CHELATING AGENTS MANAGEMENT TO OBTAIN TCF BLEACHED *Eucalyptus grandis* KRAFT PULPS I: SELECTING THE BEST SEQUENCE

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OBJECTIF

- **This work studies phosphonates performance when added in laboratory Kraft *Eucalyptus grandis* TCF bleaching O-Q-Op-P.**

JUSTIFICATION

- **The hydroxyl radical (HO•):**
  - **Extremely reactive**
  - **Attacks cellulose as well as lignin**
  - **Generated by peroxide decomposition**
  - **Reaction catalyzed by metallic ions present in pulps.**
- **Controlling organic peroxides formation and reaction in pulps will improve brightness and physical properties.**

JUSTIFICATION

- As wood itself contains Mn^{+2}, Fe^{+3}, Cu^{+2}:
  - The development of methods to control organic peroxides formation before or during the O stage is extremely valuable.
  - Metal management in an early stage of pulp production or handling could be advantageous.

CHELANT OPTIONS

- **EDTA (ethylene diamine tetra acetic acid):**
  - **Popular chelating agent in the P&P industry**
  - **Requires acid conditions**
- **An acidic stage involves:**
  - **Sulfuric acid addition**
  - **Supplementary equipment, and manipulation costs, including special materials**

CHELANT OPTIONS

- **Phosphonates (as DTPMPA):**
  - **Proved recently to be very effective in metal management**
  - **Function in strong alkaline medium**

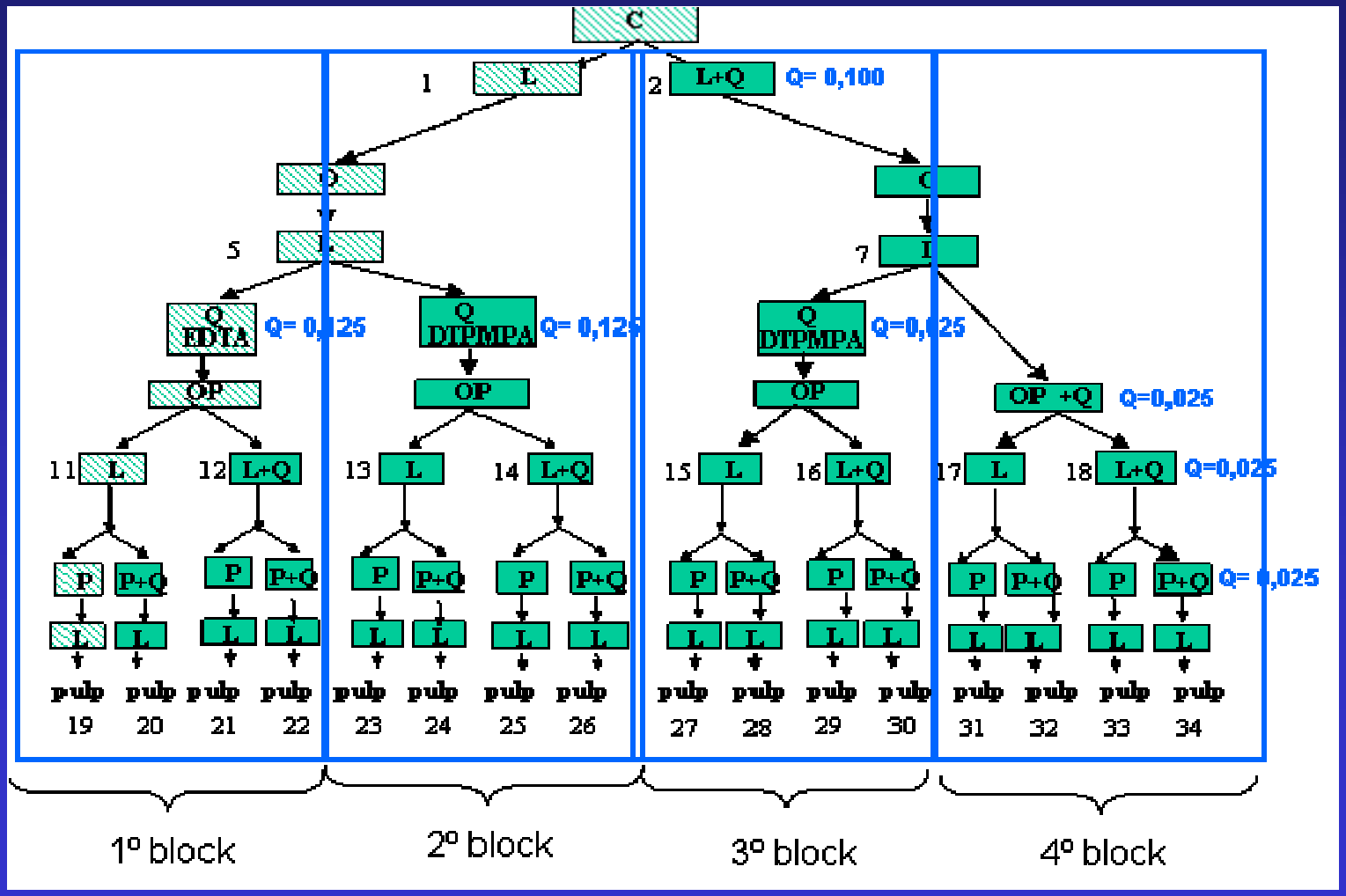
EXPERIMENTAL

- **Materials:**
  - ***Eucalyptus* (95% *grandis*) chips from Celulosa Argentina, Capitán Bermúdez mill**
  - **Phosphonates were provided by Solutia Inc**
- **Kraft pulp final Kappa number: 16-17**

EXPERIMENTAL

- **Design included trials as:**
  - **Sequences of brown stock washed with DTPMPA**
  - **A control sequence using a classical EDTA Q stage**
  - **EDTA and DTPMPA combinations**
  - **Q stage elimination**
- **34 final pulps were studied**

