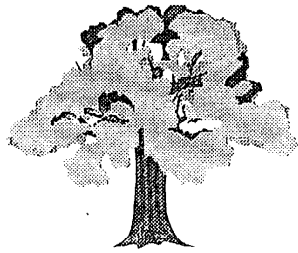


*HIGH SUBSTITUTION RATES  
AND  
ECF BLEACHING*

*A TODAY'S MUST*



Speaker: *CELSO FOELKEL*  
*RIOCELL - BRAZIL*

**RIOCELL:**

**INDUSTRIAL EXPERIENCE MAKING**

**ECF MARKET PULP**

**BY**

*CELSO FOELKEL*

*JOÃO R.B. VINHAS*

*VERA GALLARDO*

*ROSANE ESCOBAR*

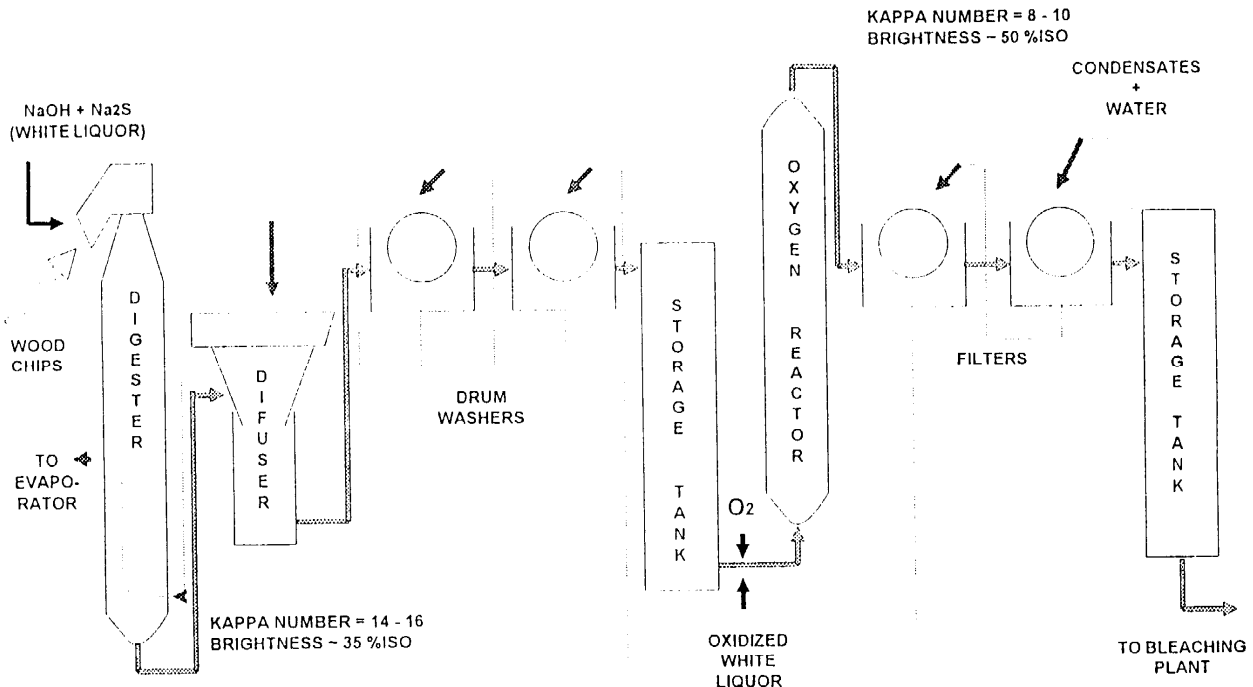
*RIOCELL S.A.*

*BRAZIL*

