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TRENDS AND ACHIEVEMENTS OF INDUSTRIAL ROLLS REPLACING THE NATURAL RUBBER BY SYNTHETIC RUBBER 1/

by

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I.- INTRODUCTION

I WAS KINDLY REQUESTED BY UNIDO TO PRESENT A TECHNICAL PAPER COVERING THE APPLICATION OF SYNTHETIC RUBBER IN BRAZIL. CONSIDERING MY EXPERIENCE FOR OVER 32 YEARS IN THIS FIELD, AND WITH THE PERMISSION OF THE BOARD OF ERMA INDUSTRIAL ROLLS MF., RIO DE JANEIRO, BRAZIL, I AM PRESENTING THIS PAPER WHICH WILL SHOW THE REPLACEMENT OF NATURAL POLYMER BY SBR, IN SEVERAL ROLL FORMULATIONS, IN THE VARIOUS FIELDS OF APPLICATION, SUCH AS, PAPER, TEXTILE, PLASTIC ETC.

THE EXPERTS FAMILIARIZED WITH THIS TYPE OF INDUSTRY, WILL FIND A DEFINITE STARTING POINT FOR A STUDY, TAKING IN CONSIDERATION THE LOCAL CONDITIONS TO BRING DOWN THE COST OF THE COMPOUND WITH NO CHANGE IN THE LEVEL OF THE PHYSICAL PROPERTIES.

THE INDUSTRIAL ROLLS MANUFACTURING INDUSTRY, PLAYS A VERY IMPORTANT FACTOR, AS A COMPLEMENTARY ITEM FOR THE FOLLOWING INDUSTRIES:

1.1.- PAPER
1.2.- TEXTILE
1.3.- PRINTING
1.4.- CHEMICAL (PLASTIC)

A STUDY WILL BE PRESENTED OF THE PRESENT PROBLEM AND REPLACEMENT OF NATURAL RUBBER BY SYNTHETIC RUBBER, FOLLOWING THE TRADITIONAL FORMULATIONS RECOMMENDED BY THE ELASTOMER MANUFACTURERS AND THE OLD TECHNIQUES ADAPTED AS WELL AS, FORMULAS COMPOUNDED IN ACCORDANCE WITH EACH LOCAL COUNTRY CONDITIONS.

II.- GUIDE FORMULATIONS AND TECHNICAL HIGHLIGHTS

TYPES OF SYNTHETIC RUBBER USED IN BRAZIL
(FOR INDUSTRIAL ROLLS PRODUCTION)

- SBR
- NITRILE
- CHLOROPRENE
- EPDM
- SILICONE
- HYPALON

GUIDE FORMULATIONS

PRINTING ROLL COVER
INTERNATIONAL SUGGESTION

LATEX CREPE	100.00
RENACIT	0.15
STEARIC ACID	0.50
ZNO	5.00
ANTIOXIDANT	1.00
SILICIOUS EARTH	85.00
TIO_2	10.00
ROSIN	3.00
PLASTICIZER NAFT. ..	5.00
TMTD	2.50
MBTS	1.00
SULPHUR	0.20
	213.35

CURE
SPECIMEN OF 4 MM THICK GAUGE AT 142 ºC
15' - 30' - 45'

	15'	30'	45'
TENSILE	165	165	165
ELONGATION	490	490	485
MODULUS 300%	70	72	77
HARDNESS SHORE A	57	58	58

OUR EXPERIENCE

SBR	80.00
CERNAMBI RUBBER	20.00
STEARIC ACID	0.20
ZNO	0.50
PBN	0.50
PAN	0.50
CLAY (CAULIM BRANCO)	80.00
SRF	10.00
PLASTICIZER DUTREX 33	8.00
SULPHUR	2.00
TMTD	0.20
MBTS	0.80
PF (PHENOLIC FILLER)	10.00

CURE
SPECIMEN OF 4 MM THICK GAUGE AT 142 ºC
15' - 30' - 45'

	15'	30'	45'
TENSILE	200	200	200
ELONGATION	400	400	450
MODULUS 300%	80	80	85
HARDNESS SHORE A	60	60	65

COMMENTS ON MODIFICATIONS

CERNAMBI BRAZILIAN NATURAL RUBBER EQUIVALENT TO BROWN CREPE Nº 2.

