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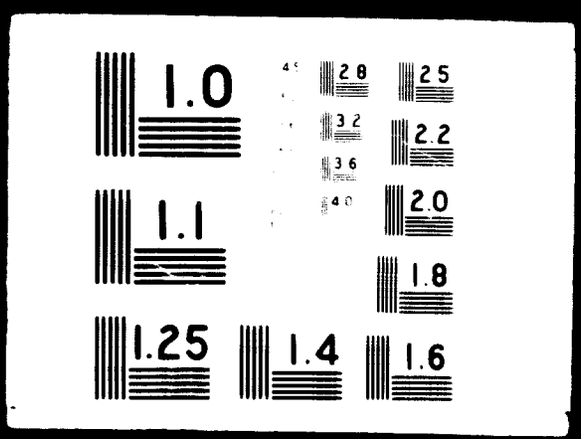

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RETROSPECTS AND PROSPECTS OF NEWSPRINT FROM BAGASSE 1/

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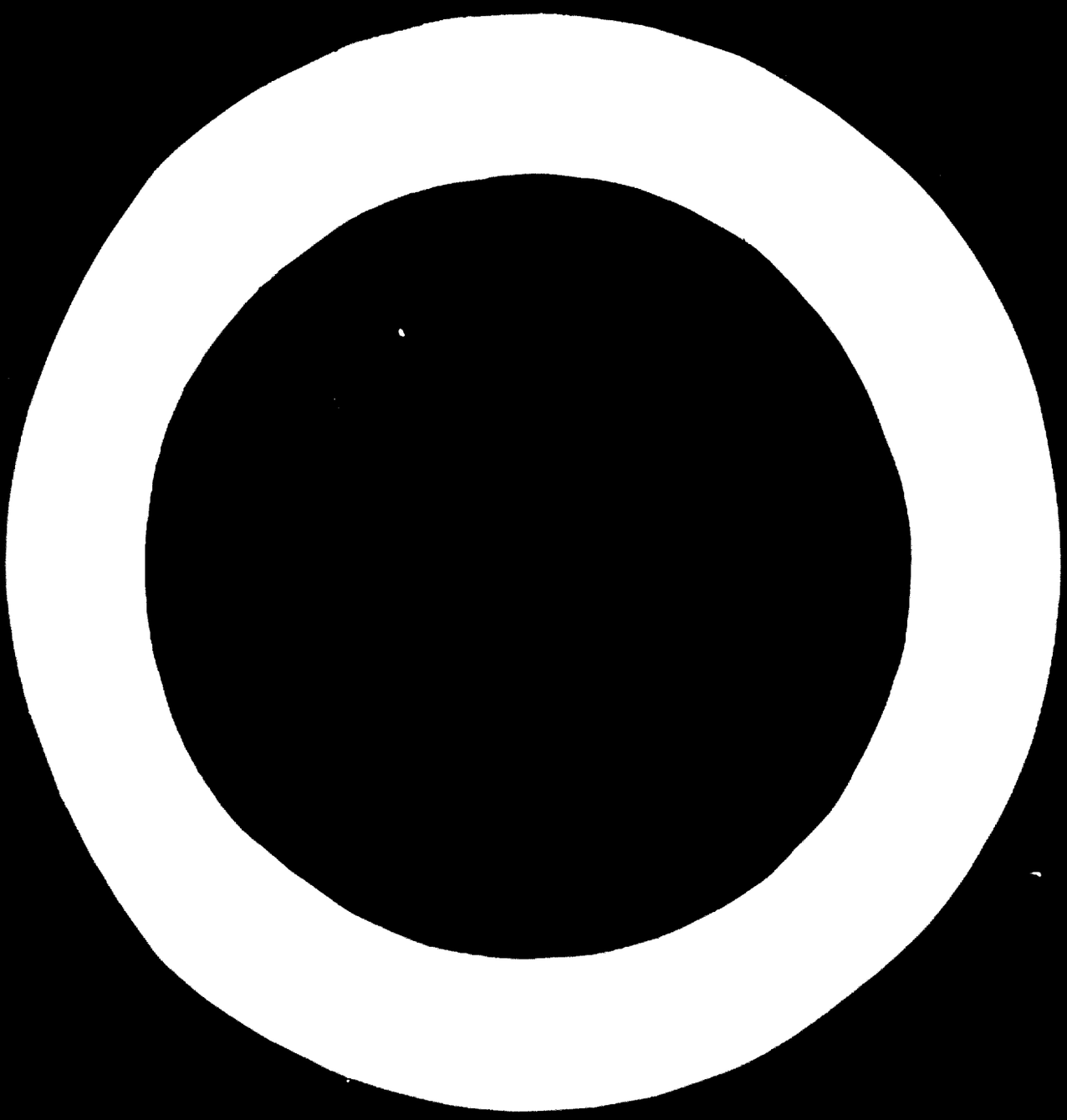


I. Introduction:

In the course of last two decades, Sugar Cane Bagasse received much closer attention as a potential fibrous-raw-material to the Newsprint Industry as there was growing evidence of encouraging progress to store and depith Bagase by an economic process and as there were favourable prospects to produce high yield as well as low cost pulps from well depithed Bagasse to form the News Furnish through adaptation of processes familiar to the wood pulp industry. Earlier approaches to store fresh Bagasse in bales with or without prior depithing have been practically abandoned in favour of more acceptable and economic forms of bulk storage as developed by Ritter, De la Roza, Valentine and Rietz. Even-though the Ritter style to store Bagasse in bulk, using lactic acid bacterial culture as medium, was developed on a commercial scale as early as 1954 at the Ngoye Paper Mill in South Africa, the merits of this system over other forms of bulk storage were not fully recognised for nearly a decade thereafter. Just a few years later, during 1957, De la Roza developed a bulk storage for Bagasse at the Technica Cubana Mill in Cuba using water sprays to wet the Bagasse in storage and Bulldozers to form the pile and to increase the degree of compaction of the material in the pile. The Valentine and Rietz system of bulk storage, which were developed thereafter, were more or less extensions of the De la Roza system with the exception that the Rietz system adopts wet depithing of