**WHERE THE MUST COMES FROM?**

**HOW TO COPE WITH THE MUST?**

# DELIGNIFICATION

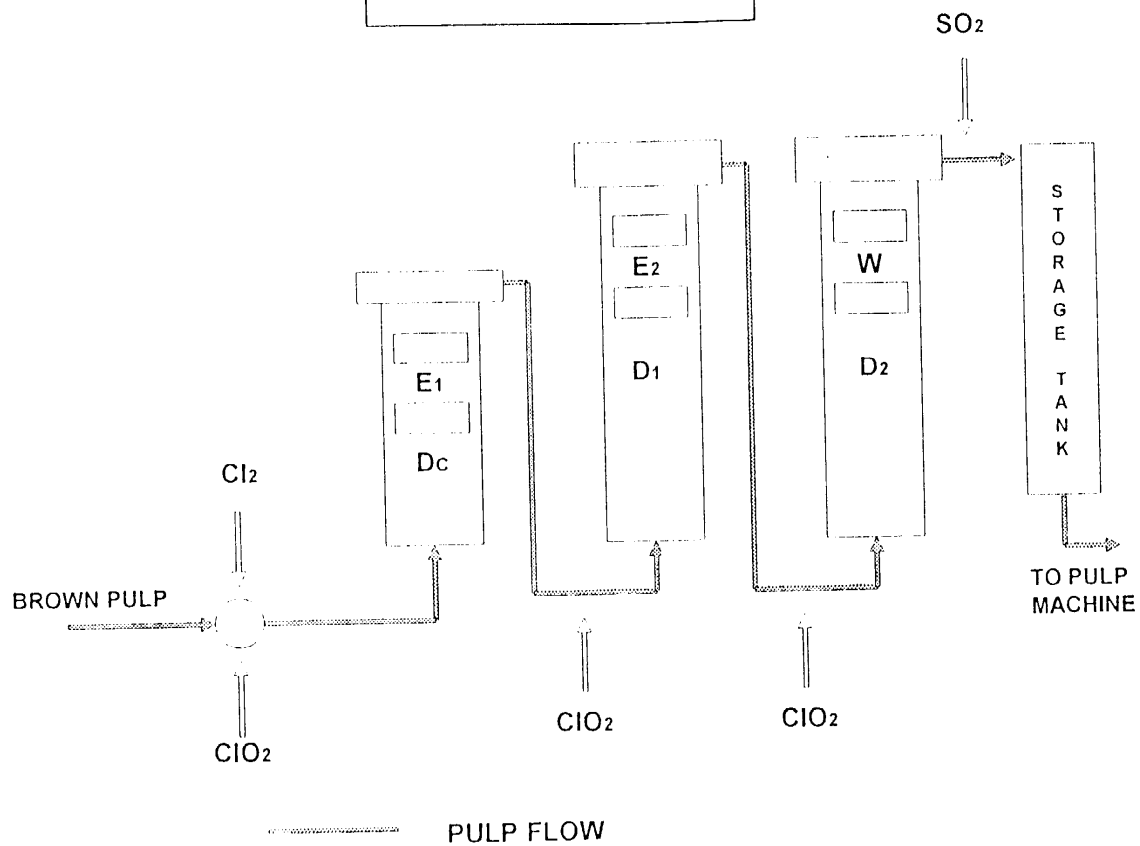


———— PULP FLOW  
- - - - - FILTRATES FLOW

## OXYGEN DELIGNIFICATION

	D(40) C(60)	D(80) C(20)	D(100)
KAPPA NUMBER AFTER DIGESTER	15.5	15.0	14.5
KAPPA NUMBER AFTER OXYGEN	10	9	8.5
BRIGHTNESS AFTER OXYGEN, % ISO	43	48	50
OXYGEN CONSUMPTION, kg/t	16	15	14.5
NaOH CONSUMPTION, kg/t	14	11	11