CLAY (CAULIM) THE CHEAPEST FILLER LOCALLY FOUND WITH GRAVITY 2.60, COSTING US$ 0,53/KG.

PH - PHENOLIC FILLER WHICH IS TREATED POWDER FROM WASTE OF PHENOLIC DECORATIVE LAMINATION AND moulding OPERATIONS.

III.- REPLACEMENT OF NATURAL RUBBER BY SYNTHETIC RUBBER

NATURAL RUBBER, BLACK COMPOUND, REPLACEMENT AND ACHIEVEMENTS

INTERNATIONAL RECOMMENDATION

SMOKED SHEETS	100.00
RENACIT IV	0.15
STEARIC ACID	0.50
ZNO	120.00
ANTIOXIDANT DDA	2.00
HAF	35.00
NAPHTENIC OIL	3.00
ROSIN	4.00
SULPHUR	15.00
FP	0.50
MBTS	0.10
	180.65

CURE
SPECIMEN OF 4 MM THICK GAUGE AT 151 °C
4 - 6 HRS

	4 HRS.	6 HRS.
TENSILE	105	105
ELONGATION	100	100
MODULUS 100%	105	100
HARDNESS SHORE A	88	88
REBOUND RESILIENCE	24	24

OUR EXPERIENCE

SBR	80.00
CERNAMBI CAMETÁ	20.00
STEARIC ACID	1.00
ZNO	5.00
CLAY (CAULIN)	55.00
VULCASIL	55.00
SRF	15.00
NAPHTENIC PLASTICIZER	5.00
SULPHUR	3.00
MBTS	1.00
	240.00

CURE
SPECIMEN OF 4 MM THICK GAUGE AT 151 °C
4 - 6 HRS

	4 HRS.	6 HRS.
TENSILE	100	100
ELONGATION	100	100
MODULUS 100%	100	95
HARDNESS SHORE A	90	90
REBOUND RESILIENCE	25	25

COMMENTS

NOT ONLY THE REPLACEMENT OF ZNO, WHICH IS A VERY EXPENSIVE PIGMENT IN BRAZIL, BY CLAY, THE NATURAL RUBBER WAS 80 PERCENT REPLACED BY THE SAME AMOUNT OF SBR 1502, WHICH COSTS HALF OF THE PRICE: NATURAL RUBBER COSTS US$ 1.50/KG, SBR COSTS US$ 0.70/KG. SULPHUR WAS REDUCED ALSO AND 15 PARTS OF PHENOLIC FILLER WERE USED TO MAINTAIN THE HARDNESS. PRICE OF PHENOLIC FILLER US$ 0.20/KG.

PAPER MAKING, ROLL COVER - SHORE A-90

INTERNATIONAL RECOMMENDATION

SMOKED SHEETS	100.00
STEARIC ACID	0.50
ZNO	40.00
ANTICXIDANT DDA	2.00
SRF	100.00
NAPHTENIC OIL	3.00
ROSIN	4.00
SULPHUR	7.00
VULKACIT FP	0.50
MBTS	0.10
	257.10

CURE

SPECIMEN KG/CM^2 OF 4 MM THICK GAUGE AT 150 ºC - 4/6 HRS

	4 HRS.	6 HRS.
TENSILE ST.	90	80
ELONGATION AT BREAK	80	80
	150	150
MODULUS 100%	67	70
REBOUND RESILIENCE	30	30
HARDNESS SHORE A	90	90

OUR EXPERIENCE

SBR	80.00
ACREFINA	20.00
ZNO	20.00
ANTIOXIDANT DDA.....	2.00
FEF	50.00
CLAY	70.00
NAPHTENIC OIL	5.00
PHENOLIC FILLER	10.00
SULPHUR	5.00
MBTS	1.00

CURE

SPECIMEN KG/CM^2 OF 4 MM THICK GAUGE AT 150 ºC - 4/6 HRS

	4 HRS.	6 HRS.
TENSILE ST.	80	85
ELONGATION AT BREAK	150	150
MODULUS 100%	70	70
REBOUND RESILIENCE	30	30
HARDNESS SHORE A	90	90

COMMENTS

THE REDUCTION OF ZNO AND SRF AND THE REPLACEMENT OF BOTH BY CARBON BLACK AND LOCAL CLAY, NOT ONLY REDUCED THE COST BUT, KEPT THE OTHER PHYSICAL PROPERTIES, ALMOST AT THE SAME LEVEL.