Bagasse ahead of the bulk storage and uses a preservative to arrest decay of stored Bagasse. Irrespective of the over-riding merits of one system of bulk storage over others, the techno-economic advantages of bulk storage over the storage of Bagasse in bales have been recognised and accepted. Simultaneous to the developments to perfect the Bagasse storage, tremendous efforts were devoted to develop suitable methods as well as equipment to upgrade Bagasse in one or two stages and to recover the Pith fraction. A host of horizontal and vertical Depithers were developed to handle humid (52% Moist) and or wet Bagasse (10% Moist) so as to permit single or multiple stage depithing. Invariably, the wet depithing circuit included standard equipment such as Hydropulper, Drainage conveyor and Dewatering Presses besides Depithers of horizontal or vertical design whilst the moist or humid depithing circuit included either horizontal or vertical depithers and ancilliaries to handle the major fractions of Bagasse. Most of the Depithing Machines have proved their dependability for efficient seperation of Pith and good yield of upgraded Bagasse although in some design power consumption has been relatively high than in others. Another wet process which was developed by Dr. Dante Cusi, over a decade ago, for commercial service at the San Cristobal Paper Mill (Mexico), employs Hydrolimpia and Hydroseperator to classify and seperate the major fractions of Bagasse besides Dewatering Presses to recover upgraded Bagasse and Pith. Eventhough tall claims have been proferred by the promoters of different depithing systems to justify a system

of their own choice, a well designed closed circuit wet depithing system employing equipment developed by one or other designers in combination with the Ritter system of bulk storage should provide upgraded Bagasse of about 88-90% fibre content based on an yield of about 58% fibre and 24% pith from dry whole Bagasse. It would therefore be safer to conclude that depithing of Bagasse has not been a major obstacle for large scale utilisation of this fibrous raw-material. About the time when problems associated with Bagasse storage and depithing were receiving due attention, the wood pulp industry was in the threshold of tremendous activity to develop processes and equipment towards utilisation of saw-mill slabs as well as a host of medium and high density Hardwoods to produce low cost pulps of acceptable quality to the Newsprint Industry. As a result of these investigations, convincing processes were established to produce straight mechanical and mechanical type of pulps as well as semi-chemical pulp from Hardwoods like Poplar, Aspen, Birch, Eucalyptus etc. The Newsprint Industry used a judicious mixture of mechanical and mechanical type of pulps from Hardwoods to replace all Spruce Groundwood from the conventional News Furnish without in any manner affecting the runnability of stock in a fast running paper machine nor the quality of Newsprint therefrom. Invariably, where semi-chemical pulp from Hardwoods was available, the industry preferred a blend of mechanical and semi-chemical pulp from Hardwoods to substitute Spruce Groundwood in the News Furnish.

This phenomenal success with Hardwoods to produce a quality of low cost pulps, of near comparable properties to Spruce Groundwood in strength, opacity and brightness, influenced most of the investigations on Bagasse pulping since it was well known that the fibre characterestics of well depithed Bagasse closely matched with that of Hardwoods in most respects. Furthermore, there were favourable indications that the Refiner Method or the Semi-chemical pulping technique established to pulp Hardwoods would be adapted to process Bagasse and to produce low cost pulps from this source. Thus most of the processes developed for pulping Bagasse to produce low cost pulps were essentially based on developed technology familiar to the wood pulp industry. These approaches for the utilisation of Bagasse as a source of pulp to the Newsprint Industry could be grouped under the following heads:--

1. Straight Sulphate Pulp from prehydrolysed whole Bagasse; and News furnish from semi-bleached Bagasse Pulp, semi-bleached Spruce Sulphate Pulp and China Clay in the ratio of 8:1:1 (De la Roza Process)
2. Straight Sulphate Pulp from well depithed Bagasse; and News furnish from equal proportions of semi-bleached and unbleached Bagasse Pulps and 10% China Clay (Japan Consulting Institute)
3. Semi-chemical pulp by N.S.S.C process from well depithed Bagasse; and News furnish from unbleached Bagasse Pulp, semi-bleached Spruce Sulphate Pulp and China Clay in the ratio of 8:1:1; (Aschaffenburger Process)

4. Semi-chemical pulp from well depithed Bagasse by the Simon-Cusi Process; and News furnish from semi-bleached Bagasse Pulp, Spruce Groundwood, Spruce semi-bleached Sulphate pulp and china clay: Ratio of furnish 74:14:5:7; (Simon-Cusi Process)

5. Refiner Mechanical and standard Sulphate pulp from well depithed Bagasse; and Newsp furnish from semi-bleached Bagasse Sulphate and Refiner Mechanical pulp from Bagasse in equal proportions; (Crown Zellerbach Corporation)

6. Refiner Mechanical Pulp from well depithed Bagasse; and News furnish from 65-75% bleached Mechanical Pulp from Bagasse and 35-25% semi-bleached Sulphate wood pulp; (Crown Zellerbach Corporation)

7. Refiner Mechanical-type of Pulp from well depithed Bagasse; and News furnish from 65-75% Mechanical type of Bagasse Pulp and 35-25% semi-bleached Sulphate wood Pulp; (Crown Zellerbach Corporation)

8. Straight Sulphate Pulp from well depithed Bagasse; and News furnish from bleached Bagasse Pulp and Spruce Groundwood in equal proportions: (Karlstad; Sweden)

9. Mechanical type of pulp from well depithed Bagasse by the Thermomechanical Process; and News furnish from a substantial % age of mechanical type of pulp from Bagasse and Sulphate wood pulp; (Defibrator Process)

10. Mechanical type of pulp from well-depithed Bagasse by the Peadco system; and News furnish from Mechanical type of pulp from Bagasse, Spruce Groundwood and Spruce Sulphate Pulp in the ratio of 8:1:1; (Peadco Process)

These different approaches as well as the future possibilities of Newsprint from Bagasse are briefly discussed below:—

II. Bagasse News by the De la Roza Process:

Nearly 2 decades ago, De la Roza proposed prehydrolysed Sulphate Pulp from Whole Bagasse as a starting point to produce Newsprint from all Bagasse Pulp. Later, this proposal was given due consideration by the U.S. Department of Commerce, National Bureau of Standards, Washington D.C after extended investigations on the quality of News from this source. The department of commerce report dated October 1, 1952 shows the characterestics of News from 70:30 Spruce Groundwood and Sulphite wood-pulp as well as from all Bagasse pulp which is reproduced below:—