# BLEACHING



## BLEACHING

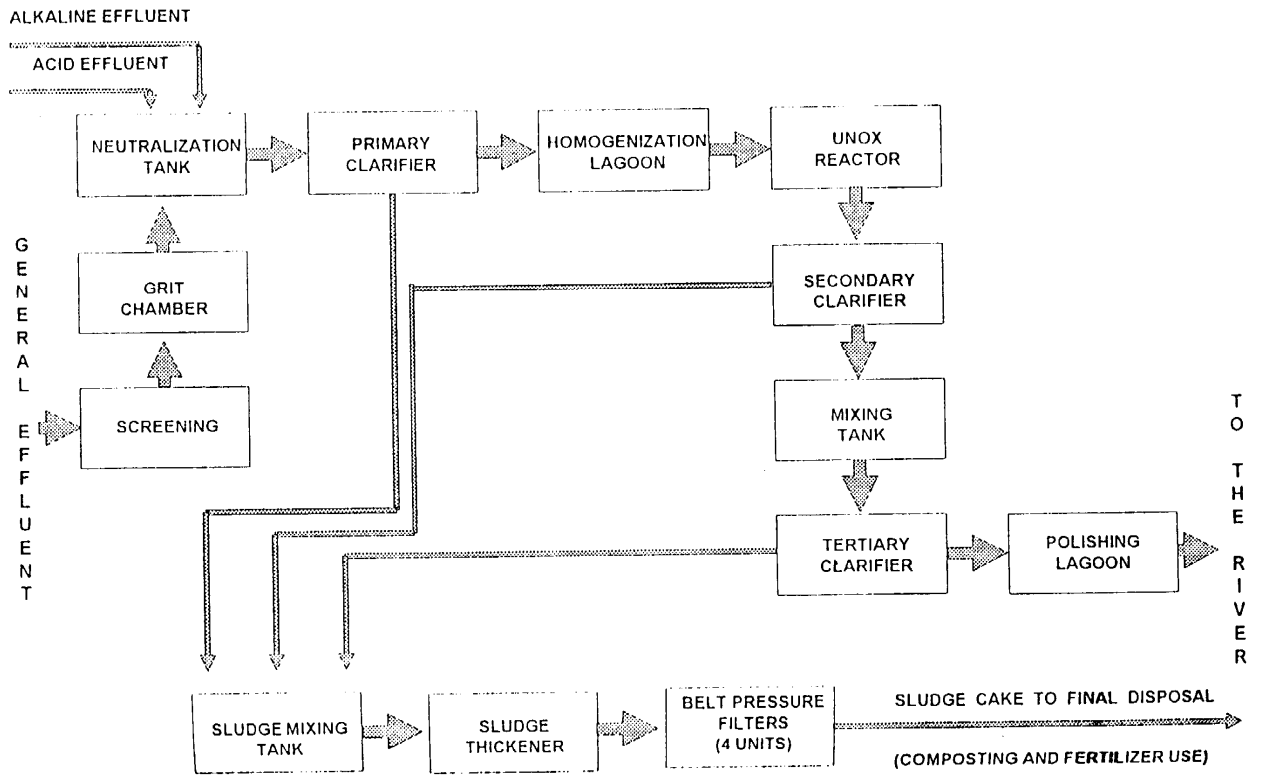
	D(40) C(60)	D(80) C(20)	D(100)
TOTAL ACTIVE CHLORINE, kg/t	65	55	54
TOTAL CAUSTIC SODA, kg/t	30	25	23
Dc - ELEMENTAL CHLORINE, kg/t	16	5	0
Dc - ClO <sub>2</sub> AS ACTIVE CHLORINE, kg/t	10	19	22
D1 - ClO <sub>2</sub> AS ACTIVE CHLORINE, kg/t	28	21	21
D2 - ClO <sub>2</sub> AS ACTIVE CHLORINE, kg/t	11	10	11
BLEACHING PRODUCTION CAPACITY	900	850	750



## BLEACHED PULP PROPERTIES

	D(40) C(60)	D(80) C(20)	D(100)
BRIGHTNESS, %ISO	90.0	89.8	89.5
INTRINSIC VISCOSITY, cm <sup>3</sup> /g	680	700	730
PULP AOX, ppm	40	30	20
PULP 2,3,7,8 TCDD, ppt	0.4 - 0.5	n.d. - 0.3	n.d.
PULP 2,3,7,8 TCDF, ppt	2.0	1.0	0.6
KAPPA NUMBER AFTER E1	1.3	1.4	2.3
VISCOSITY AFTER E1, cm <sup>3</sup> /g	820	840	920