THE ROLLS FOLLOWING THIS FORMULATIONS HAVE BEEN IN OPERATION WITH NO TROUBLE, WORKING CONSTANTLY 24 HOURS A DAY.

NATURAL RUBBER LIGHT COLORED COMPOUNDS

IN LIGHT COLORED COMPOUNDS, THE CRITERION WERE DIFFERENT BECAUSE WE CAN NOT USE THE CHEAP FILLER PF AND THE CLAY MUST BE THE TYPE A MESH 320, ABSOLUTELY WHITE, WITH NO Fe_2O_3 CONTENT.

INTERNATIONAL RECOMMENDATIONS

SMOKED SHEETS OR PALE CREPE.....	100.00
STEARIC ACID	0.50
ZINC OXIDE	5.00
ANTIOXIDANT DDA	1.50
VULCASIL S	30.00
SILICIOUS EARTH	90.00
TIO^2	10.00
COUMARONE RESIN	3.00
ROSIN	2.00
NAPHTENIC OIL	10.00
SULPHUR	0.20
TMTD	2.80
CZ	1.00

CURE

SPECIMEN OF 4 M THICK GAUGE AT 151 ºC

2 - 4 HRS

	2 HRS.	4 HRS.
TENSILE STRENGH	160	160
ELONGATION AT BREAK	595	600
MODULUS 300%	41	37
HARDNESS SHORE A	49	48
REBOUND RESILIENCE	62	60

OUR RECOMMENDATIONS

SBR 1502	70.00
ACREFINA	30.00
ZINC OXIDE	5.00
ANTIOXIDANT DDA	1.50
VULCASIL S	30.00
WHITE CAULIM	100.00
TIO^2	10.00
NAPHTENIC OIL	5.00
SULPHUR	0.20
MBTS	1.00
CZ	1.00

