45 ml/l H_2O_2 130 vol.
25 ml/l NaOH 30%
6 ml/l stabilizer
3 ml/l detergent

5) Continuous washing



Evaluation of recipes performances after desizing and bleaching process

Analytical controls of natural and artificial subtances on cotton fiber

Residual starch quantity (Tegewa method)
Residual fats-waxes quantity (Soxhlet-petroleum ether)
Pectine quantity (oxalate extraxtion-gravimetric determination)
Iron ions quantity (colorimetric determination)

Evaluation of degree of preparation on the fabric

Degree of hydrophility (Tegewa Drop-Test method)
Degree of desizing (Tegewa method)
Degree of whiteness (Berger-Ganz formula)
Degree of cellulose polymerisation (Cuen viscosity method)

ENZYMATIC DESIZING PROCESS

Evaluation of Standard recipes performances

Standard

After bleaching Pad-Steam process
low degree of preparation

3 ml/l amilolitic enzyme
(α-amilase batteric 240 KNU)

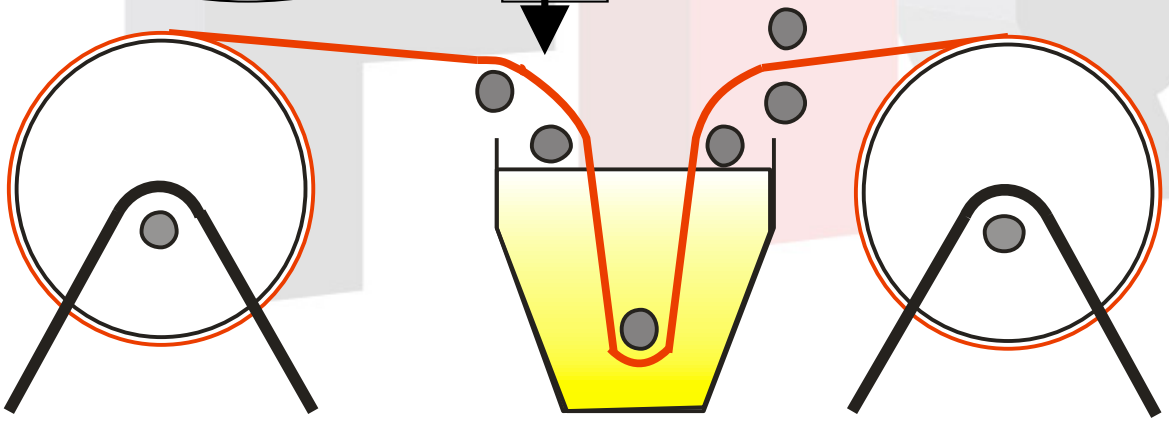
5 ml/l detergent
(ethoxylated fatty alcohol)

Fats waxes	-25% elimination
Pectins	-66% elimination
Iron ions	-22% elimination
Starch	5 Tegewa scale