		Bagasse News	Commercial News:
Basis weight: (lbs) 24" x 36" -500		... 35.8	... 32.5
Caliper: 1/1000"		... 3.2	... 3.5
Burst: (lbs/sq.in)		... 11.0	... 7.0
Tensile strength: (½" strip)			
Machine Direction:		... 3.9	... 2.4
Cross Direction:		... 2.1	... 1.2
Tear: (grams)	M.D	... 29.0	... 19.0
	C.D.	... 43.0	... 23.0
Opacity %		... 92	... 90
Ash %:		... 13.2	... 0.24

Thereafter, during 1955, De la Roza planned a commercial unit of 100 tons daily capacity and established the first Newsprint Mill—Technica Cubana—in Cuba proximate to Jose Smith Comas Sugar Mill at a cost of about U.S.$17 Million. This installation came for commercial production during June 1958. Off-

season as well as On-season demand of whole Bagasse to the Pulp Mill was drawn via the bulk storage system developed by De la Roza. The bulk storage yard was designed for a holding capacity of about 35,000 BDT Whole Bagasse. The Pulp Mill was designed for an annual production of 25,000 BDT semi-bleached pulp by a two stage digestion of Whole Bagasse-- first stage for water prehydrolysis at 160 C and second stage for standard sulphate digestion with about 12% active alkali as Sodium Oxide and at 160 C--; and the installation was formed with standard tumbling type kettles, brown stock washing system, pulp screening and single stage bleaching systems as well as conventional chemical recovery station including evaporators, recovery furnace with waste heat boiler and a recausticising station. The Stock Preparation station included standard equipment; and the Machine House included a Rice Barton Paper Machine of 158"deckle intended for a maximum operating speed of about 400 Meters/Mt as well as standard paper processing units including an automatic roll-packing device. The operating capacity of the Stock preparation station and the Machine House were adequate for 100 daily tonnes Newsprint. According to reliable information, the yield of prehydrolysed Bagasse was around 70% - 75% on the weight of whole Bagasse to the Kettle and the yield of unbleached pulp was around 68% on prehydrolysed Bagasse. Yield of semibleached Bagasse Pulp of about 65% brightness was around 45-46% on the weight of whole Bagasse processed to the Kettle; and consumption of chlorine to bleach the pulp was around 5%. Pentosan content of the semi-bleached pulp was in the low range. Semi-bleached Pulp was refined

to a freeness level of 30-35°S.R (425-360 C.S.F) to form News furnish with 85% Bagasse Pulp and 15% China Clay. It was difficult to process this News Stock even at the restricted Paper Machine Speed of 200 Meters/minute. Wet strength of the sheet was poor; and wet-end breaks were far too many. Operating efficiency of the Paper Machine was extremely low. About 3000 tons Newsprint was produced during the first 9 months of commercial production. The quality of Newsprint was far below the levels predicted after extensive investigations at the pilot plant. Following is a typical illustration of the physical properties of this quality of Newsprint:--

Basis weight (Grams/M^2)	54-56
Av. Breaking length (Meters)	2,000
Average Mullen %:	20
Tear in grams/sheet:	
Machine direction:	17
Cross direction:	20
Opacity %:	89
Brightness: G.E.	65
Ash %	11

Since the earlier productions remained unsold and there was no prospective buyer, the situation was remedied by altering the News furnish to 80% semi-bleached Bagasse pulp, 10% Spruce Sulphate Pulp and 10% China Clay. It was then possible to improve the wet strength properties of the sheet, reduce the number of breaks at the wet end and gradually step up the operating speed of Paper Machine to around 300 Meters/minute. According to available information, local Newspapers readily accepted this quality. For months on, several editions of

"Revolution" were printed in this quality. Production also steadied at about 60 tons Newsprint/day. Following is a typical illustration of the physical properties of this better quality Newsprint Paper produced at the Technica Cubana Paper Mill:--

Basis weight: (Grams/M^2)	55-56
Breaking length: (Meters)	
Machine direction:	3,900
Cross direction:	2,000
Tear: (Grams/Sheet)	
Machine direction:	33
Cross direction:	35
Caliper:	0.0033"
Smoothness, sheffield:	
wire side:	130
Top side:	110
Brightness: G.E.	60
Ash %:	5
Opacity %:	90

Inspite of steady production at 60 T/day and total production was lifted by the Press, the direct cost of production was quite heavy. The mill management as well as the Government thought it desirable to shift the production to 2nd class writting and printing rather than continue with the expensive Newsprint programme; and therefore by about early 1960, Technica Cubana shifted to writting and printing quality after nearly 2 years of struggle to develop Bagasse Newsprint. Since then, Technica Cubana has been producing cheap quality writting and printing from undepithed whole Bagasse using single stage sulphate digestion; and their yield of semi-bleached pulp is around 43-44%. Present furnish for white printing paper consists of 75% semi-bleached

Bagasse Pulp, 20% bleached soft wood sulphite and 5% China clay. Freeness of stock at the machine chest averages at 400 C.S.F. At the operating speed of 250 Meters/minute, runnability of stock at the wet end of the Machine is quite good. Up to the operating speed of 300 Meters/mt no serious handicaps have been noticed except increase in pick up at the press section. Following is a typical illustration of the physical properties of writting and printing produced at the Technica Cubana Mill:--

Basis weight: (Grams/M^2)	55
Av. Breaking length in Meters:	3800
% Mullen:	40
Av. Tear: (Grams/sheet)	45
Av. Brightness: G.E.	75
Opacity %	86
Ash %	5

Average consumption of steam and Power at Technica Cubana has been around 15 T/T and 1000 Kwhr/T respectively. The Chemical Recovery Station is reported to function at an average chemical efficiency of about 80-82% and over-all chemical recovery is reported at 73-75%. Assuming that the levels of consumption of steam,power, chemicals and Bagasse have not been worse during the first 2 years of mill operation compared to present day consumption levels, and granting that well-depithed Bagasse to Kettle operations would have admitted the possibilities of producing Newsprint from all Bagasse Pulp,. would it not be correct to conclude that all chemical pulp from Bagasse is an expensive furnish to the Newsprint Industry?