CURE

SPECIMEN OF 4 MM THICK GAUGE AT 151 ºC

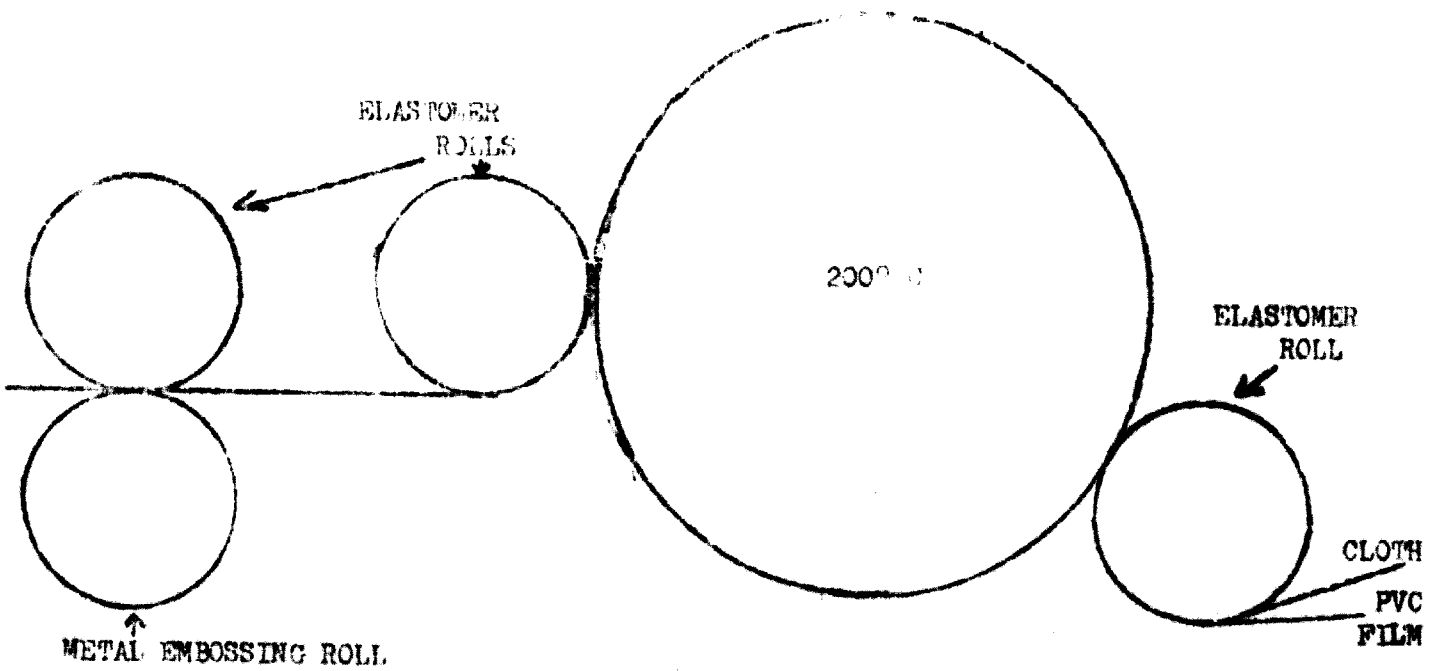
2 - 4 HRS

	2 HRS.	4 HRS.
TENSILE STRENGHT	150	160
ELONGATION AT BREAK	600	580
MODULUS 300%	45	40
HARDNESS SHORE A	50	50
REBOUND RESILIENCE	60	60

COMMENTS

AGAIN THE COST OF THE COMPOUND WAS REDUCED, KEEPING THE SAME PHYSICAL PROPERTIES. THIS COMPOUND IS USED WITH SUCCESS IN LAMINATION OF PVC SUSPENSION TYPE WITH CLOTH. ROSIN AND COUMARONE RESIN WERE ELIMINATED BECAUSE OF THE STAINING PROBLEMS AT THE FINAL PLASTIC LAMINATED PRODUCTS.

THE OTHER IMPORTANT REPLACEMENT OF NATURAL RUBBER AND EPDM BY REGULAR SBR 1502 BLENDED WITH CERNAMBI BRAZILIAN RUBBER, WERE IN THE PLASTIC INDUSTRY FOR EMBOSSING ROLLS THAT WORKS NORMALLY AT A TEMPERATURE OF 200 ºC. THE SULPHUR MUST BE KEPT AS LOW AS POSSIBLE, OR EVEN REPLACED BY TMTD AND INORGANIC FILLER, SUCH AS NATURAL SCREENED CLAY MESH 325.



INTERNATIONAL SUGGESTION (1).

EPDM	100.00
SRF	60.00
NAPHTENIC OIL	20.00
ZINC OIL	5.00
STEARIC ACID	1.50
TMTD	1.50
MBT	0.50
SULPHUR	1.50

COST PER KG US$ 1,00

OUR EXPERIENCE

SBR 1502	50.00
ACREFINA	50.00
STEARIC ACID	1.00
CLAY A TYPE	60.00
LITHOPONE	20.00
ZNO	20.00
ANTIOXIDANT DDA	1.00
SULPHUR	2.50
MBTS	1.00