TOTAL EXPERIMENTAL DESIGN

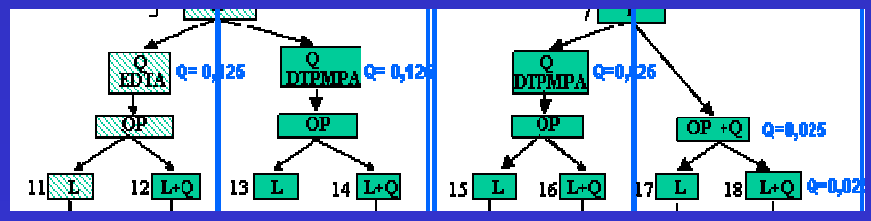


BLEACHING STAGES CONDITIONS

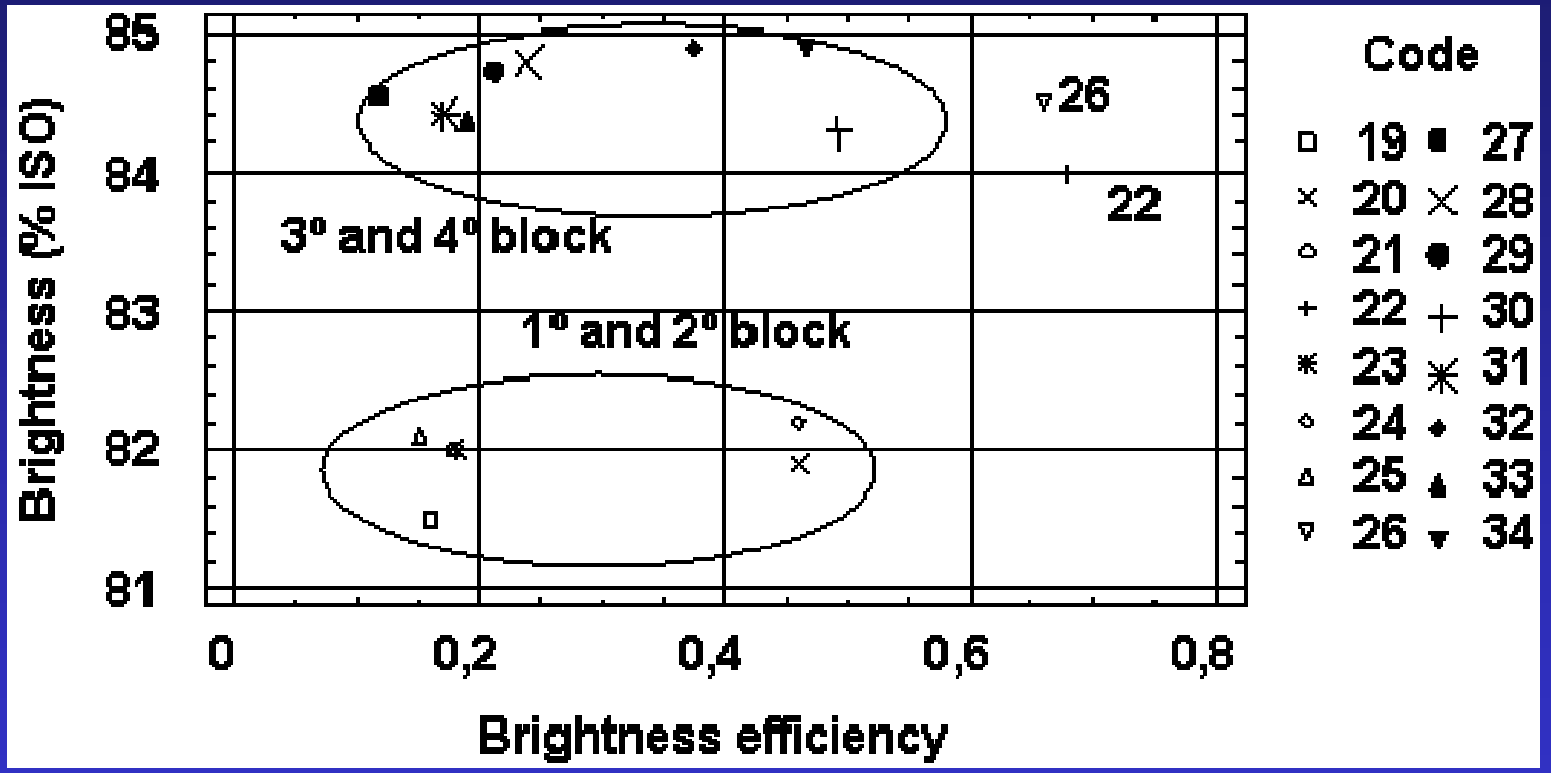
	O	Op	Q_{EDTA}	Q_{DTPMPA}	P
O_2 Pressure (kg/cm^2)	6	6	--	--	--
Consistency (%)	10	10	3	3	10
Temperature (ºC)	100	100	60	60	90
Time (min)	30	120	30	30	2
NaOH (odp %)	2	1	--	--	1.5
SO_4H_2 (odp %)	--	--	0.3	--	
H_2O_2 dosed (odp %)	--	1	--	--	3
Chelant charge (odp %)	--	--	0.125	0.125	0.025
pH	--	--	5.5	--	--

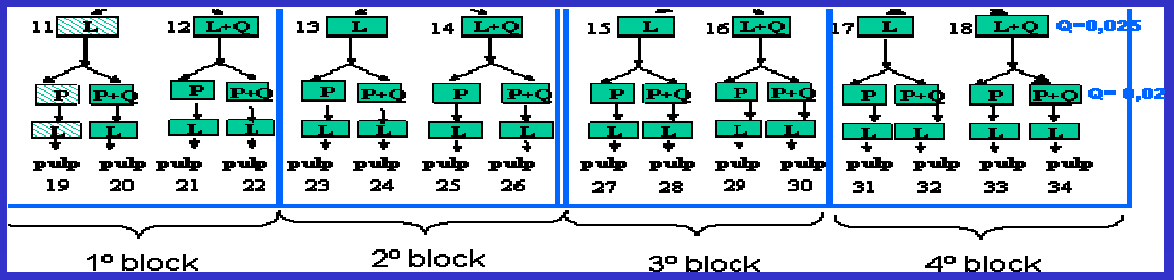
METALLIC IONS IN POST-Op PULPS

Q	Pulp	Mg (ppm)	Cu (ppm)	Fe (ppm)	Mn (ppm)
Q_E	11	359	< 0.1	3.79	0.89
Q_E+L_D	12	378	< 0.1	4.30	0.65
Q_D	13	427	< 0.1	3.52	1.09
Q_D+L_D	14	445	< 0.1	4.71	0.64
L_Q+Q_D	15	422	< 0.1	3.65	0.54
$L_Q+Q_D+L_D$	16	420	< 0.1	3.11	0.18
$L_D + Op_D$	17	509	< 0.1	3.53	0.75
$L_D+Op_D+L_D$	18	487	< 0.1	4.06	0.29