III. Newsprint from Bagasse by the A-Z Process:

Aschaffenburger Zellestoffwerke of West Germany did substantial work on Bagasse by adapting processes already established to produce semi-chemical pulp from Hardwoods by the Neutral Monosulphite Process. Their earlier investigations were based on nominal mechanical depithing of Bagasse in two stages—first stage in Vibrating Screens and 2nd stage in Hydropulper and Wet Screens to upgrade Bagasse to about 75% fibre content—, prehydrolysis of upgraded Bagasse at 160 C using water as medium followed by washing of prehydrolysed Bagasse to eleminate extractives and fines, 2nd stage digestion of prehydrolysed Bagasse using Neutral Sulphite liquor of about 8.5 pH at 160 followed by hot refining of Brown Stock, conventional washing and screening to produce unbleached pulp of about 55 G.E brightness, preparation of news furnish from 85% Bagasse Pulp and 15% China Clay and production of acceptable quality Newsprint at a speed of 250-300 meters/mt in a Paper Machine. By the above technique, yield of unbleached pulp from whole Bagasse was about 36% on dry basis. Consumption of cooking chemicals were of the order of 80 Kg Sulphur and 300 Kg Soda ash per BDT unbleached pulp. During the years 1954-55, Aschaffenburger produced sufficient quantity of Bagasse Pulp from Egyptian Bagasse in their pilot plant at the Walsum Mill and carried out a semi-commercial trial in one of the Paper Machines attached to the Miesbach Mill using a furnish of 85% A-Z Pulp and 15% China Clay. The Newsprint was tried in a Rotary Printing Machine of "Rosenheimer Anzeiger" to

prove its runnability and printing properties. Bagasse Newsprint which was used by "Rosenheimer Anzeiger" for their daily issue dated 26th April 1955 showed normal porosity and oil absorption properties although its opacity was slightly lower than the specifications for conventional News. Following is a typical illustration of the physical properties of A-Z Newsprint from Bagasse:—

Basis weight:(Grams/M^2)	...51.0
Breaking length: (Meters)	...
Machine Direction:	...3530
Cross Direction:	...2090
% Mullen:	... 28
Tear: (Grams)	
Machine direction:	... 22
Cross direction:	... 28
Smoothness, Sheffield:	
Wire side:	... 130
Top side:	... 120
Opacity %	... 88
Ash %	... 15

Since the A-Z process did not include a suitable chemical recovery system to handle spent lye from the pulping station, this process did not find commercial acceptance. During the next 3 years or so, Aschaffenburger Zellestoffwerke tied up with Ritter for bulk storage of Bagasse using Biological culture, added standard wet depithing equipment to upgrade Bagasse from the Ritter Pile, discontinued the prehydrolysis programme, considered the Mead recovery system to handle spent lye from the Pulping station and offered the N.S.S.C process with suitable refinements. Eventhough the process economy was more attractive than by the earlier process, the rentability of the process was not sufficiently bright

to attract commercial interests. It was felt that the A-Z Process with the proposed refinements would be better suited to produce more remunerative qualities like writting and printing rather than Newsprint Paper.

IV. Newsprint from Bagasse by Simon-Cusi Process:

This technique to produce high yield pulp from Bagasse which was developed at the San Cristobal Paper Mill in Mexico employs the Chemi-mechanical pulping as developed for Hardwoods besides own processes to upgrade Bagasse, impregnation of upgraded Bagasse, fractionation of impregnated material as cooked and semi-cooked pulp and Refiner treatment of semi-cooked material before the major fibre fractions are pooled to the washing, screening and bleaching stations. Essential features of this process could be summarised as under:--

a. Whole Bagasse in depithed in two stages-- first stage in Vibrating Screens (Dry type) and second stage in Hydrolimpin and Hydro-seperator7to advance the fibre in upgraded Bagasse to around 82%; Yield of upgraded Bagasse and Pith fraction on the input to the system is estimated at 60% and 20% respectively calculated on dry basis;

b. Upgraded Bagasse is mixed with sufficient volume of circulating Caustic lye of about 40 gpl concentration to allow good impregnation of incoming material with the cooking lye, processed through a Retention tower at about 4% consistency (Retention time about 40 mts),and thereupon through drainage conveyor and Dewatering Presses to release

surplus Caustic Soda from the impregnated material such that the impregnated material entering Kettle operation shall not retain more than 6% of its dry weight as free Caustic. Yield of impregnated material on the weight of upgraded Bagasse to the system is estimated at 88% on dry basis.

c. Impregnated material is cooked in vapour phase in a continuous kettle at or around 130 C for a short duration, cooked stock is processed through Hydrolimpia and Screen to seperate the long from the short fibre fraction, the long fibre fraction (Bfibre) is dewatered in a Press and fiberized in a disc refiner to around 30°S.R, Fiberised B fraction is pooled with the A fraction ahead of the Pulp Washing units and washed Pulp is screened, centricleaned and Deckered to the store system ahead of pulp bleaching Station; Permanganate number of A Fraction is reported as 12 whilst that of B Fraction as around 20. The pooled fraction is reported as having a permanganate number of about 16. Yield of Unbleached semi-chemical pulp is reported as 66-68% on upgraded Bagasse equivalant to about 40-41% on Baled Bagasse to the Depithing station.

d. Unbleached pulp is bleached either in one or two stages using Calcium Hypochlorite as bleaching medium. Consumption of chlorine to produce semi-bleached pulp of about 60 G.E brightness is reported as 5%. Yield of semibleached Pulp on baled whole bagasse to the Depithing station is reported as 38%.

and e. Formation of News furnish from 75-80% semi-bleached Bagasse pulp, 15% Spruce groundwood and 10-5% Bleached Spruce-

-Sulphate wood pulp with or without china clay. Based on the furnish pattern indicated above, commercial trials have been conducted in the San Cristobal Mill, in Texas-U.S.A and in Canada. The latest trial was conducted in the Lawrentide Mill of the Consolidated Paper group early during last year using a furnish pattern--80% Bagasse Pulp, 15% Spruce Groundwood and 5%bleached Spruce Kraft; and about 30 tons Newsprint was produced in a high speed machine. Following is a typical illustration of the physical properties of Newsprint on which "Lavoih Metropolitaine" was printed on 2nd June 1970:--