Good Hydrophility

Good Desizing

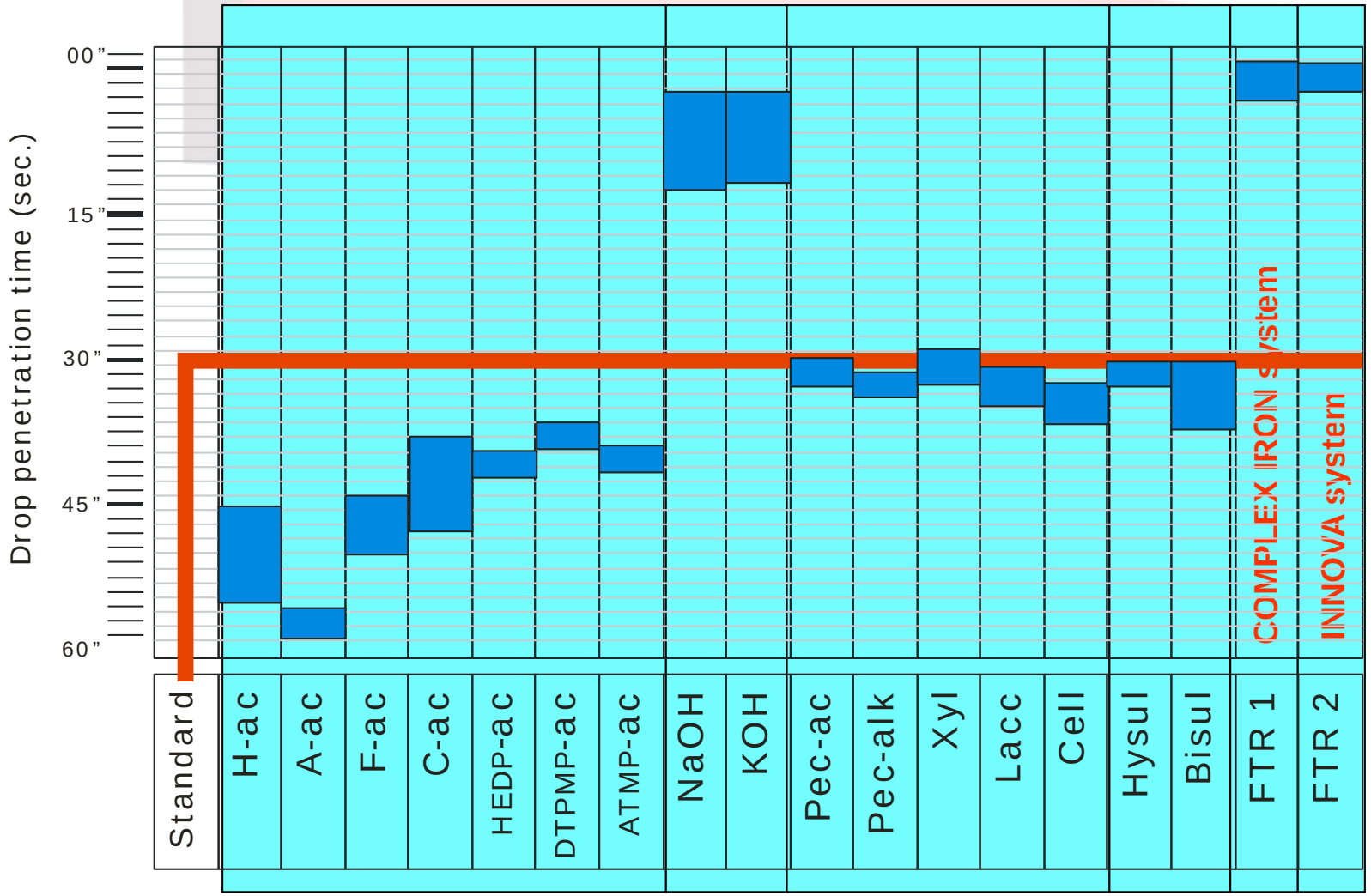
Good Whiteness

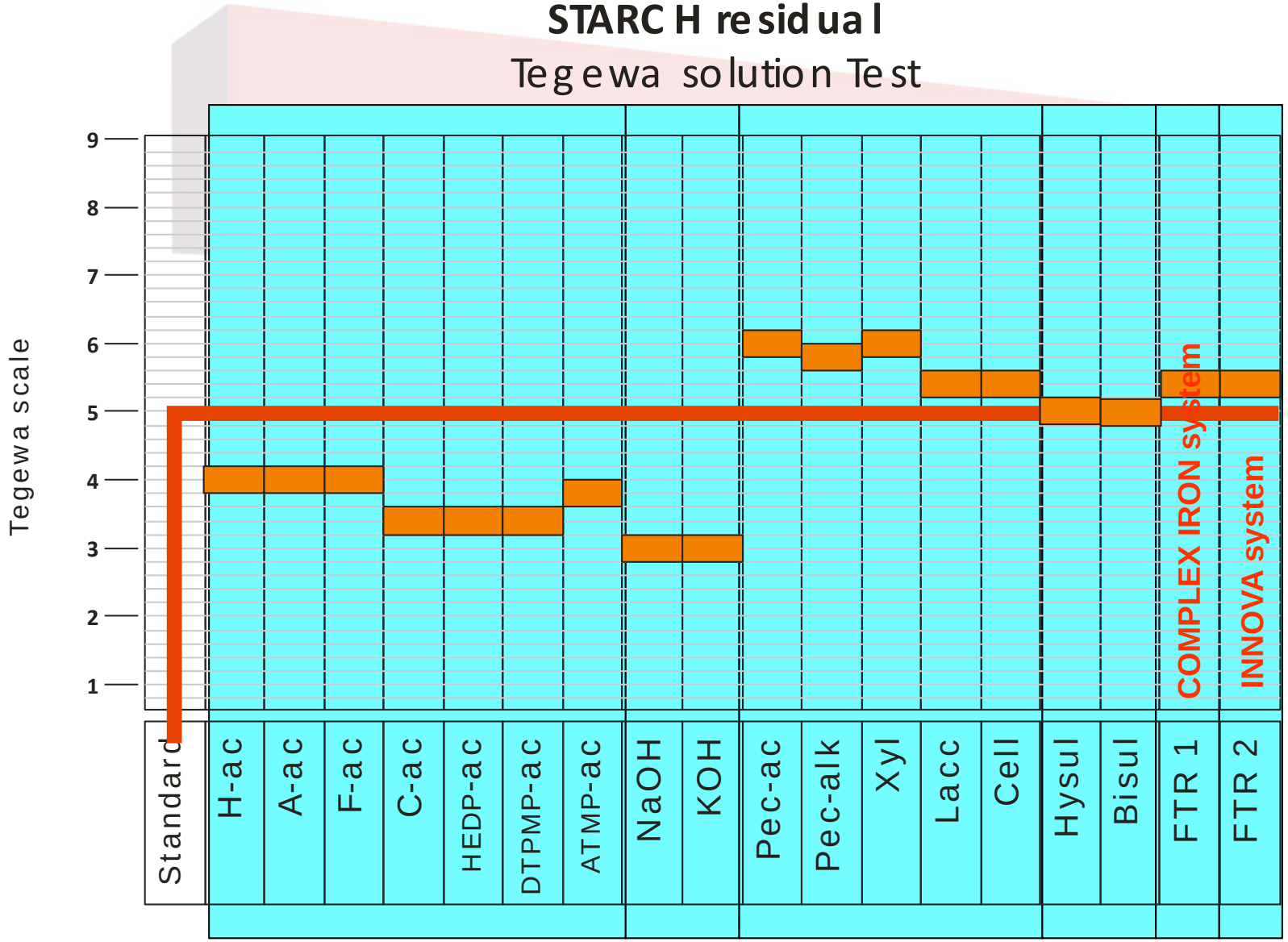


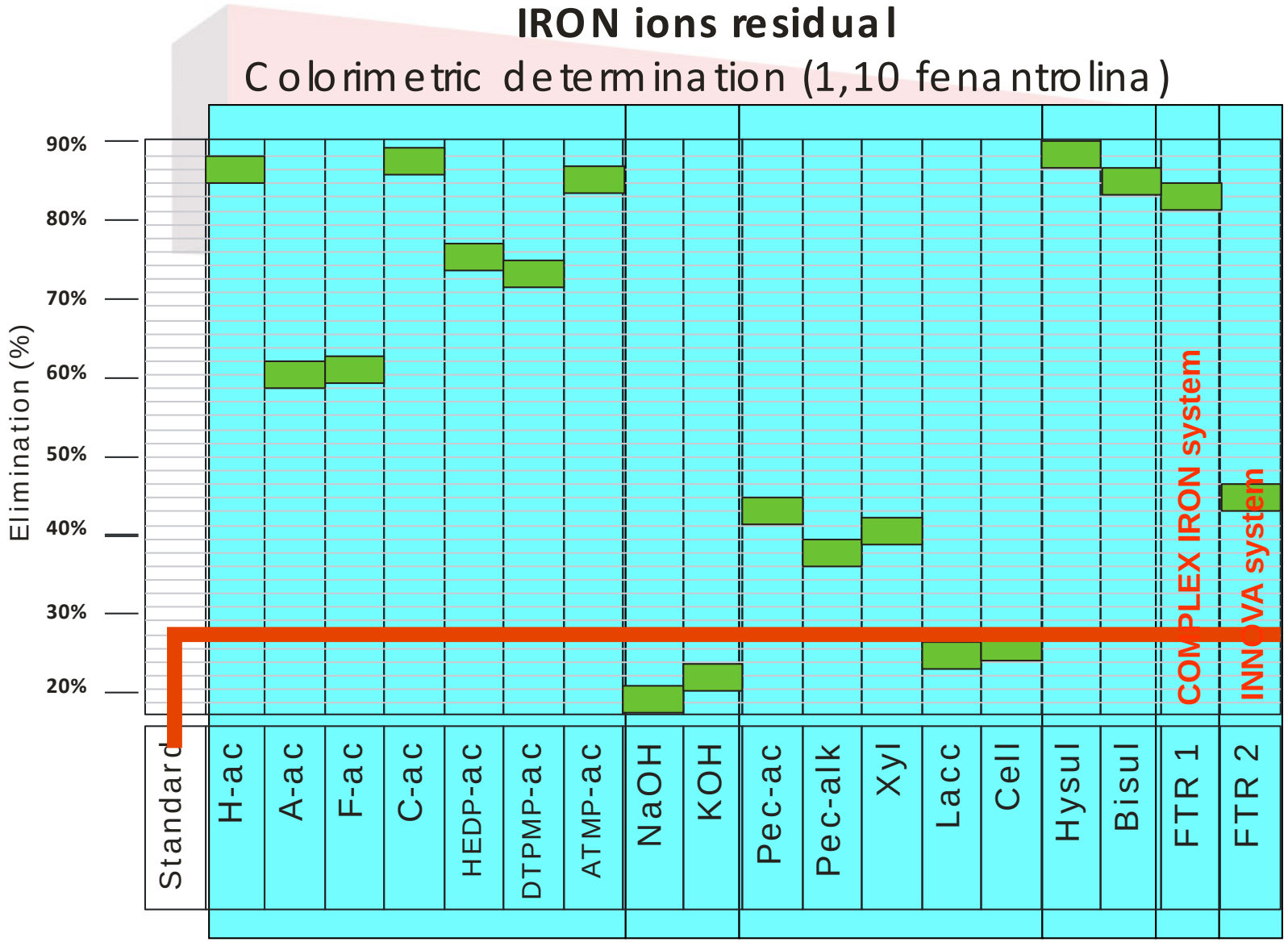
RESULTS

HYDRO PHILITY

Drop Test determination




STARC H residual
Tegewa solution Test
Tegewa scale
9
8
7
6
5
4
3
2
1
Standard
H-ac
A-ac
F-ac
C-ac
HEDP-ac
DTPMP-ac
ATMP-ac
NaOH
KOH
Pec-ac
Pec-alk
Xyl
Lacc
Cell
Hysul
Bisul
FTR 1
FTR 2
COMPLEX IRON system
INNOVA system


IRON ions residual
Colorimetric determination (1,10 fenantrolina)
Elimination (%)
90%
80%
70%
60%
50%
40%
30%
20%
Standard
H-ac
A-ac
F-ac
C-ac
HEDP-ac
DTPMP-ac
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NaOH
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Xyl
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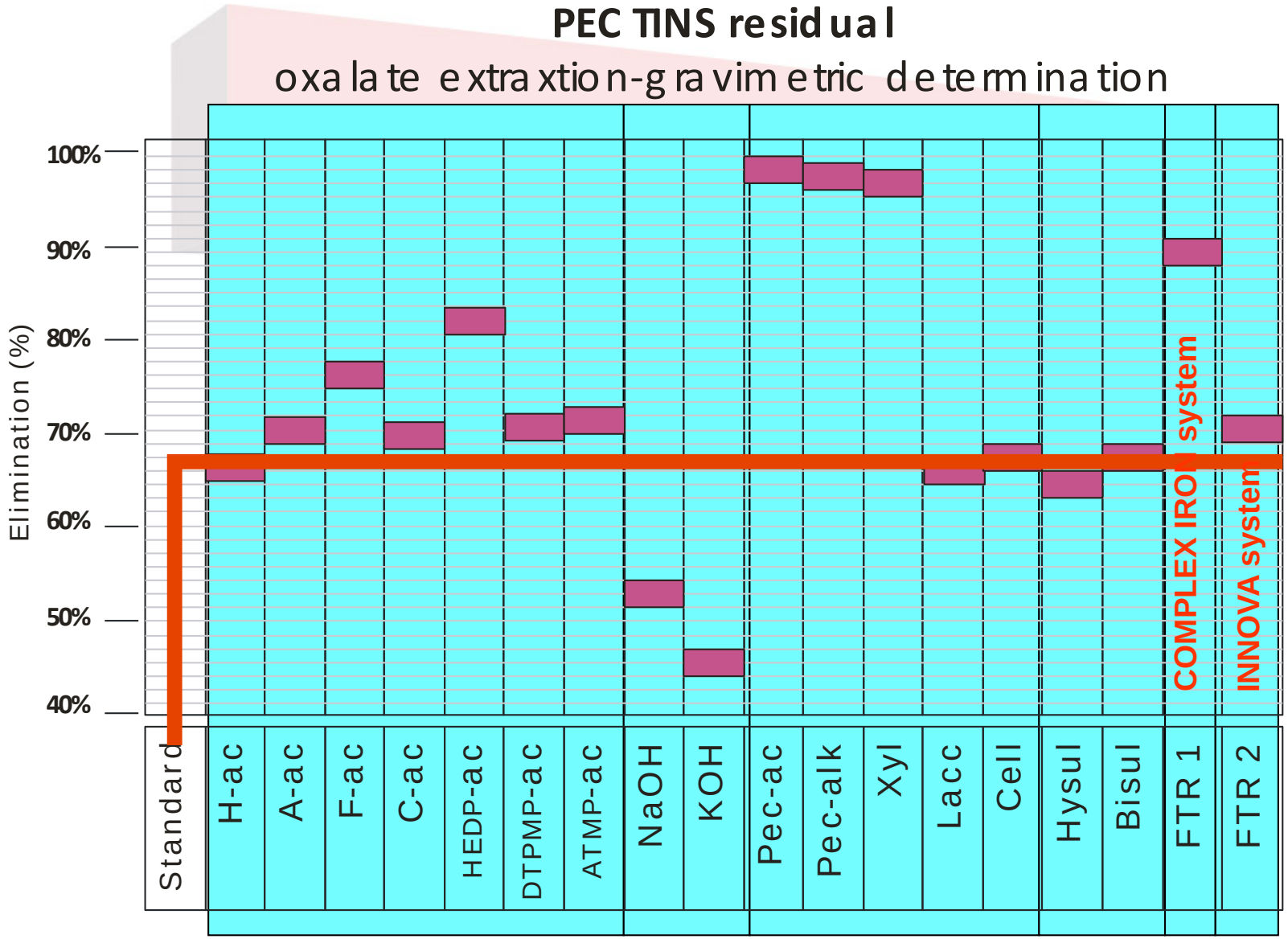
FTR 1
FTR 2
COMPLEX IRON system
INNOVA system