RESULTS
OF FINAL PULPS





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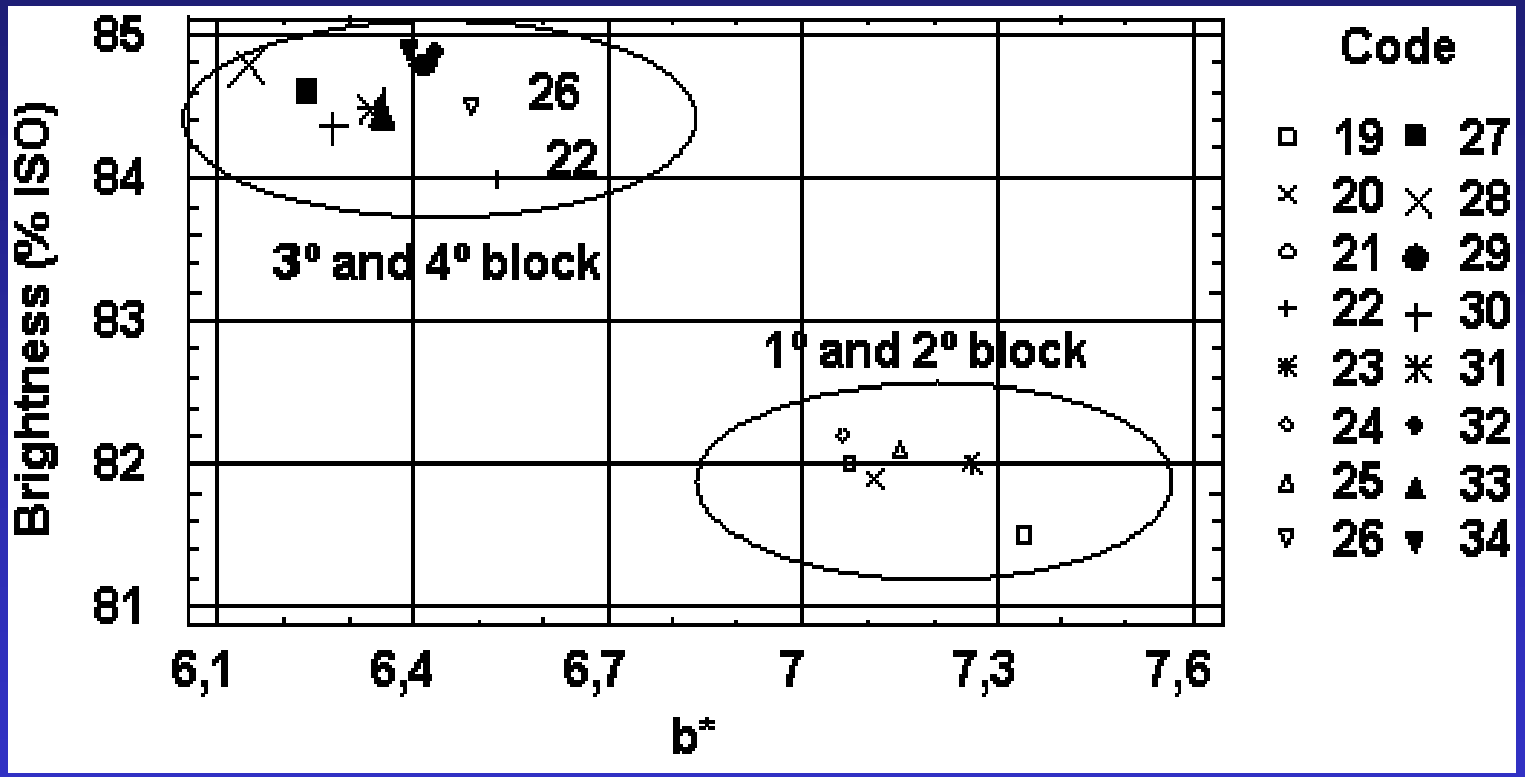

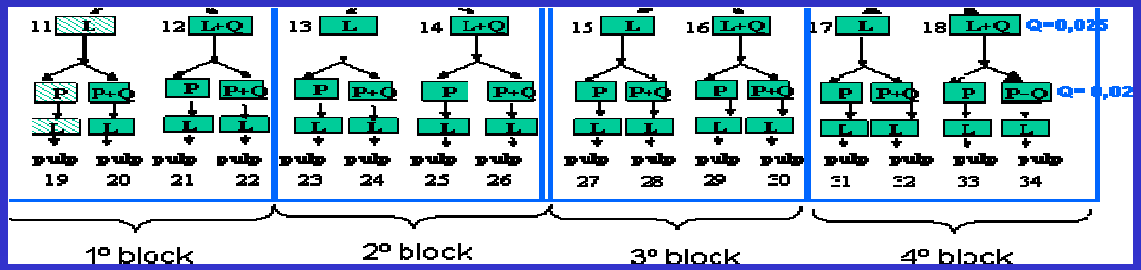

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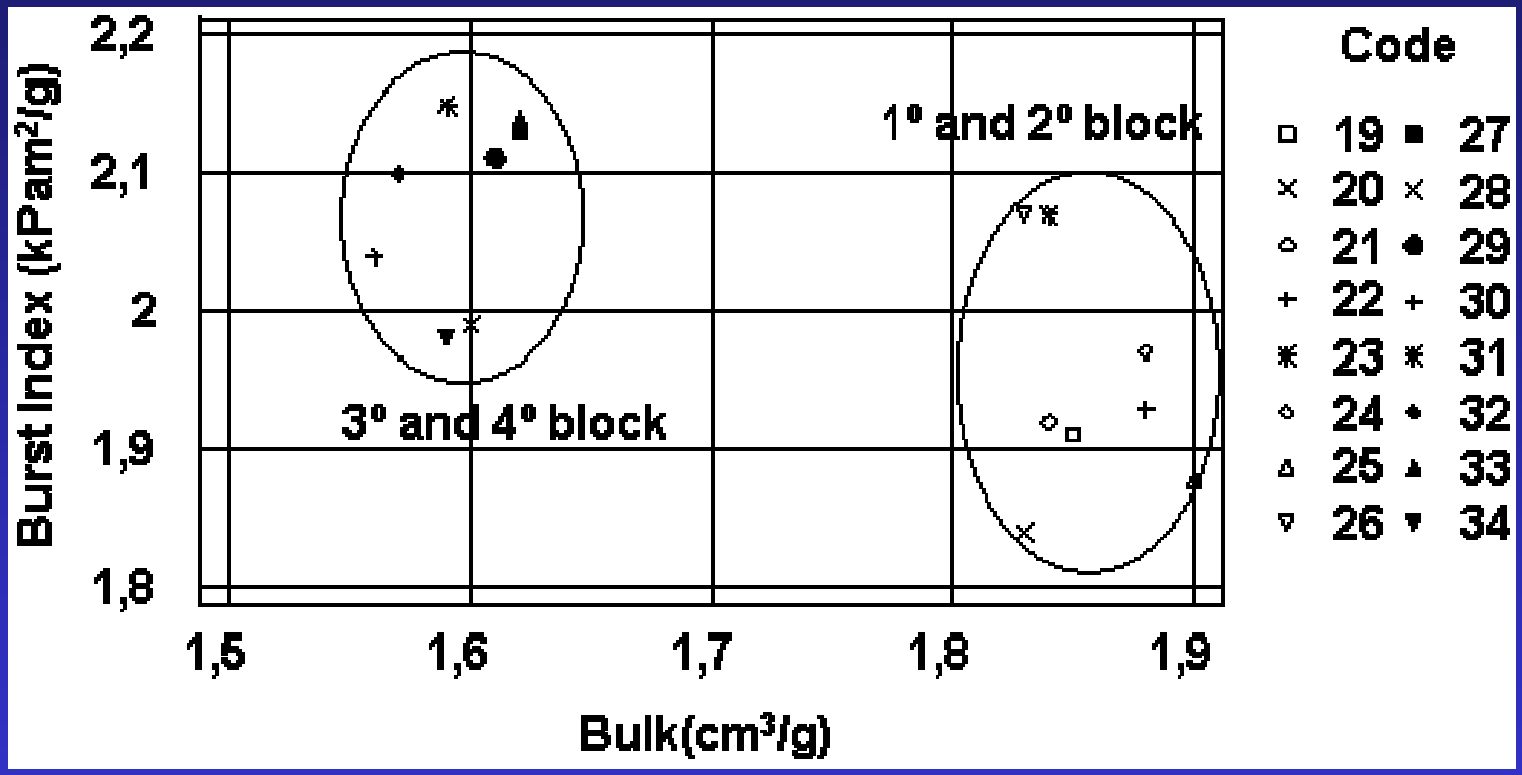