Basis weight: (Grams/M^2) ...	56
Breaking length in Meters (Av)	2140
Mean Tear Factor:	45
caliper:	0.0034"
Brightness G.E:	60
Opacity:	88
Ash %	1.6

Eventhough the San Cristobal Mill has been in operation for several years now and they have stepped up the capacity of the Pulp Mill to near 150 daily tons, they have not yet installed a chemical recovery system to handle spent lye from the kettle operations. Had they the facilities of a chemical recovery system, they would have realised the tremendous problems associated with the recovery of spent lye from the semi-chemical pulp as well as recovery of chemicals from spent lye. Furthermore, expensive depithing technique employing Hydrolimpia and Hydroseperator may have to be substituted by conventional equipment so far developed for wet depithing should storage of Bagasse in bulk take the precedence over bale storage and expensive

operations are to be avoided from the depithing circuit. In short, the technology of semi-chemical pulp by this technique appears to be more complicated than by the improved version of the A-Z process inspite of no tangible benefits either to process economy or to the quality of semi-chemical pulp.

V. Newsprint from Bagasse by the C-Z Process:

By about 1950, the Crown Zellerbach Corporation initiated a joint development programme with the Hawaiian Sugar Planters Association to determine which grades of paper could be commercially produced from Bagasse in the Hawaiian Islands. Extensive investigations were conducted to produce a wide range of pulps from Bagasse including chemical pulp, semi-chemical pulp, mechanical type of pulp and mechanical pulp by processes familiar to the wood-pulp industry. When the results of laboratory investigations were encouraging, a pilot plant was built at Camas, Washington (USA) which included a Hydropulper, Riets depither (Own design) and Drainage conveyor to depith Bagasse, a continuous upward flow continuous digestor of Impco design to produce chemical pulp by the quick cook method, a Refiner station to produce mechanical and mechanical type of pulp and these installations (WEST HOOKAH) to the then existing facilities at the Central Research Station. Thereafter a great many pilot plant trials were conducted using Hawaiian, Indian and Egyptian Bagasse to establish what combination of Bagasse pulps or a combination of low cost Bagasse pulps with chemical wood pulp would permit

the production of acceptable quality Newsprint. Following is a typical illustration of the experimental investigations on Indian and Hawaiian Bagasse at the Central Research Division of Crown Zellerbach Corporation during Jan-March 1962:--

KRAFT PULP FROM INDIAN & HAWAIIAN BAGASSE COMPARED:

Cook No:	K-2790	K-3233-3242
Source of Bagasse:	Hawaii	India
Rietz Depithing Unit:	24"	12"
Active Alkali, %(1)	12	12
Liquor Ratio:	4:1	5.33:1
Time to Max.Temp. (Mts)	60	60
Time at Max.Temp. (Mts)	10	11
Max Temp: °F	345	345
Max. Press: (Lns/sq.in)	120	110-120
Permanganate No:	9	8
Brightness GERS @ 460 mmu	n.a	43
Screened Yield: %	57.3	54.1
Intial Freeness CSF:	540	505
Bursting Strength: Initial:	74	87
@400 CSF:	96	96
@200 CSF:	104	107
Tearing Resistance: Initial:	1.02	1.16
@400 CSF:	1.03	1.00
@200 CSF:	0.90	0.80
Break.Length: Initial: (M)	6440	7900
@400 CSF	8250	7900
@200CSF:	8950	9700
Folding endurance: Initial:	127	162
@400 CSF:	220	260
@200 CSF:	650	1057
Opacity: Initial:	-	-
@400 CSF:	n.a	85.6
@200 CSF	,,	84.5
Density: Initial:	0.619	0.695
@ 400 CSF	0.680	0.780
@ 200 CSF	0.750	0.816

N.B. (1) Active Alkali as Na_2O based on O.D Bagasse Kraft Cooking was carried out in the 2.5 c.ft. Rotary Digestor:

BLEACHED KRAFT PULPS FROM INDIAN AND HAWAIIAN BAGASSE COMPARED:

	Hawaiian Bagasse: (1)	Indian Bagasse: (2)
Brightness GE:	68-70	n.a
Initial Freeness:cc. CSF	415	450
Bursting strength:Initial:	74	79
@ 400 cc. CSF:	77	87
@ 200 cc. CSF:	101	108
Tearing resistance:		
@ 400 cc. CSF:	0.9	1.05
@ 200 cc. CSF:	0.7	0.88
Breaking Length (Metere):		
@ 400 cc. CSF:	7000	8000
@ 200 cc. CSF:	8600	9940
Folding endurance:		
@ 400 cc. C.S.F	160	290
@ 200 cc. CSF:	635	950
Opacity:		
@ 400 cc. CSF:	74	68.8
@ 200 cc. CSF:	68.8	59.4
Density: Initial:	n.a	0.714
@ 400 cc.CSF:	,,	0.720
@ 200. cc. CSF:	,,	0.795

N.B. (1) 3 stage bleaching was used;

(2) Bleached with one stage Hypochlorite using 60% of bleach demand;

(continued in page 19)

STRAIGHT MECHANICAL PULP FROM INDIAN & HAWAIIAN BAGASSE:

	Hawaiian Bagasse	Indian Bagasse
Depithing site:	Hawaii	CAMAS
Rietz Depither:	24"	12"
Refiner used:	SW36-2	SW36-2
No. of Passes:	2	2
Plates used:		
Rotor:	16808B	18035C
Stator:	16107A	17637A
Plate Material:	Ni-Hard	Ni-Hard
Feed Rate: BDT/Day:	15.0	12.2
Consistency:	10.3	8.3
Stock Chest Freeness: cc.CSF:	95	n.a
Fibre Fractionation:		
% on 20 mesh:	0.19	0.59
% on 35 mesh:	1.90	5.63
% on 65 mesh:	15.75	21.55
% on 150 mesh:	34.82	39.61
% Through 150 mesh:	47.34	32.62
Brightness GE (Bleached)	n.a	53.9
Centricleaning:	Bird	6" Vorject
Consistency:	n.a	0.40
Pressure: psig	,,	50
Fibre Fractionation:		
On 20 mesh: %	n.a	0.73
on 35 mesh: %	,,	5.08
on 65 Mesh: %	,,	16.08
On 150 mesh: %	,,	37.34
Through 150 Mesh: %	,,	40.77
Freeness: cc.CSF:	,,	334
Brightness: G.E.	,,	51.5