PEC TINS residual
oxalate extraxtion-gravimetric determination
Elimination (%)
100%
90%
80%
70%
60%
50%
40%
Standard
H-ac
A-ac
F-ac
C-ac
HEDP-ac
DTPMP-ac
ATMP-ac
NaOH
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Xyl
Lacc
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Hysul
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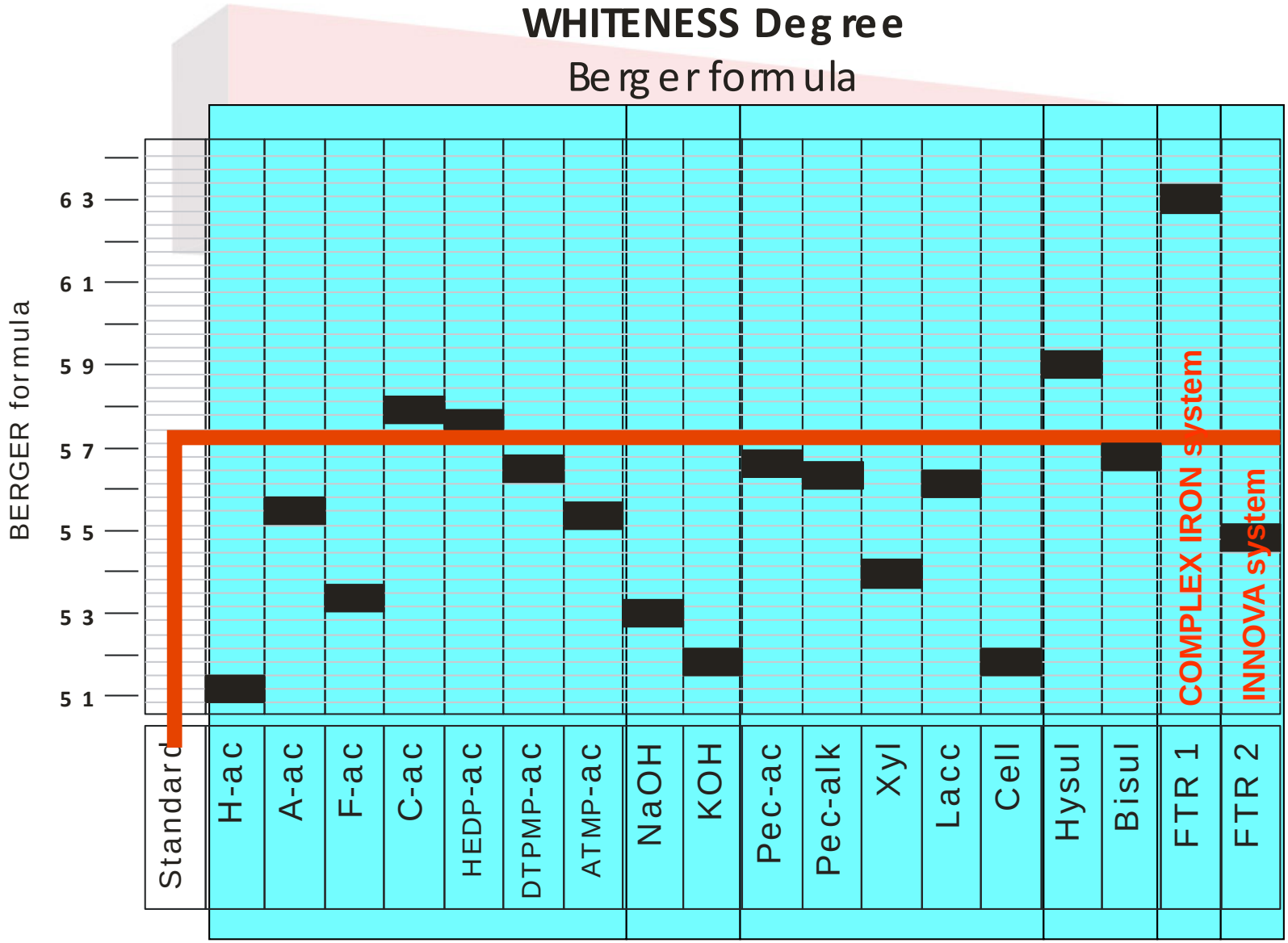
FTR 1
FTR 2
COMPLEX IRON system
INNOVA system


WHITENESS Degree
Berger formula
BERGER formula
63
61
59
57
55
53
51
Standard
H-ac
A-ac
F-ac
C-ac
HEDP-ac
DTPMP-ac
ATMP-ac
NaOH
KOH
Pec-ac
Pec-alk
Xyl
Lacc
Cell
Hysul
Bisul
FTR 1
FTR 2
COMPLEX IRON system
INNOVA system