CURE
SPECIMEN OF 4 MM THICK GAUGE AT 160 °
2 - 4 HRS

	2 HRS.	4 HRS.
TENSILE	182 *	180
ELONGATION	760	800
MODULUS 300%	60	58

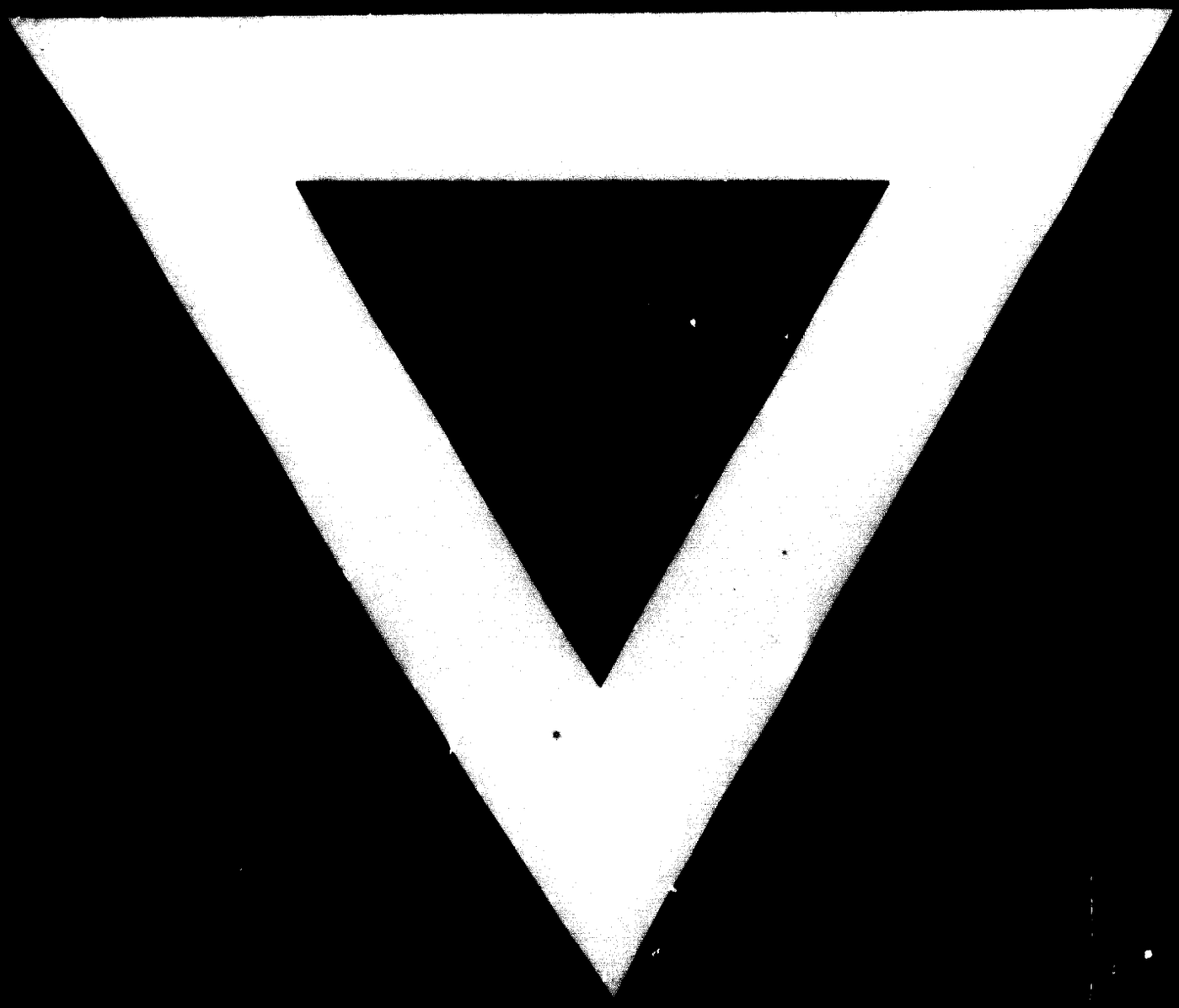
* 182 KG/SQCM

CURE
SPECIMEN OF 4 MM THICK GAUGE AT 150 °
2 - 4 HRS

	2 HRS.	4 HRS.
TENSILE STRENGHT	180	172
ELONGATION AT BREAK	750	700
MODULUS 300%	50	55
REBOUND RESILIENCE	60	55
HARNESS SHORE A	60	60

IV. - CONCLUSION

THE PURPOSE OF THIS PAPER WAS TO SHOW THE PRACTICAL RESULTS ACHIEVED BY ONE COMPANY ESTABLISHED IN DECEMBER 1949, WHICH TODAY IS THE FOURTH LARGEST MANUFACTURER OF RUBBER ROLLS IN BRAZIL. THE INFORMATION DISCLOSED IS BASED ON YEARS AND YEARS OF EXPERIENCE, HOWEVER WE CAN NOT GUARANTEE THE SUCCESS OF THE RESULTS IN DUPLICATION OF THIS WORK ABROAD. PROBABLY DUE TO LOCAL CONDITIONS, THE COMPOUNDER WILL HAVE A CONSIDERABLY LABORATORY AND A PILOT PLANT OBSERVATIONS, BEFORE releasing THE NEW COMPOUND TO THE CUSTOMERS.
I DO HOPE THAT THE EXPERTS INVOLVED IN THIS INTERESTING FIELD WILL FIND THE INFORMATION OF THE PAPER USEFUL AS A STARTING POINT FOR TRIALS, ON ACCOUNT TO BRING DOWN THE COST FORMULATION WITHOUT AFFECTING THE FACTORY STANDARDS.



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