Indian Bagasse Pulp was bleached using 1% sodium hydrosulphite on O.D. Pulp at 160 F

PHYSICAL PROPERTIES OF STRAIGHT MECHANICAL & MECHANICAL TYPE OF PULPS FROM BAGASSE:

	Straight Mech. Pulp:		Mechanical type of Pulp
	A	B	C
1. Freeness: cc. CSF:	126	106	100
2. % Mullen	4	7	12
3. Tear Factor:	7	7	26
4. Breaking length: (Meters)	600	700	1800
5. % Opacity	93.2	92.6	98
6. Brightness: G.E:	n.a	n.a	43

N.B.

i.(A) Refers to straight mechanical pulp prepared under a power load of 80 H.P days/ BDT Bagasse;

ii.(B) Refers to straight mechanical pulp prepared under a power load of 120 H.P days/ BDT Bagasse:

iii.(C) Refers to Mechanical type of pulp prepared under a power load of 100 H.P days/BDT Bagasse;
Following are datas pertaining to pretreatment of depithed Bagasse:

Consumption of Sodium-Sulphite on BDT Bagasse: 3 %

Temperature: ^{0}F 200—+200

Pressure: psig 14.7 to + 14.7

Soaking time: Mts: 30

Yield: (UNB) % 92

(continued in page 21)

PHYSICAL PROPERTIES OF NEWS BLEND FROM STRAIGHT MECHANICAL BAGASSE & SULPHATE WOOD PULP:

Particulers:	Furnish A	Furnish B
1. Freeness:cc. CSF:	155	118
2. % Mullen:	25.5	27.3
3. Tear Factor:	55.0	58.0
4. Breaking Length(M)	2390	2455
5. Density gms/cc:	0.393	0.408
6. Opacity %	90.8	92.6
7. Fold:	3	4

N.B.

i. Furnish(A) refers to 70% straight mechanical pulp from Bagasse prepared under a power load of 80 H.P day/T and 30 % semi-bleached Sulphate wood pulp;

ii. Furnish (B) refer to 70% straight mechanical pulp from Bagasse prepared under a power load of 120 H.P day/T and 30 % Sulphate wood pulp of 65 G.E brightness;

iii. Straight mechanical pulp for furnishes (A) & (B) was prepared in Bauer Double Disc Refiner followed by 2nd stage treatment in 12" Sprout Waldron unit;

iv. Chemical Pulp was slightly refined in Sprout Waldron unit;

v. Physical properties of Newsblend reported above were from Laboratory test sheets;

After establishing series of test runs in the experimental Paper Machine (24" width) to produce Newsprint from 1:1 furnish of Bagasse Mechanical and Bagasse Chemical pulps as well as from 65-75% Bagasse Mechanical and 35-25% semi-bleached sulphate Wood Pulp, the Crown Zellerbach Research Division planned a commercial trial in a regular Newsprint machine attached to West Linn Mill--Camas--to produce Newsprint from a furnish of 65-75% Ground Bagasse and 35-25% semi-bleached Sulphate wood pulp, during Dec., 1961 Total needs of ground Bagasse pulp for the proposed semi-commercial trial was produced at the Research Division. Whole Bagasse was depithed using the Hydropulper, drainage conveyor and Rietz disintegrator. Yield of depithed Bagasse was around 67%. Depithed Bagasse was processed through the Bauer double disc refiner (880 H.P) at about 5% consistency. Primary fibre from stage 1 refining was dewatered on a Sweco seperator, consistency was corrected to 7.5% and the stock was processed through Sprout Waldron Refiner (500 H.P). Secondary fibre was bleached with sodium-hydrosulphite (1.5% on dry fibre) and the stock was washed, centricleaned in a Vorject cleaner and thickened for storage and transport to the West Linn mill. Following are other particulars of this commercial run:—

a. Power consumption at Bauer Refiner: 30 H.P. days/ton

b. Freeness of Fibre from 1st stage refining: 744 cc C.S.F

c. Power consumption at Sprout Waldron Refiner: 41 H.P. Days/ton

d. Freeness of pulp from 2nd stage Refiner: 203 cc. CSF.

e. Brightness of UNB Pulp: 33.4 G.E.

f. Brightness of Bleached Ground Bagasse: 45 O.E.

g. Fibre fractionation of Centricleaned material:

%Retained on 20 mesh:	3.4
% " 35 "	5.0
% " 65 "	15.6
% " 150 "	31.6
% Passing through 150 mesh:	50.4

N.B. Ground Bagasse did not show recognisable Physical Properties:

TEST RUN FOR BAGASSE NEWS AT WEST LINE

(Machine No.3)

		(1)	(2)	(3)
Date:	.. 21-12-61			
Time:		12:0 N	3:40P.M	6:40P.M
Reel Speed: Ft/Mt		1118	1139	1128
Trim:		76"	76"	76"
Furnish: Ground Bagasse:		67%	75%	75%
Kraft Woodpulp:		33%	25%	25%
Jordan: Amps:		145	130	130
Head Box:	Consistency:	0.652	0.688	-
	pH	4.4	4.4	-
	Freeness CSF	[illegible]	76	-
Shake:	Stroke:	¼ - ¼	¼-1/8	3/16-1/8
	Speed:	59	59	59
Couch Vacuum:		13½"	13½"	12"
1st Press Vacuum:		11"	11"	11"
1st Press loading:		49/49	50/50	50/50
2nd Press Vacuum:		12"	12"	12"
2nd Press Loading:		215/220	215/220	215/220
Stack nips:		9	9	9

N.B. Approximately 16 T Bagasse News was produced during above test run:

(continued in page 24)

PHYSICAL PROPERTIES OF BAGASSE NEWS PRODUCED AT WEST LINN--No.3Machine:

	Bagasse News: 67/33 Furnish	Bagasse News: 75/25 Furnish	Standard Quality News:
Moisture:%	5.4	5.0	6.2
Basis Wt: Lbs: (24"x36"-500)	32.1	31.9	31.4
Mullen: pt.	12.3	9.1	11.0
Caliper: 1/1000"	3.32	3.33	3.12
Bulk index:	103	104	97
Tear: Grams: M. Direction	42	38	24
C. ,,	50	46	33
Tensile: Lbs/½" width: MD.	6.3	5.0	6.2
Opacity %	90	90.5	89
Smoothness, Sheffield:			
Wire side:	124	116	103
Top :	121	111	95
Densometer, Sheffield:	379	400+	155
Brightness: G.E. Wire side	49	48	55
Top:	18	47	54

Eventhough, Ground Bagasse pulp did not possess recognizable strength properties its bonding power with long fibered Chemical wood pulp was quite good. Drainage properties of the furnish consisting of 75% Ground Bagasse and 25% Chemical Wood-pulp was comparable to conventional News furnish. The wet strength of paper was sufficient to allow increase of ground bagasse from 67 to 75%. Physical properties of News from 75/25 furnish was satisfactory. Brightness of newsprint was low because of the quality of Bagasse used for the above test run. This is certainly a credit-

-worthy contribution by the Crown Zellerbach Corporation to have opened up the possibilities of producing acceptable quality News from a substantial % age of straight mechanical pulp from Bagasse. But for the non-recognisable physical properties of Ground Bagasse Pulp, its low brightness and heavy power demand at the Refiner Station, Newsprint from Bagasse might have become a reality several years ago. Probably these handicaps could have been partially resolved if Rittered Bagasse would have been available to the process.

VI. Newsprint from Bagasse by Thermomechanical Process:

The Asplund Defibrator group (Sweden) investigated the possibilities of producing mechanical type of pulp from well-depithed Bagasse by the Thermo-mechanical process developed by them. Results from these investigations seem to be encouraging; and these are furnished below:--

DeFibration:

preheating time: (Mts)	4
Steam Pressure: kg/cm^2	2
Steam Temp: ^oC	130
Disc type:	5821 Cr
Disc Clearance: mm.	0.35

Refining:

(Raffinator type ROP, Screw feeding, discs type 5821 Cr)

Sample:	R_1	R_2	R_3	R_4
Refining stage:	1	2	3	Pulp R_3 screened & centri-cleaned:
Refining Consis: %	22	20	19	
Disc clearance: mm	0.3	0.25	0.2	
Freeness: cc CSF	400	290	230	

Screening & Centri-cleaning:

	E_3	E_4
Total amount of Rejects: %		15
Freeness of accept cc CSF:		120
Physical Properties:		
Basis weight: g/m^2	97.0	104.7
Bulk; cm^3/g	2.47	2.10
Burst factor:	7.00	15.0
Breaking length(Meters)	1720	3070
Elongation %	1.8	2.6
Tear Factor	31	42
Folding, Kohler-Molin, load 200 g:	40	400

(Source: Defibrator AB, Sweden)

VII. Newsprint from Bagasse by the Grace-Peadco Process:

Earlier approaches to this technique were based on to quick prehydrolysis to well depithed Bagasse at 175 C and at a pH of about 5.5 to reduce the hemicellulose content of the raw-material to the required level, followed by mild treatment with Sodium sulphite to prehydrolysed Bagasse and finally/with treatment sodium silicate of low concentration supposedly to control the brightness of resulting pulp. It would seem, the promoters conducted a commercial trial in their Ecuador mill during Jan 1970 based on their pilot plant investigations and obtained a pulp yield of about 75% in the brightness range of 54-55 G.E and of 91% opacity. Consumption of Sodium-sulphite and sodium silicate were reported at 2% and 1% respectively for the above levels of pulp/yield. Another set of commercial trials were conducted in the same mill during March 1970 in which the period of prehydrolysis

was controlled closer to 7 minutes and the subsequent sulphite digestion was kept at 10 minutes. Sodium silicate was injected at the discharge cone of the Kettle. Consumption of Sodium Sulphite and Sodium Silicate on Bagasse to prehydrolysis is reported at 2 and 1% respectively. In most of the above trials. permanganate number of resulting pulp was on the low side. Yield of pulp on upgraded Bagasse remained at 72%. Total production was shipped to USA for commercial evaluation of this pulp. During May last year trials were established in the Beloitt Research Centre, on a twin wire former machine at a speed of about 2500 feet/minute, to prove the runnability of the stock from a furnish of 80% Bagasse Pulp. 10 % ground wood and 10 % Chemical Wood pulp as well as to assess the properties of Newsprint therefrom. It is reported that Bagasse pulp had to be refined to a sufficient freeness to break up its shive content before the furnish was formed with other pulps. It is also reported that the institute of Paper Chemistry, Appleton-Wisconsin assisted the promoters to carry out the above test run at the Beloitt Research Division. No details of this test run are available. However, Mr. Villavicencio's paper on Bagasse Newsprint to TAPPI conference in Louisiana during November 1970 provides some datas on the physical properties of Bagasse Newsprint from different furnishes; and these are reproduced below:—

Physical Properties of
Bagasse Newsprint:

		100 % Bagasse Pulp		85% Bagasse Pulp + 15% Che.W.Pulp	
Run Number:		2	3	4	6
Basis Wt: Gms/M^2		n.a	n.a	n.a	n.a
Caliper: mils:		4.63	4.4	4.93	4.42
Tensile:Lbs/in:	M.D.	14.13	17.53	13.47	19.16
	C.D.	7.55	9.28	8.26	9.16
Stretch%:	M.D	1.3	1.6	1.5	1.9
	C.D.	1.0	1.3	1.3	1.6
Tear: gms/sheet	M.D.	24	23	38	34
	C.D.	28	28	46	37
Gurley Porosity: Sec/100cc:		17	35	11	31
B & L Opacity:		86.8	85.3	87.1	84

The promoters of this process are optimistic that they could achieve yields of +80% with a brightness of about 55 G.E and capacity of 90% for Bagasse Pulp after dropping out the intermediate pulping with Sodium Sulphite and retaining the Prehydrolysis technique and use of Sodium Silicate to correct the brightness of pulp before the same leaves Kettle operations. They have christened this quality as Thermo-Chemical Pulp. It would be a welcome development if this Thermo-Chemical Pulp would solve the possibilities of low cost pulps of acceptable quality to the Newsp Furnish.