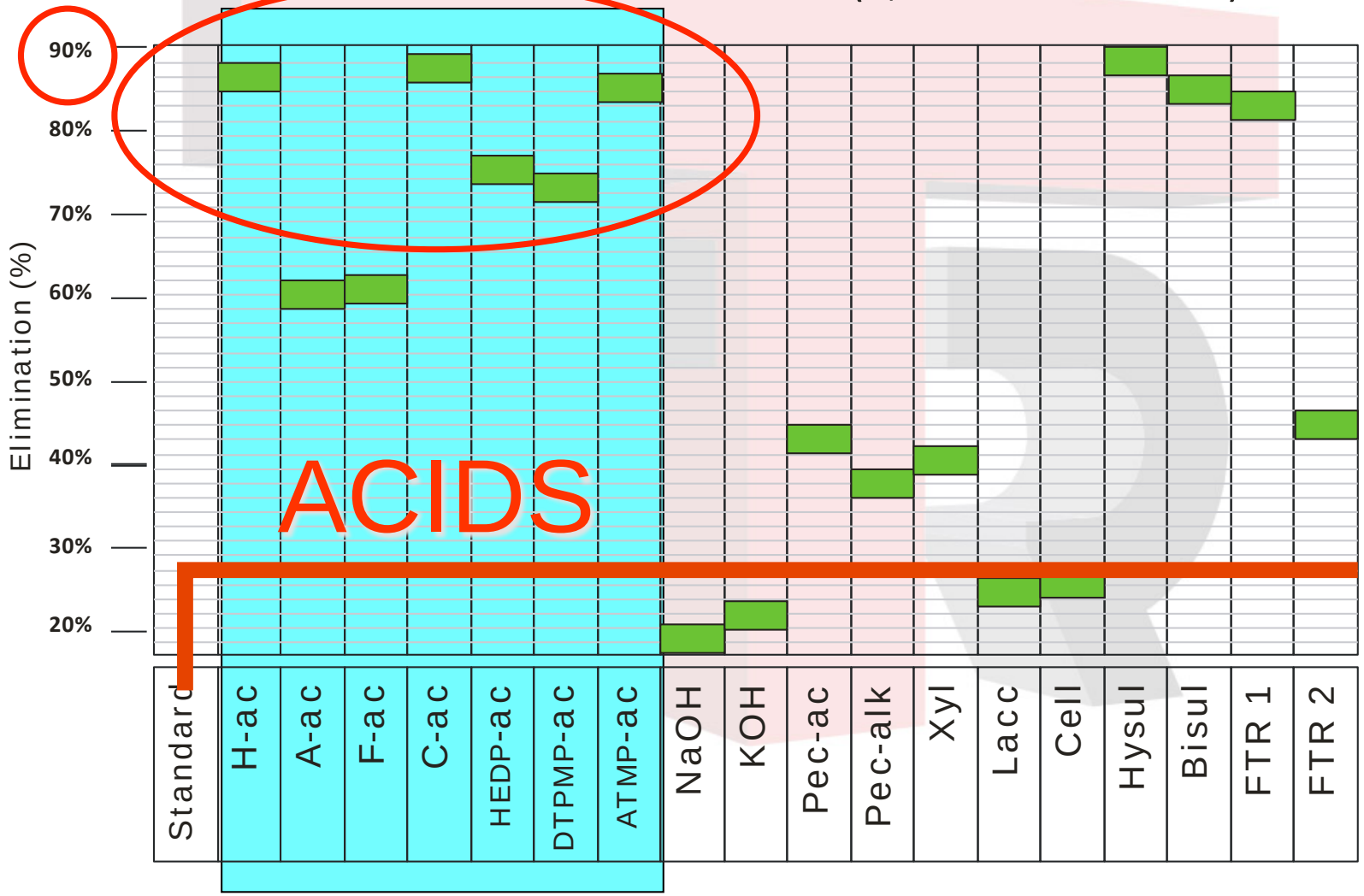
Final conclusions

The ACIDS chemicals add to an enzymatic desizing

Encrease the elimination of

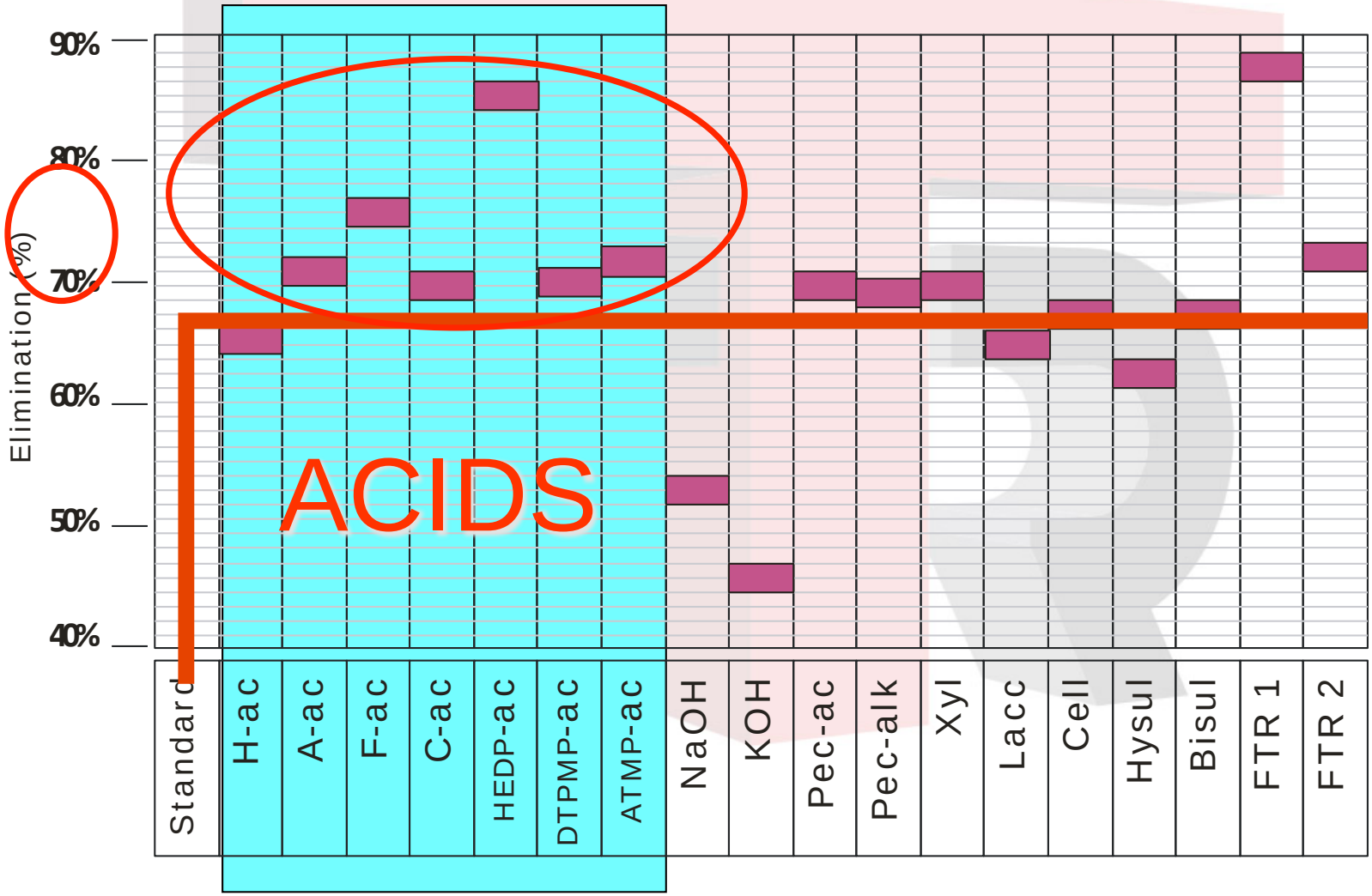
IRON ions residual

Colorimetric determination (1,10 fenantrolina)



Encrease the elimination of PEC TINS residual

oxalate extraxtion-gravimetric determination



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The ENZYMES add
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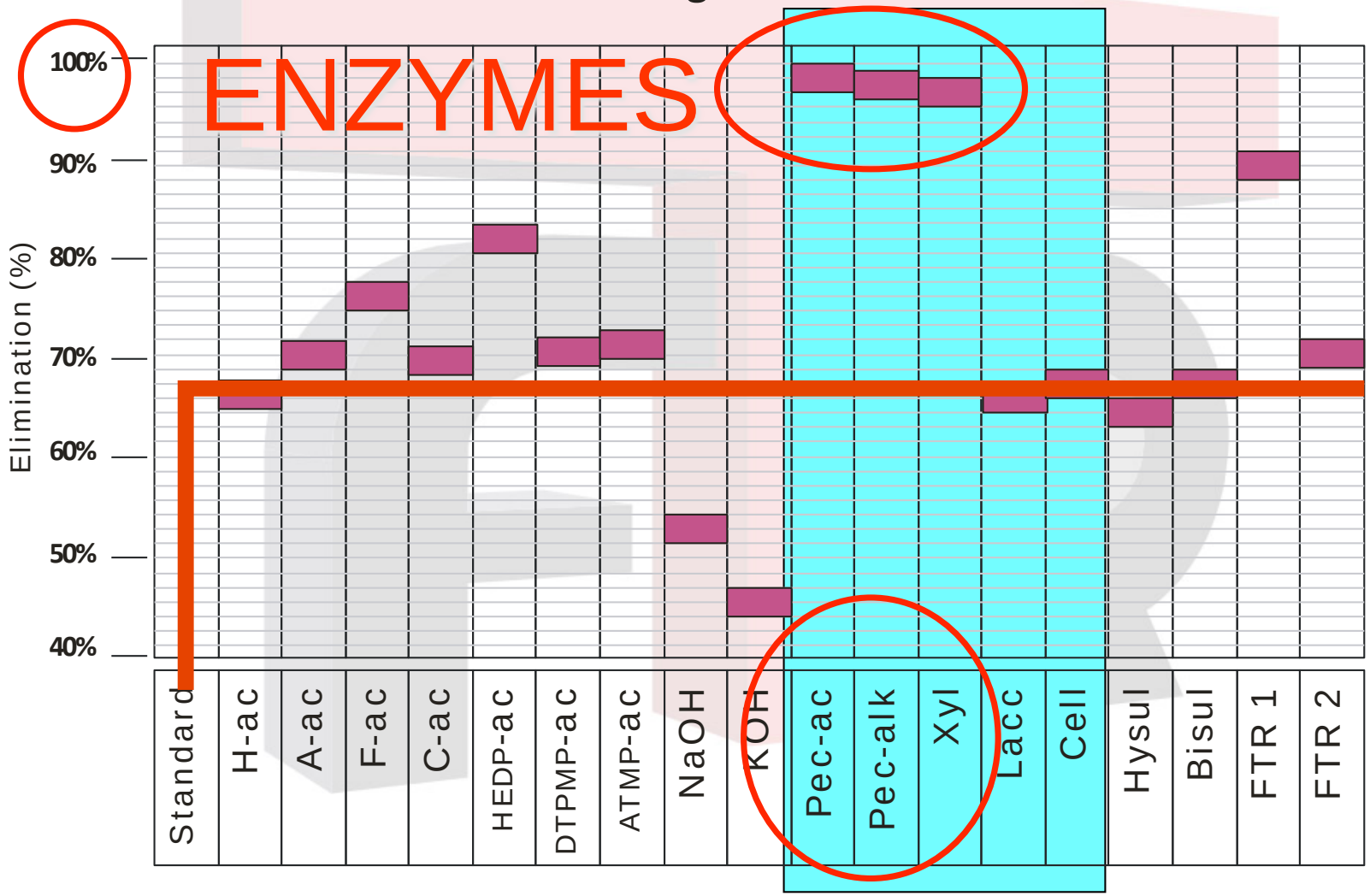
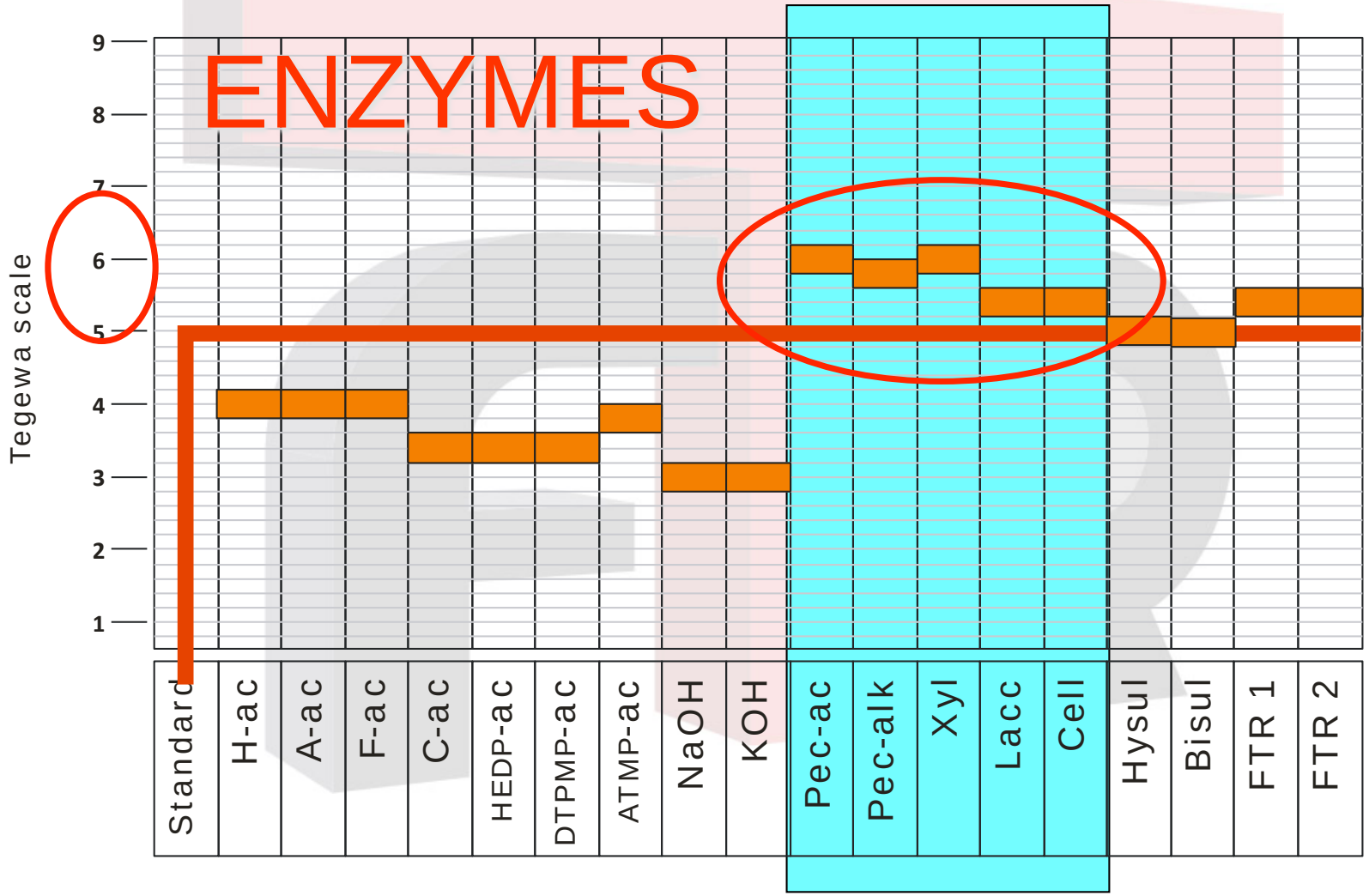
Encrease the elimination of PEC TINS residual