# FLOW DIAGRAM OF RIOCELL S.A. EFFLUENT TREATMENT PLANT



## WASTE WATER TREATMENT

	D(40)		D(80)		D(100)	
	C(60)		C(20)			
	ppm	kg/t	ppm	kg/t	ppm	kg/t
<b>COD</b>						
TREATED EFFLUENT	120	4.8	80	3.2	70	2.6
RAW EFFLUENT	1400	57	1300	55	1200	50
<b>BOD</b>						
TREATED EFFLUENT	10	0.38	8	0.29	6.5	0.25
<b>COLOR</b>						
TREATED EFFLUENT	850	34	650	24	500	19
<b>CHLORIDES</b>						
TREATED EFFLUENT	700	28	400	15	380	14
<b>AOX</b>						
TREATED EFFLUENT	4.0	0.18	2.4	0.10	1.8	0.07

**CHARACTERISTICS ALONG WASTEWATER  
TREATMENT PLANT**

	AOX (kg/t)		% REMOVAL
	D(80) C(20)	D(100)	
RAW EFFLUENT	0.55	0.40	---
PRIMARY TREATMENT OUTLET	0.37	0.32	28
SECONDARY TREATMENT OUTLET	0.24	0.17	56
TERTIARY TREATMENT OUTLET	0.12	0.08	79
POLISHING LAGOON OUTLET	0.10	0.07	83

**CHARACTERISTICS ALONG WASTEWATER  
TREATMENT PLANT**

	COD (kg/t)		% REMOVAL
	D(80) C(20)	D(100)	
RAW EFFLUENT	55	54	---
PRIMARY TREATMENT OUTLET	23	25	51
SECONDARY TREATMENT OUTLET	13	15	72
TERTIARY TREATMENT OUTLET	4	3	93
POLISHING LAGOON OUTLET	3.2	2.5	95

**CHARACTERISTICS ALONG WASTEWATER  
TREATMENT PLANT**

	BOD (kg/t)		% REMOVAL
	D(80) C(20)	D(100)	
RAW EFFLUENT	18	14	---
PRIMARY TREATMENT OUTLET	9	8	47
SECONDARY TREATMENT OUTLET	0.90	0.90	94
TERTIARY TREATMENT OUTLET	0.33	0.30	98
POLISHING LAGOON OUTLET	0.28	0.24	98.2

**SAVINGS IN PRODUCTION COSTS  
BLEACHING AND WASTEWATER TREATMENT PLANT  
FROM D(40) C(20) TO D(100)**

	$\Delta$ CHEMICAL	$\Delta$ COST (US\$/t)
OXYGEN	- 9%	-0.09
CAUSTIC SODA	-27%	-2.40
CHLORINE	-100%	-1.50
CHLORINE DIOXIDE	+10%	+1.04
ALUM	-40%	-2.00
		-4.95 (TOTAL)

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Professor Johan Gullichsen, Helsinki University, Finland

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Dr. Thomas McDonough, professor, Institute of Paper Science and Technology, USA

### **3-Ozone Bleaching**

Dr. Rudra P. Singh, president & CEO, Emerging Technology Transfer, Inc, USA

### **4-Low AOX Bleaching**

Hassan L. Loutfi, corporate technical manager, Irving Pulp & Paper Mills, Ltd., Canada

### **5-Oxygen, Peroxide and Ozone Process and Equipment**

William Miller, manager, process technology, Ingersoll-Rand Co., Nashua, N.H.

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John H. Waechter, executive vice president, Weyerhaeuser Paper Co.

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Dr. Ingemar Croon, managing director, CroonConsult, Sweden

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David Clark, managing director, Confederation of European Paper Industries, Belgium

### **9-Non-Chlorine Trends in Russia**

Dr. Harry L. Akim, professor, All Russian Institute of Pulp and Paper, Russia

### **10-Bleaching of Kraft Pulps with EnZone Process**

Dr. Karl-Erik L. Ericksson, professor of biochemistry, and Dr. Jan L. Yang, University of Georgia, Athens;  
Dr. Rudra P. Singh, N.C. State University at Raleigh

## **SESSION II PAPERS: MILL EXPERIENCE WITH ECF BLEACHING**

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Douglas C. Pryke, consultant, Canada; Pertti Winter, Ekono, Inc.; Grant R. Bourree, Weyerhaeuser Canada Ltd.; Chris Mickowski, Procter and Gamble Inc.