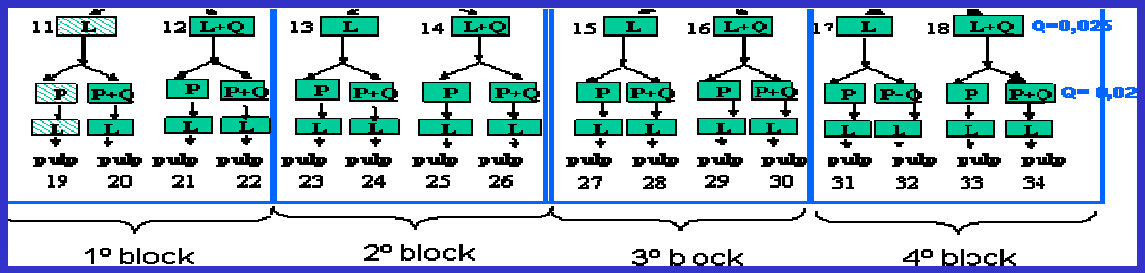

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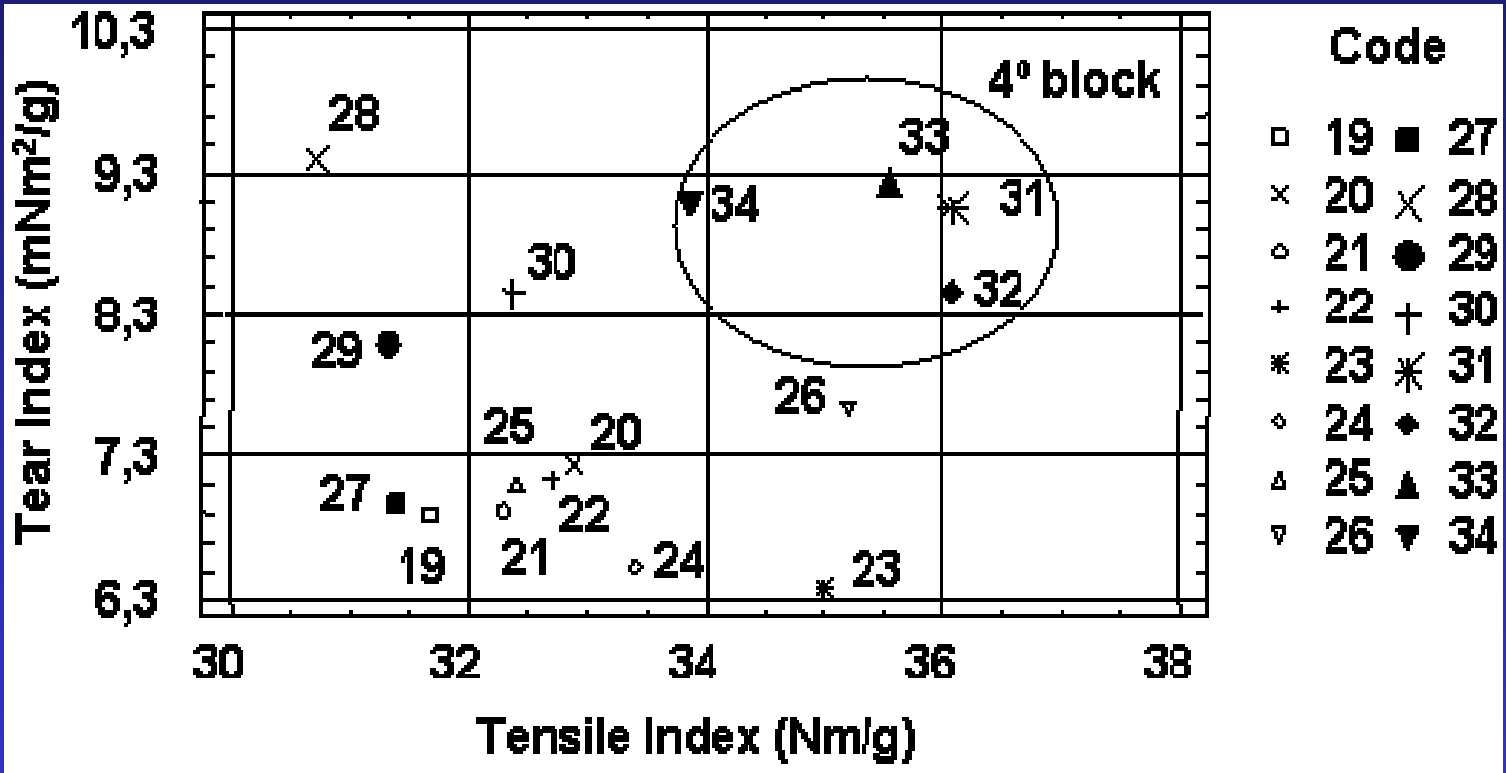
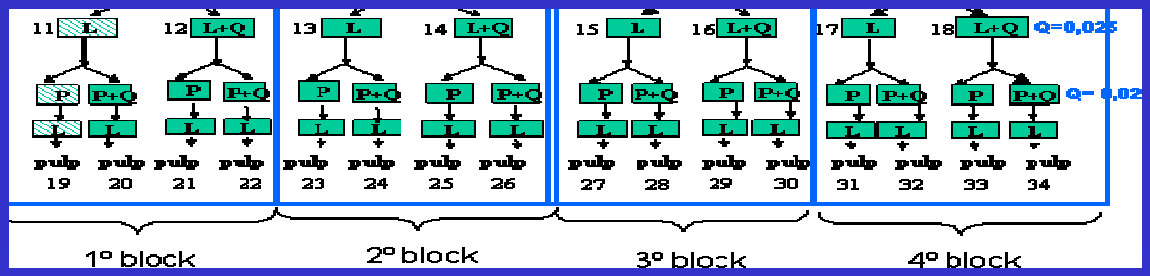
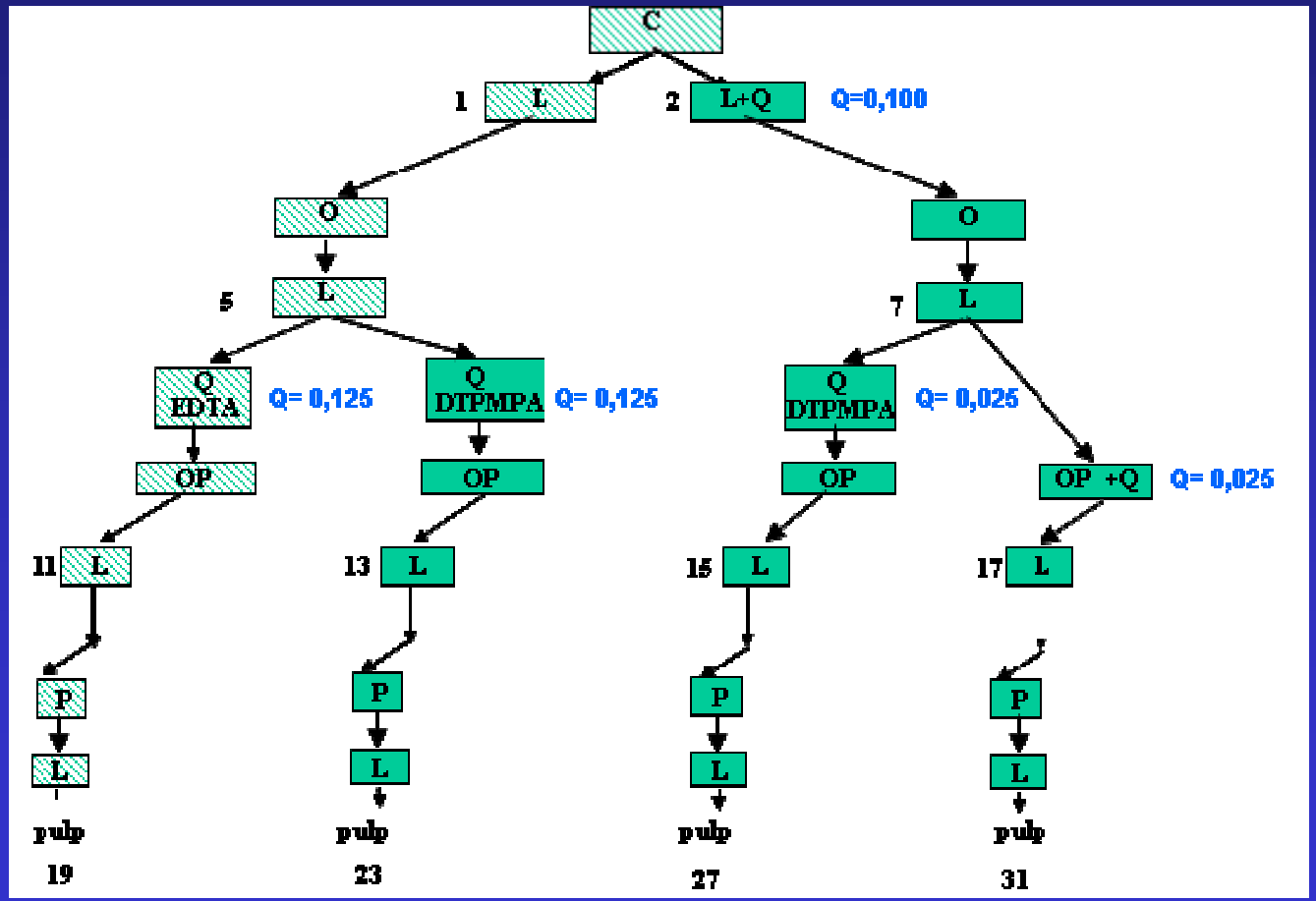