oxalate extraxtion-gravimetric determination



Encrease the elimination of STARCH residual

Tegewa solution Test



Final conclusions

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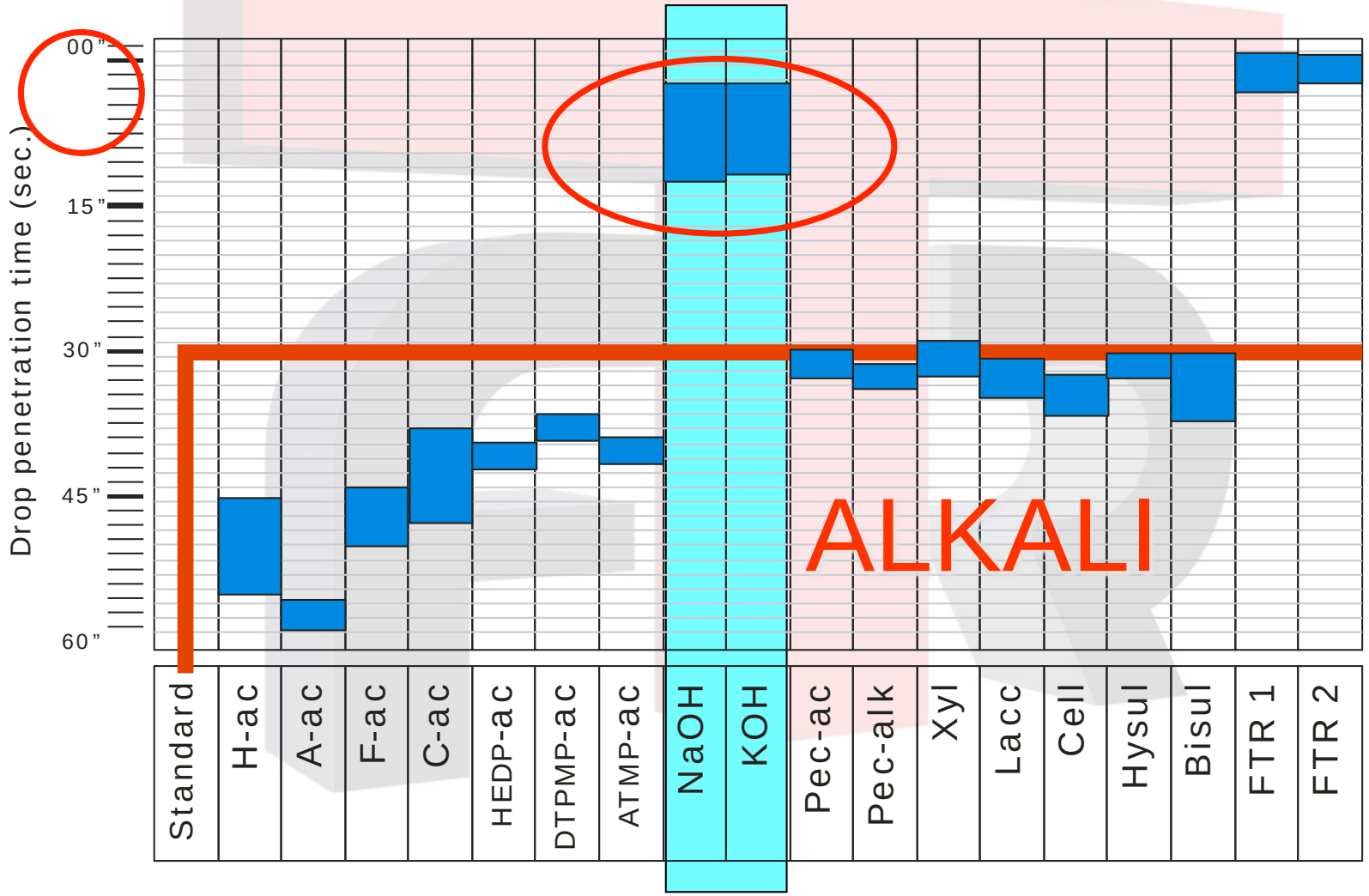
The REDUCING chemicals add to an enzymatic desizing

The ENZYMES add to an enzymatic desizing

The ALKALINE chemicals add to an enzymatic desizing

Encrease the degree of HYDROPHILITY

Drop Test determination



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The application of
INNOVA system
to an enzymatic desizing

Encrease the degree of HYDROPHILITY

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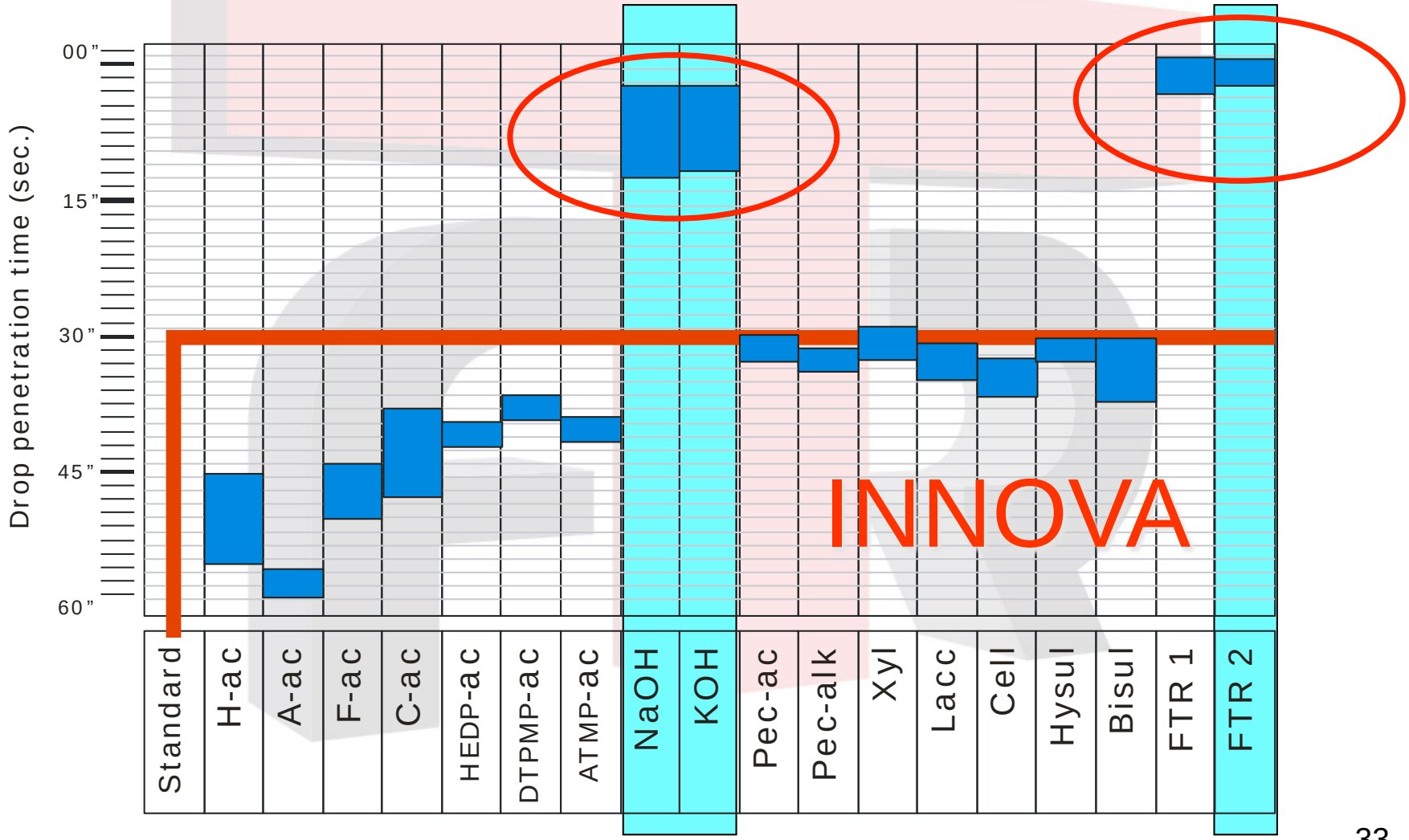