### **12-Simpson Tacoma Mill Bleaching Trial with Low AOX Formation**

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Gene Boatwright, technical director, and Dr. Kanai Ghosh, Alabama River Pulp Co.



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John Morgan, technical superintendent, Fletcher Challenge Canada, Croften Pulp and Paper Div.

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Ismo Reilama, project coordinator, and Kosti Kukkonen, Rauma Pulp Mill, Oy Metsä-Botnia AB, Finland

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*Please Note: Submission of a paper was not a requirement of session panelists. If a paper was submitted, it is included in section 21.*

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**Brazil** - Dr. Celso Foelkel, director of technology and environment, Riocell SA

**Canada** - Hasan Loutfi, corporate technical manager, Irving Pulp & Paper Ltd.

**India** - Shailendra K. Jain, senior executive president, Grasim Industries Ltd.

**Sweden** - Dr. Jiri Basta, head of bleaching chemicals, research and development, Eka Nobel AB

**USA** - Walter Kleinberg, manager, pulp and paper processes, Airco Gasses; Dr. Malcolm Beaverstock, director, advanced technology, Automation Technology; Troy Wilks, Weyerhaeuser Co., Newborn Mill

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Erwin Funk, sr. development engineer, Aki Vilpponen, and Dr. Richard Szopinski, Kamyr, Inc.; Fred Munro, manager, E.B. Eddy Pulp Mill, Canada

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Gordon Homer, business manager, Jack Ayton, and Derek Homsey, Canadian Liquid Air Ltd., Canada

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Drs. Rajai Atalla, I.A. Weinstock, E.I. Springer, and J.L. Minor, USDA Forest Service, Forest Products Laboratory

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## **SESSION X PAPERS: PANEL ON IMPLEMENTATION OF EMERGING TECHNOLOGIES WORLDWIDE**

*Please Note: Submission of a paper was not a requirement of session panelists. If a paper was submitted, it is included in section 45.*

**45-**

**Brazil** - Dr. Celso Foelkel, director of technology and environment, Riocell SA

**Austria** - Dr. Walter Peter, production manager, Lenzing AG

**Finland** - Ismo Reilama, project coordinator, Oy Metsa-BotniaAB

**Sweden** - Dr. Peter Axegard, research director of pulp dept., STFI, Stockholm

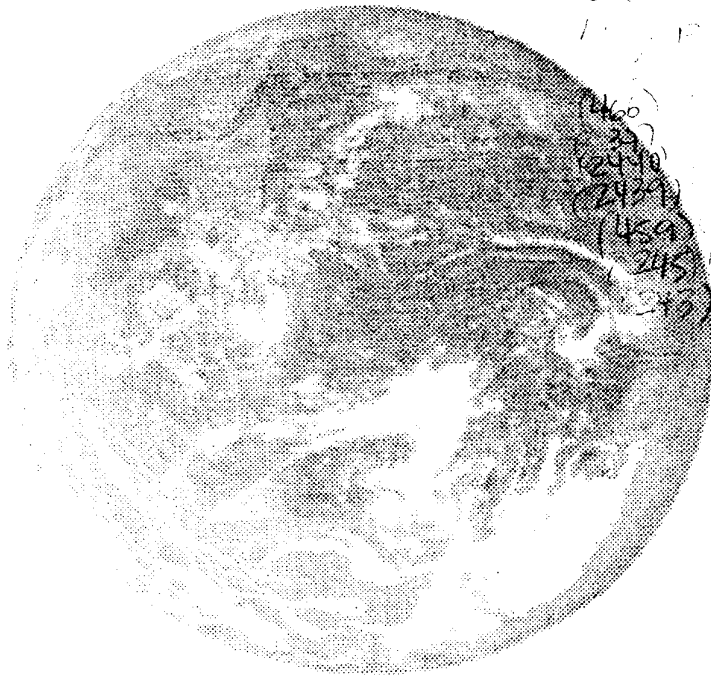
**Norway** - Dr. Peder Kleppe, vice president of technology, M. Peterson and Son AS

**USA** - Dr. Thomas McDonough, professor, IPST

**USA** - Dr. I.J. Wilk, Brincell, Inc.

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