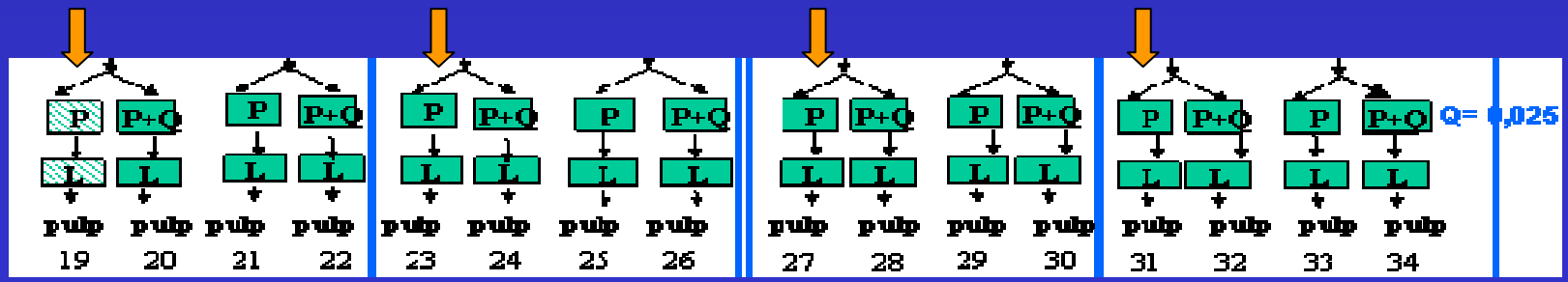


PULPS COMPARISON BY CHELANT LOAD (0,125 odp %)



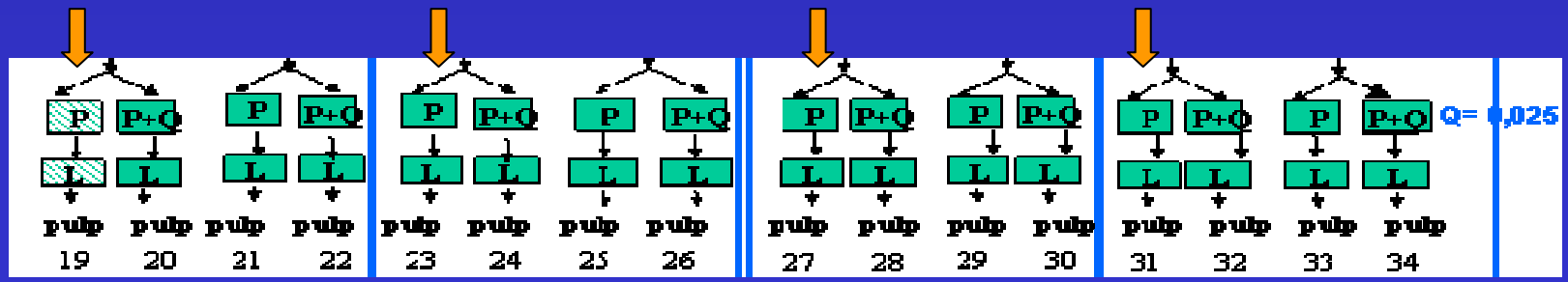
PULPS COMPARISON BY CHELANT LOAD (0,125 odp %)

- Pulp 19 (control, EDTA in Q stage), presents generally:
  - Low brightness, high peroxide consumption, and poor physical properties.
- Pulps 27 and 31 attain brightness levels near 85% ISO.