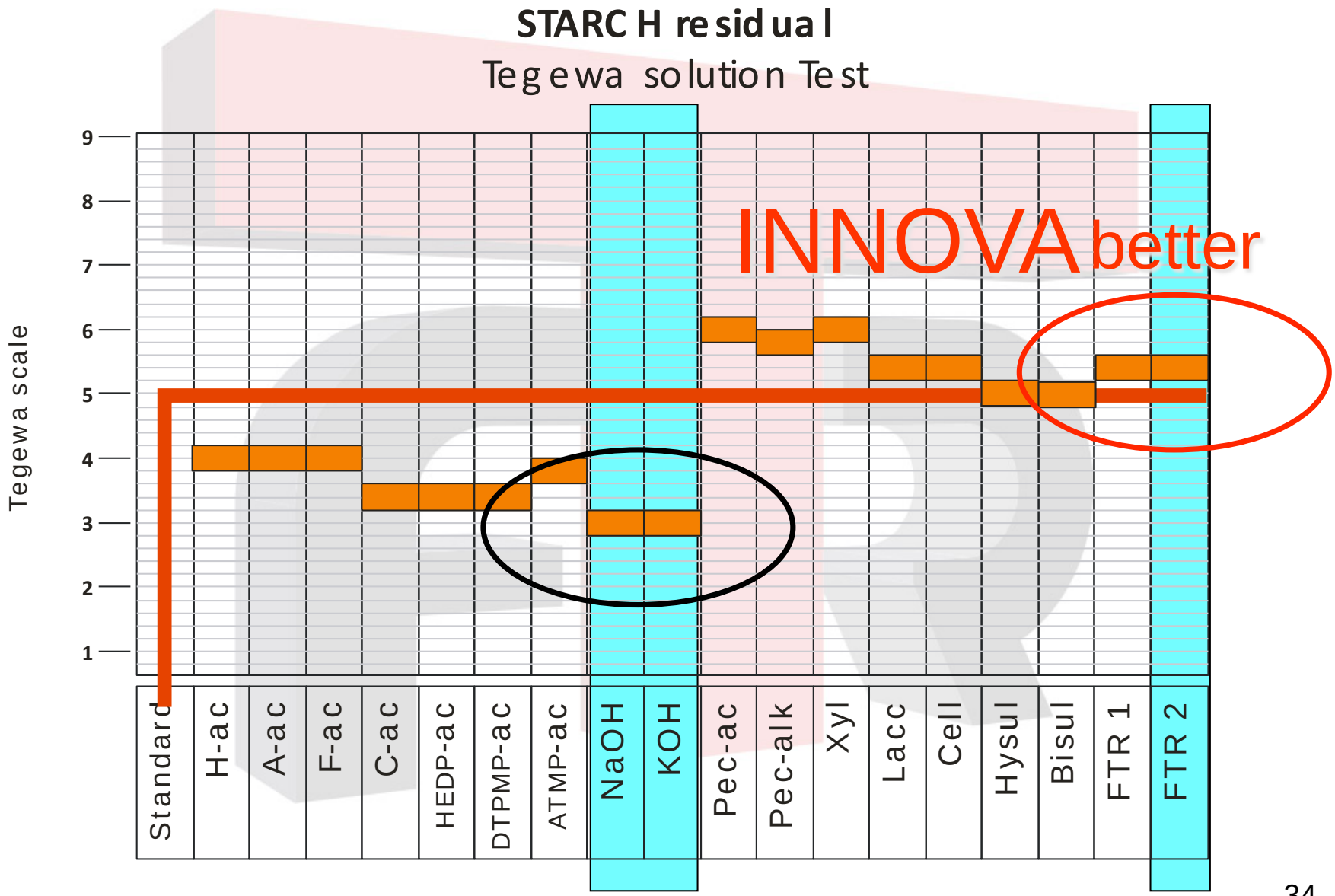
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Tegewa scale
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INNOVA better
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F-ac
C-ac
HEDP-ac
DTPMP-ac
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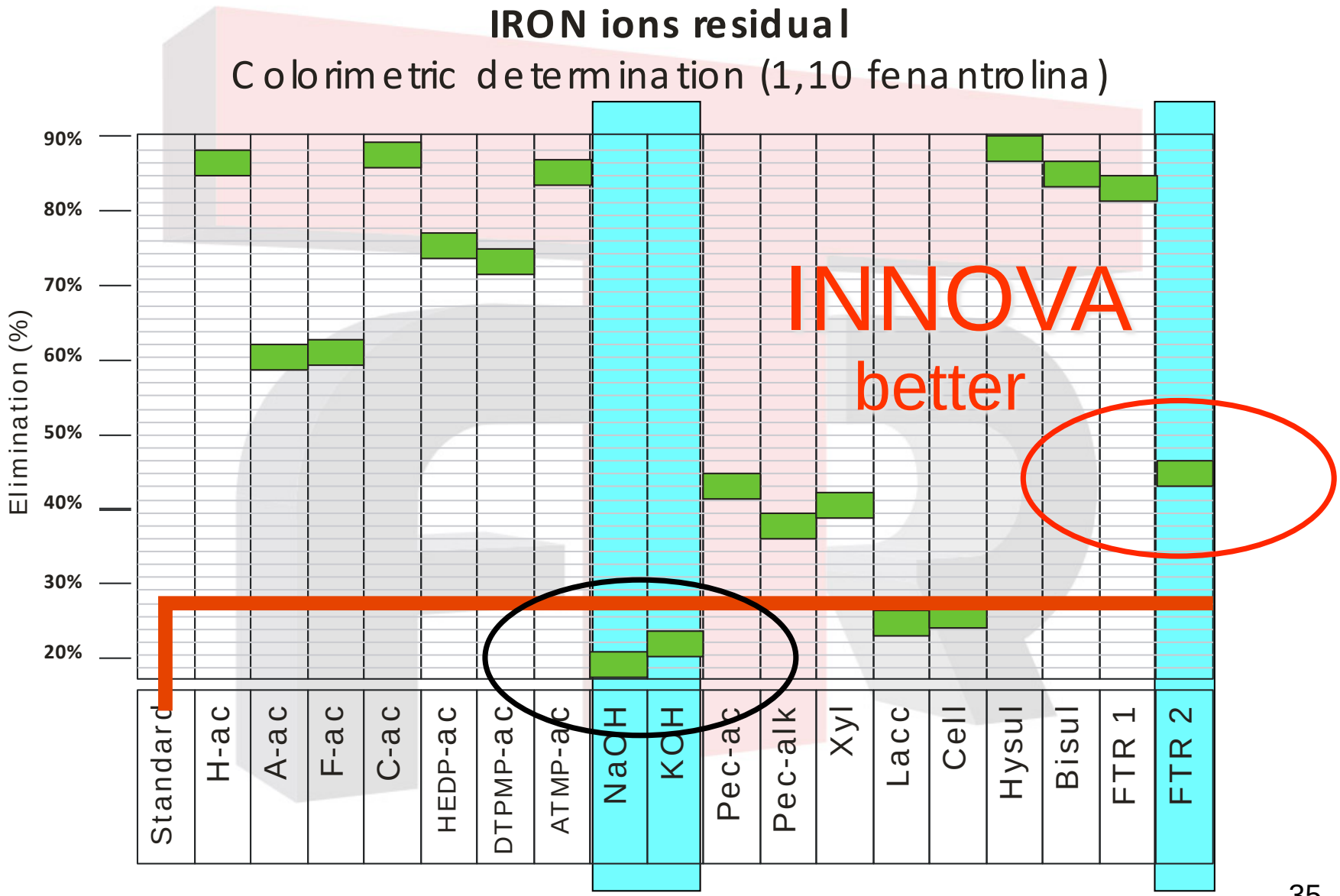
FTR 1
FTR 2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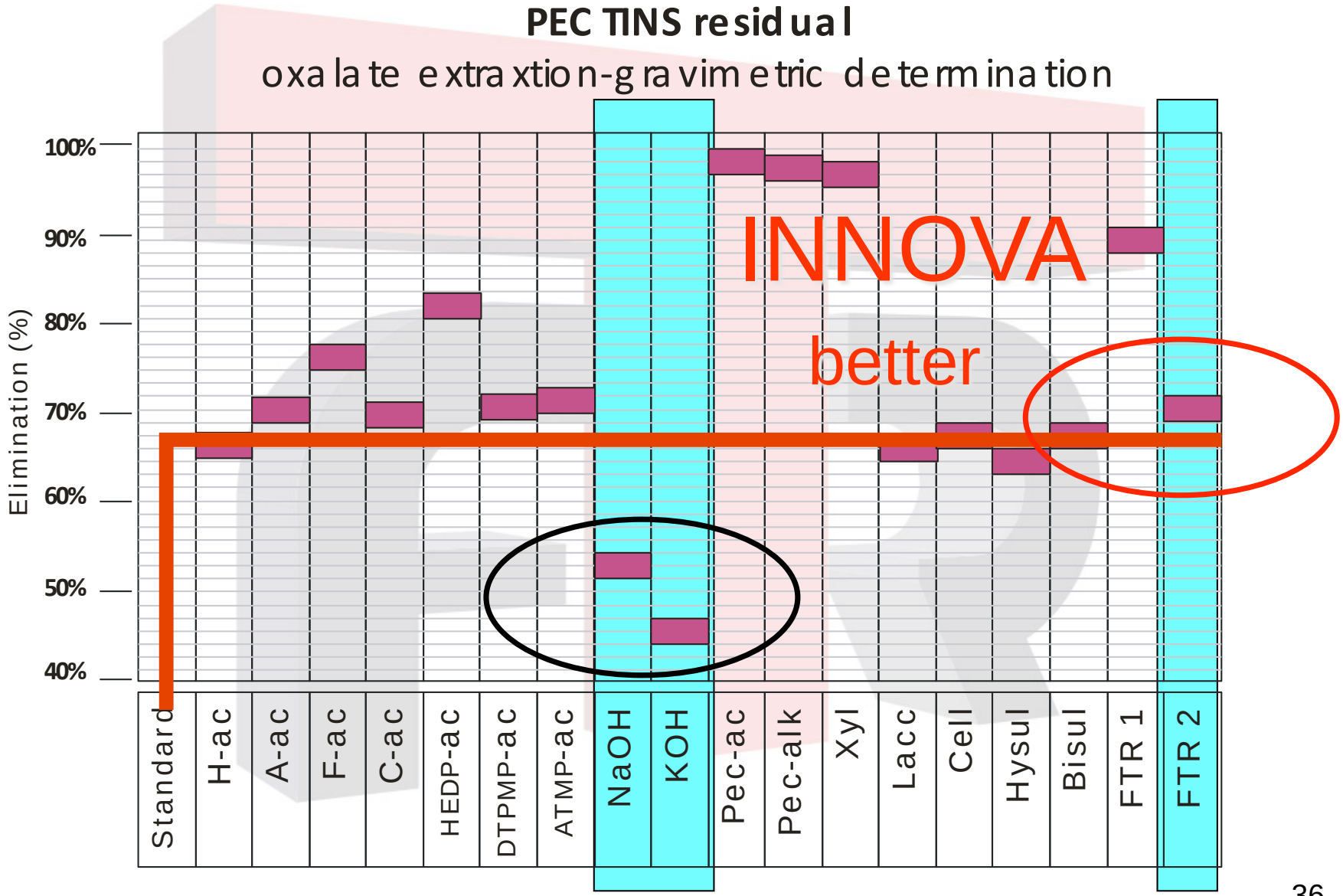
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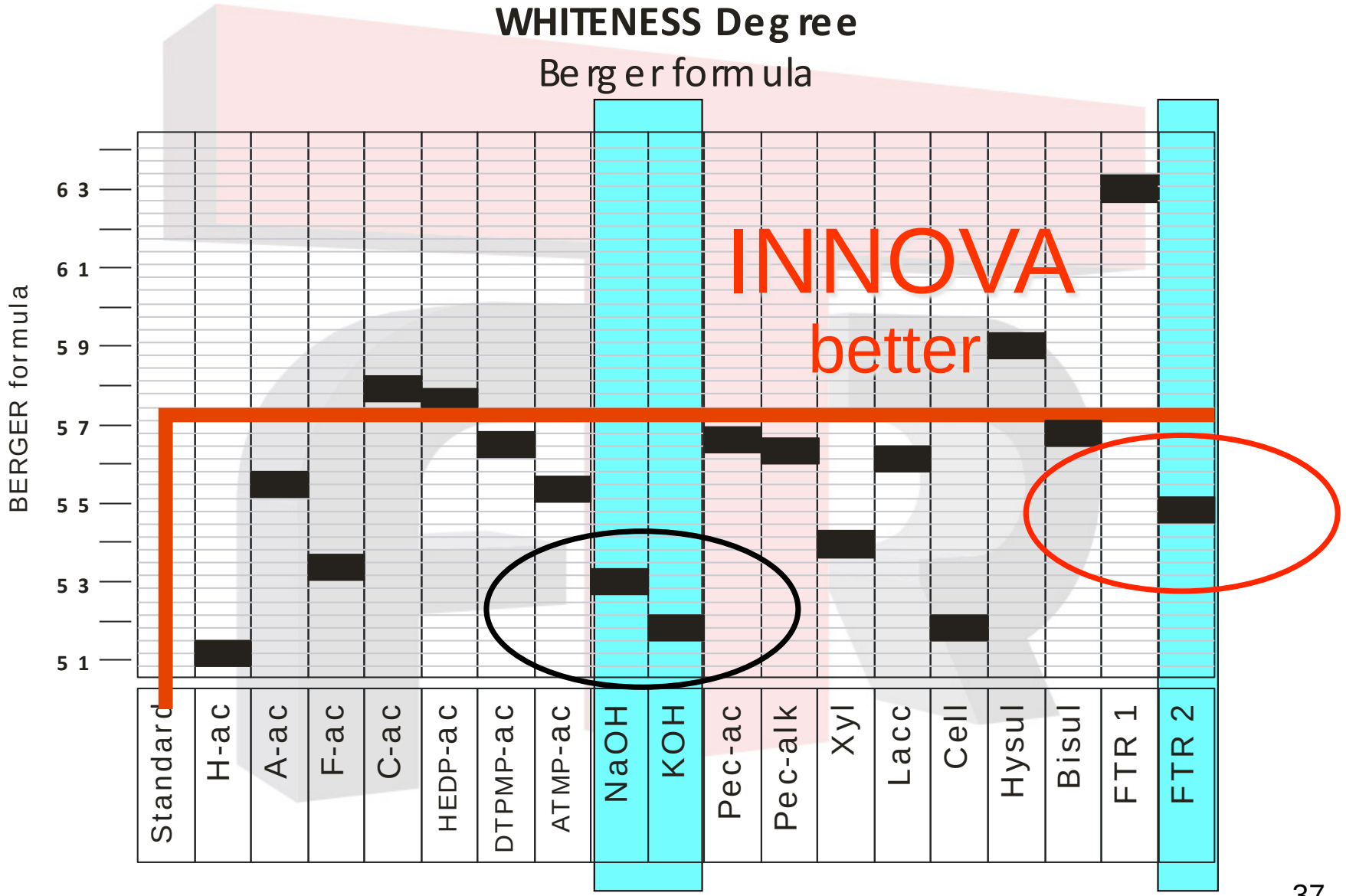
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The REDUCING chemicals add to an enzymatic desizing

The ENZYMES add to an enzymatic desizing

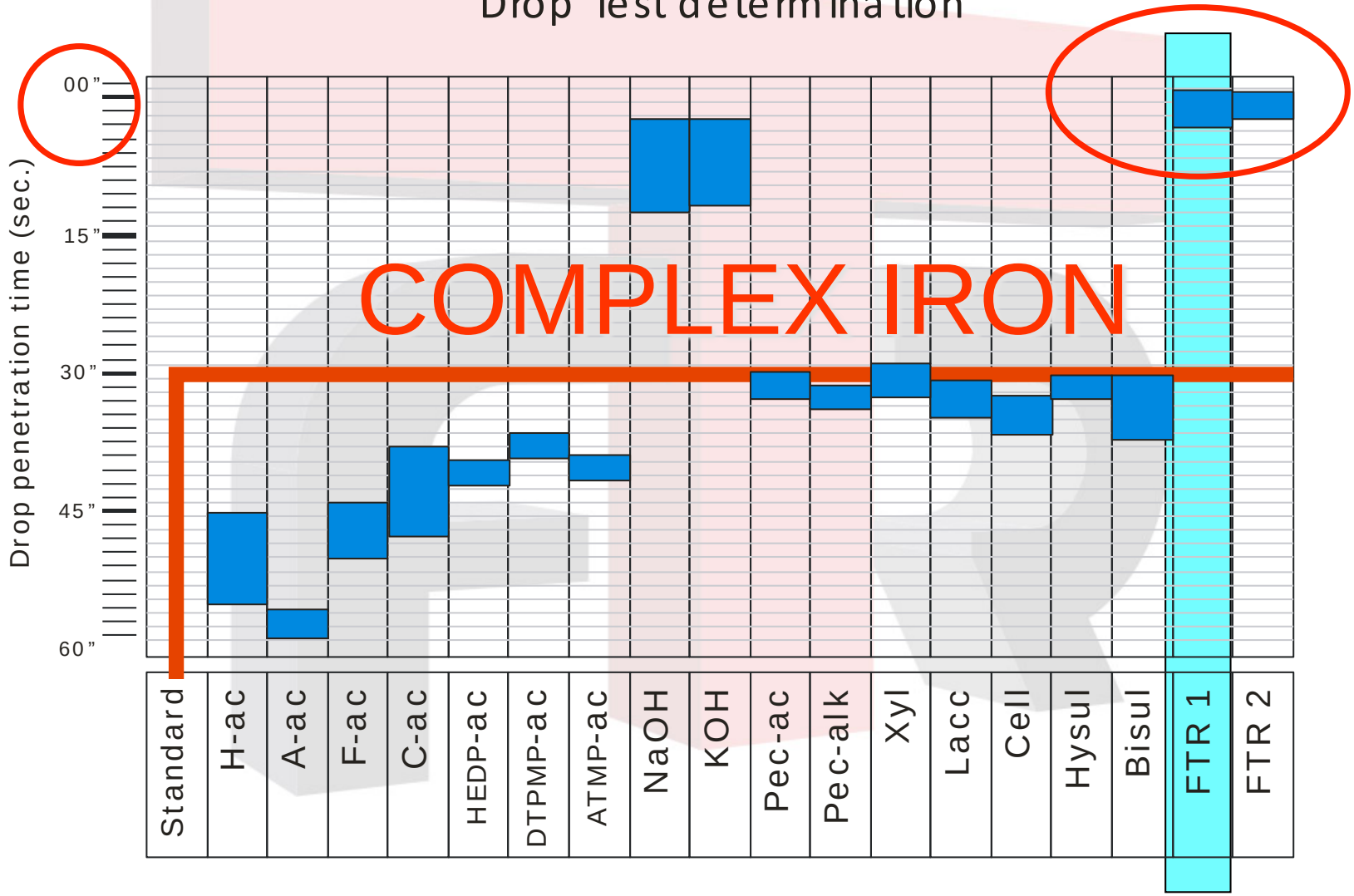
The ALKALINE chemicals add to an enzymatic desizing