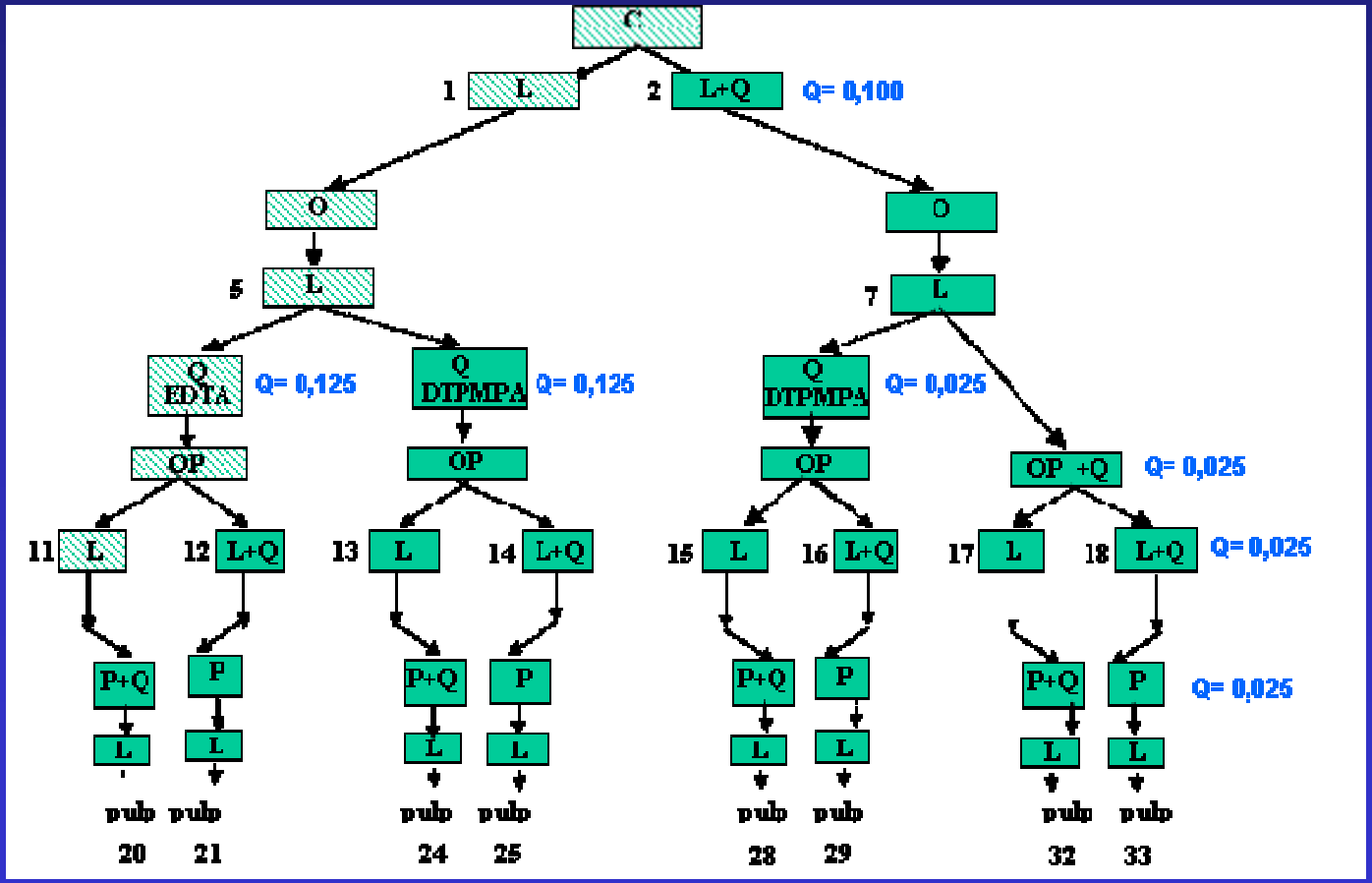


PULPS COMPARISON BY CHELANT LOAD (0,125 odp %)

- Pulp 27 shows low peroxide consumption, in comparison with pulp 31:
  - Additional washing produced by the Q stage
- Pulp 31 shows:
  - Better physical properties than pulp 27
  - Great economy (without Q stage)

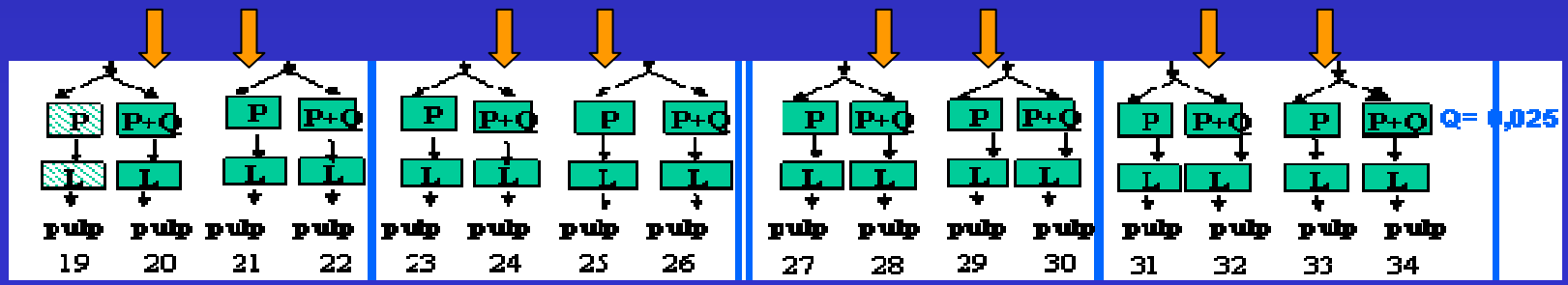


PULPS COMPARISON BY CHELANT LOAD (0,150 odp %)



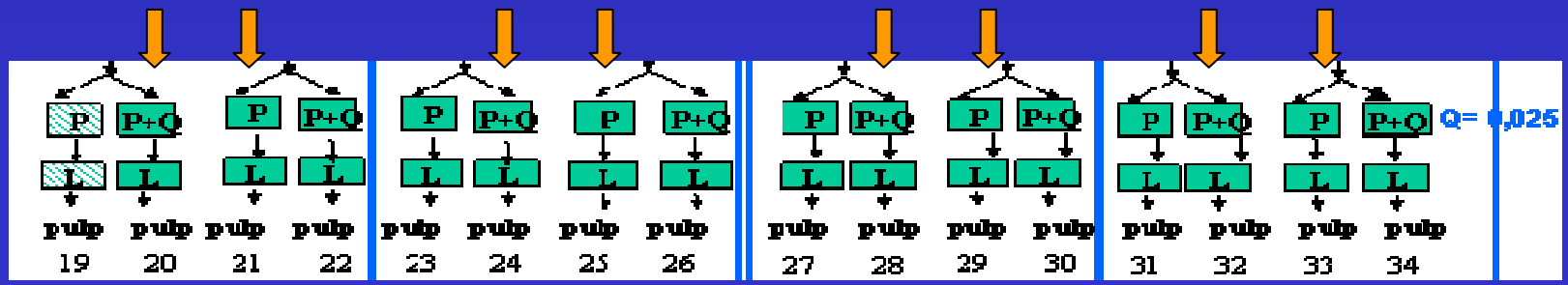
PULPS COMPARISON BY CHELANT LOAD (0,150 odp %)

- All peroxide consumptions are lower when chelant charge is 0,150 odp %, than when it is 0,125 odp %.
- DTPMPA presence in P stage reduces peroxide consumptions.



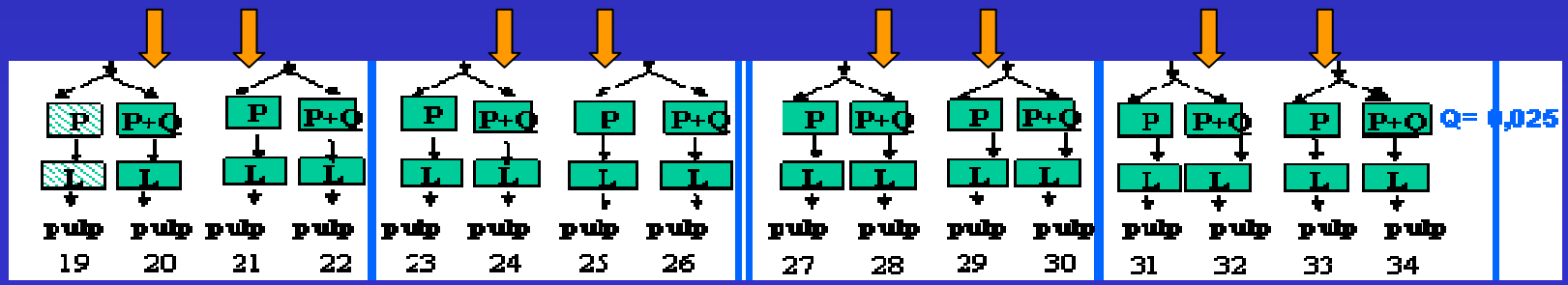
PULPS COMPARISON BY CHELANT LOAD (0,150 odp %)

- Pulps of the 3rd and 4th block (brown stock washed with chelant) present:
  - Brightness levels 2.5 ISO points (average) superior than those of the 1st and 2nd block.
  - Better physical properties than those of the 1st and 2nd block.

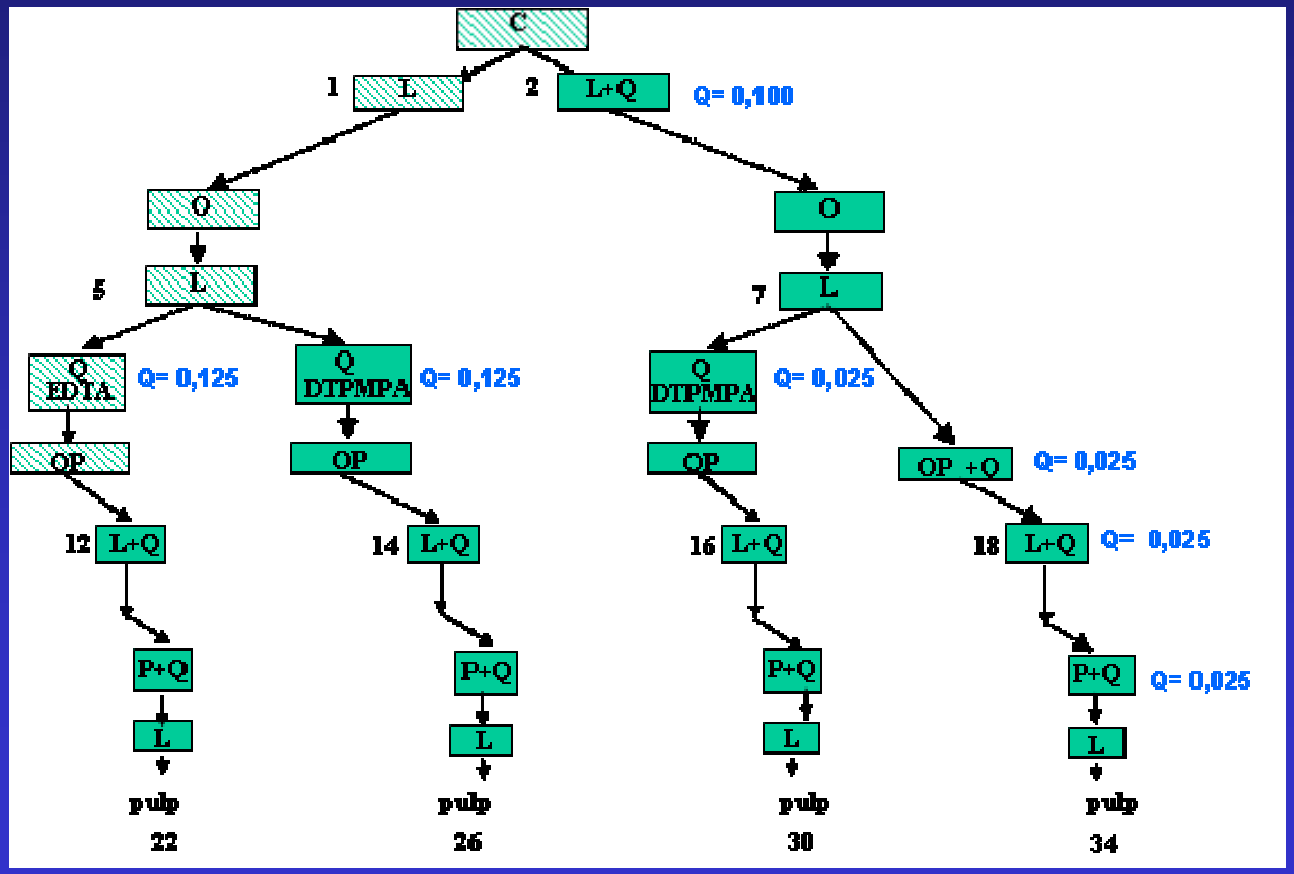


PULPS COMPARISON BY CHELANT LOAD (0,150 odp %)

- Pulps 28 and 32 reach high brightness levels (about 85 %ISO), with low peroxide consumptions.
- Pulp 28 presents lower tensile and burst strengths, and higher costs (Q stage), than pulp 32.