The application of INNOVA system

The application of COMPLEX IRON system

Encrease the degree of **HYDRO PHILITY**

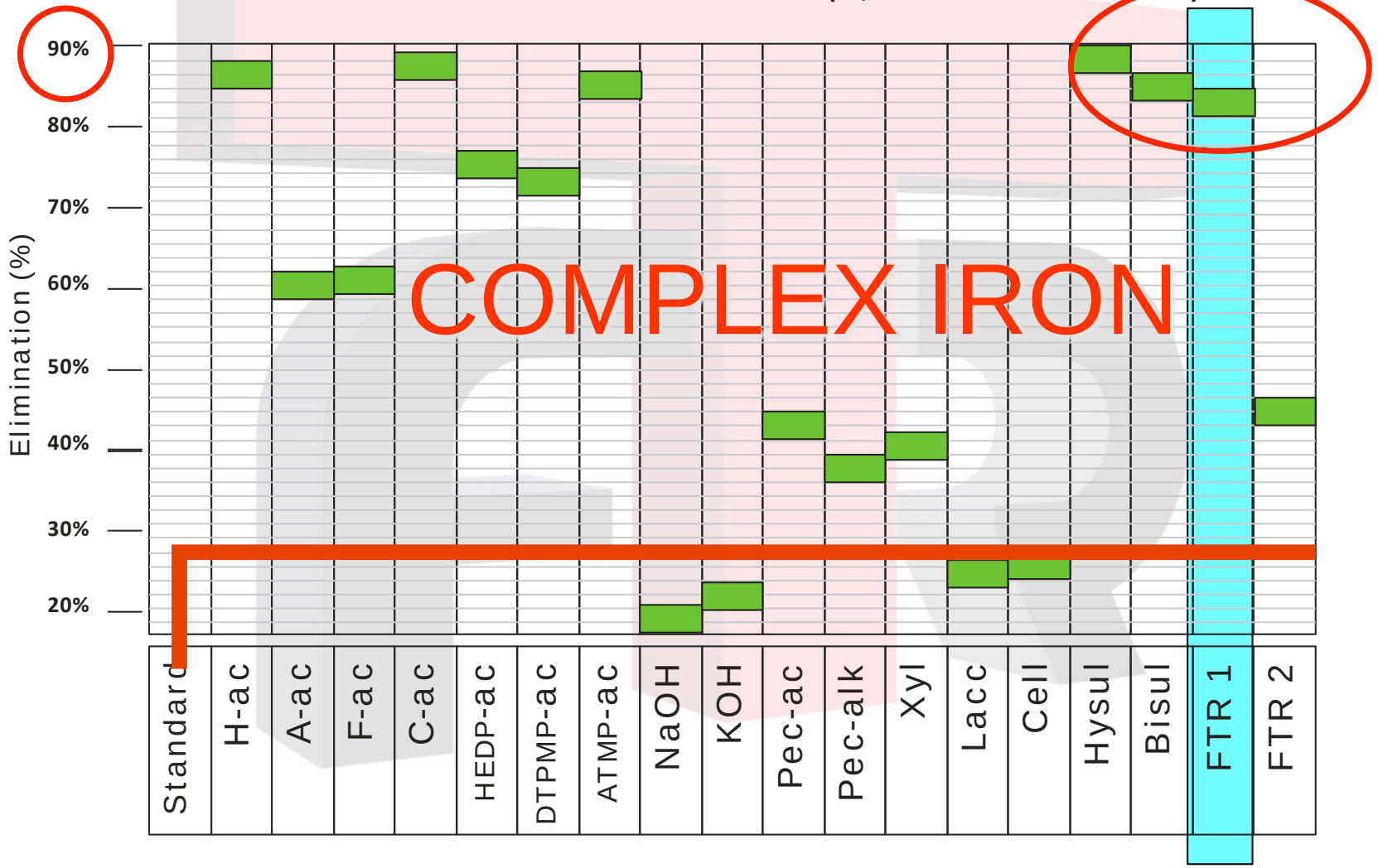
Drop Test determination



Encrease the elimination of

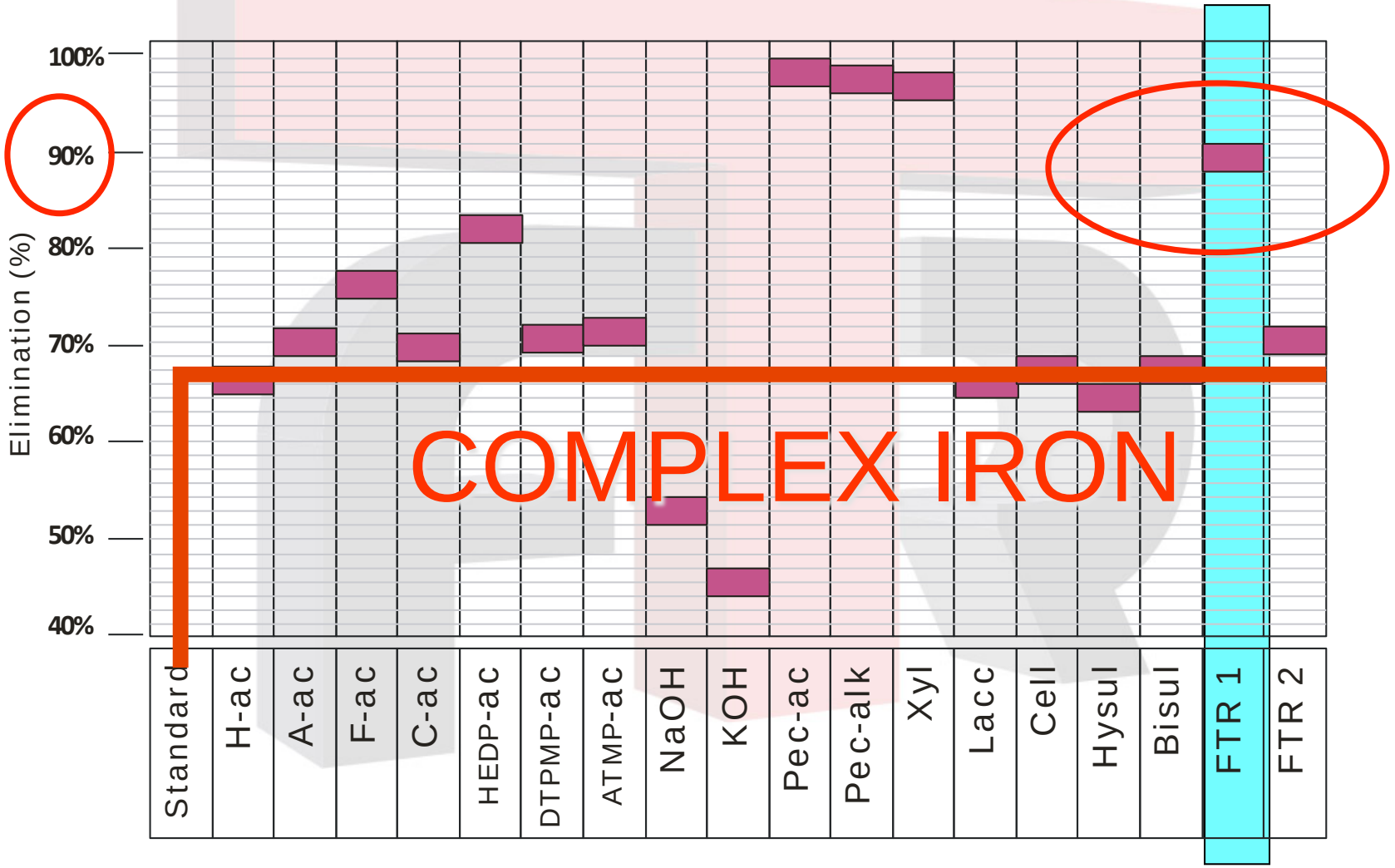
IRON ions residual

Colorimetric determination (1,10 fenantrolina)



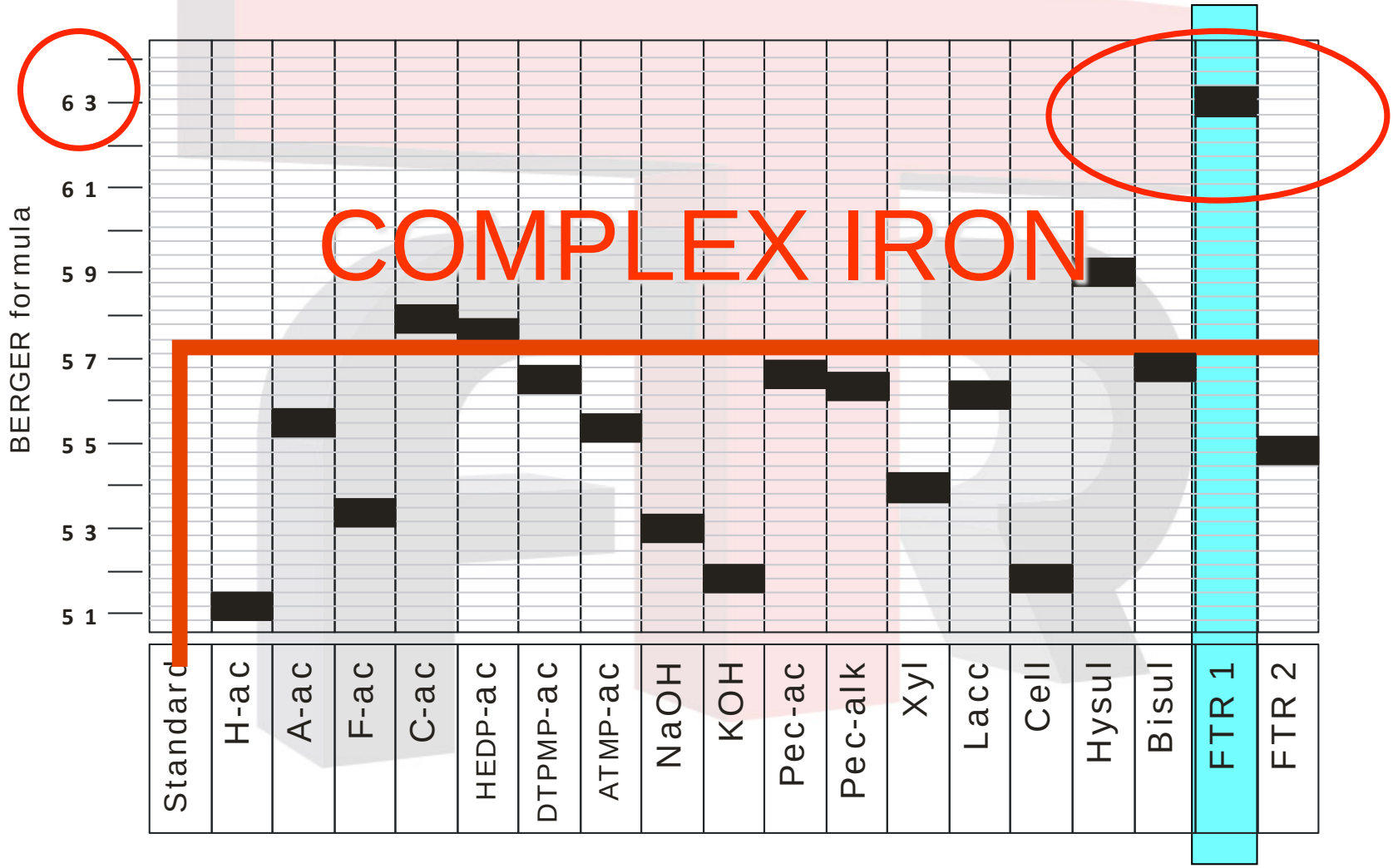
Encrease the elimination of PEC TINS residual

oxalate extraxtion-gravimetric determination



Encrease the degree of WHITENESS Degree

Berger formula



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The ENZYMES add to an enzymatic desizing

The ALKALINE chemicals add to an enzymatic desizing

~~The application of INNOVA system~~

The application of COMPLEX IRON system

encrease the efficacy of the enzimatic desizing process

Thank you very much for your kind attention