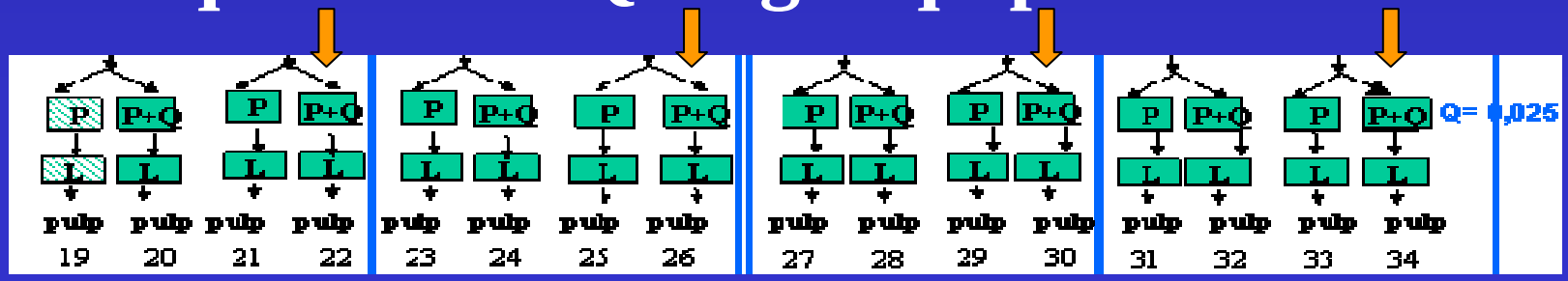


PULPS COMPARISON BY CHELANT LOAD (0,175 odp %)

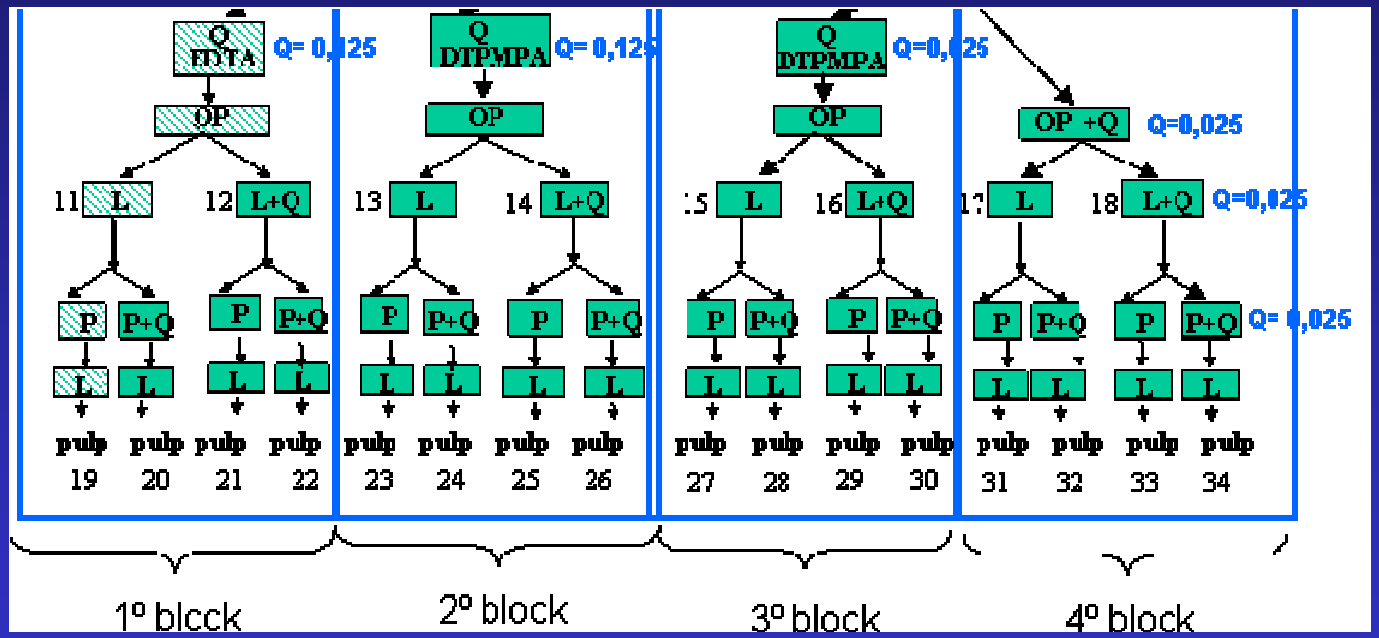


PULPS COMPARISON BY CHELANT LOAD (0,175 odp %)

- The lowest hydrogen peroxide consumption of all series, (12 - 21 %).
- Brightness levels of all pulps > 84%ISO.
- Physical properties are generally good (pulps 26 and 34 better than the others).
- Sequence 26: Q stage equipment costs.



PULPS COMPARISON BY CHELANT LOAD



TOTAL LOAD	*0,125 odp %* *(19, 23, 27, 31)*	*0,150 odp %* *(20, 21, 24, 25, 28, 29, 32, 33)*	*0,175 odp %* *(22, 26, 30, 34)*
Selection	**Pulp 31**	**Pulp 32**	**Pulp 34**

CONCLUSIONS

- Control pulp (EDTA application in Q stage) presents generally:
  - Low brightness
  - High peroxide consumption
  - Poor physical properties regarding the other studied options

CONCLUSIONS

- **Mn and Fe content in pulps is not statistically different when applying a Q stage with the same quantity of EDTA or DTPMPA.**
- **As pulp acidification is not needed when using DTPMPA, bleaching strategy is simplified in this case.**

CONCLUSIONS

- Metals removal is more efficient when chelant load is distributed between stages, than when applied only in a Q stage.
- This last strategy also preserves Mg.

CONCLUSIONS

- Optimizing the P stage of this sequence can result in 50% of peroxide residual.
- This residual can be recycled to the Op stage.
- High brightness levels and savings costs can be obtained.

CONCLUSIONS

- **Considering pulp quality and economical savings, the best choice includes:**
  - **DTPMPA in brown stock washing**
  - **Q stage elimination**
  - **DTPMPA in Op stage**
  - **DTPMPA in P stage**

ACKNOWLEDGEMENTS

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