VIII. Other Processes for Newsprint from Bagasse:

Other developments associated with Newsprint from Bagasse had emphasised the use of good quality Sulphate

Bagasse Pulp to substitute all of Chemical Wood Pulp and a part of Groundwood pulp from the conventional furnish and recommended 1:1 furnish of Bagasse Chemical Pulp and Spruce Groundwood to form [illegible]. Bordering on these lines, institutions like Japan Consulting Institute, Ayotla Tuxtepec and Karlstad Makaniska Werkstad had conducted pilot plant investigations to prove such possibilities. The Ayotla Tuxtepec Mexico trial in April 1961 used 40% Bagasse Chemical and 60% mechanical pine wood pulp to manufacture acceptable grade News at a paper machine speed of 1250 feet/minute. Runnability of the News stock as well as the functional properties of Newsprint therefrom were comparable to conventional News furnish& standard Newsprint. Nevertheless these formulations have some meaning only to such countries where possibilities exist to produce mechanical pulp from softwood. Even then, 100% furnish from short fibered pulps should [illegible] an operating speed limit in the Paper Machine very much below the present day standards of 800 meters/minute. Short spells of trials in a Paper Machine would not provide a right answer to the behaviour of stock at a particular operating speed. Only extensive trials would permit a correct analysis of the bahaviour of news stock at specific operating spped of the Paper Machine.

IX. A possible future approach to improve the prospects of Newsprint from Bagasse:

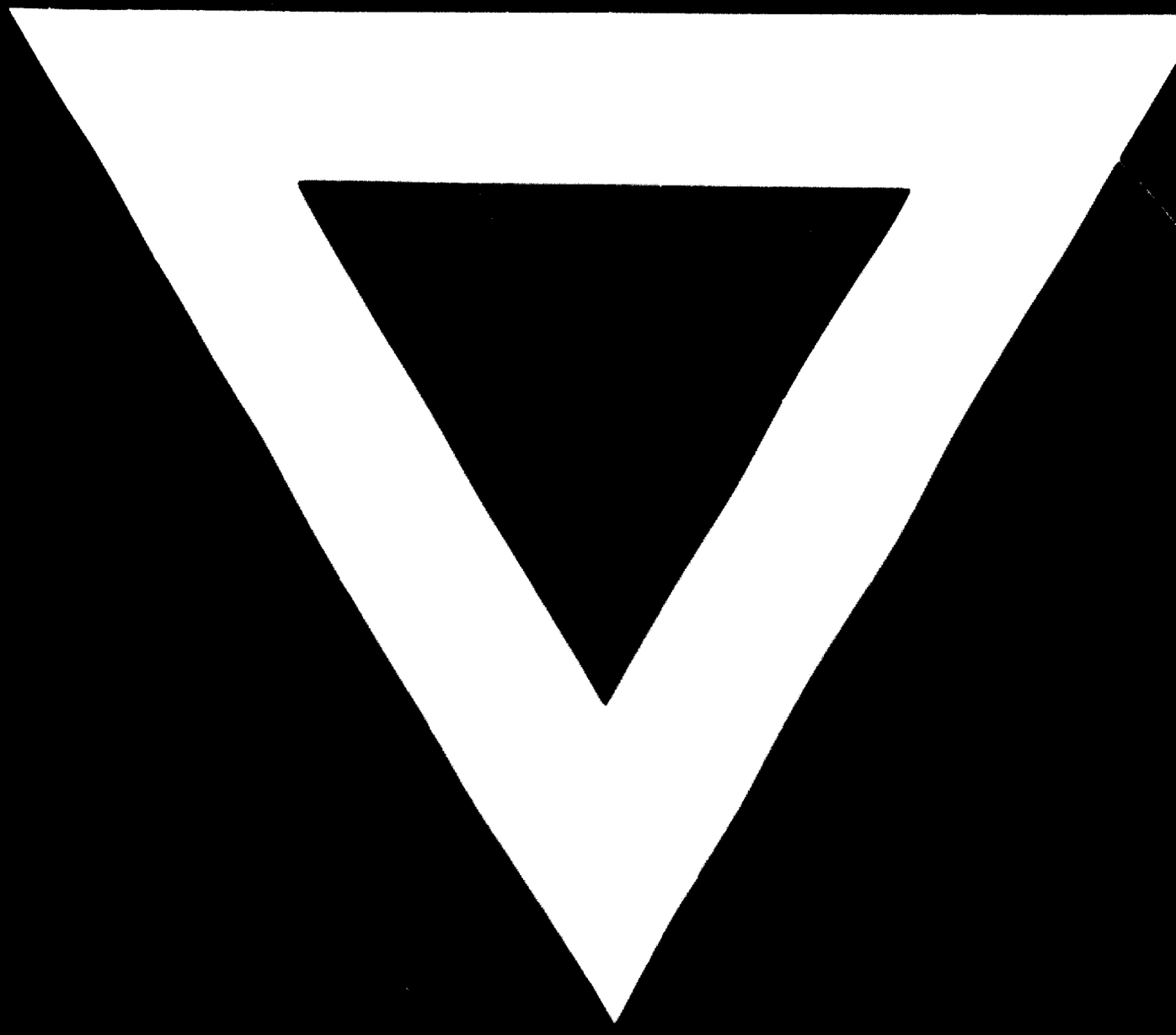
Hitherto approaches to resolve the problem of Newsprint from Bagasse have been mostly direated towards the [illegible]tion

full chemical or semi-chemical pulp to cover a substantial % age of furnish to the News Stock except in the case of the Crown Zellerbach Process. It should be recognised that Chemical or Semi-chemical pulping is a highly capital intensive process and its economy would very much depend on the scale of production. Assuming the possibilities of an economic capacity semi-chemical pulp mill of 150-160 daily tons rating, its installed cost along with connected Utility and Service Stations would be in the region of US $ 21-22 million. A standard full chemical pulp mill of above capacity would also warrant a similar investment. It would therefore be logical from the investment point of view to question the concept of a semi-chemical pulp mill in preference to full chemical pulp mill. Furthermore, the only recognisable variable in the direct cost of production between semi-chemical and full chemical (both semi-bleached) is 0.2 T Bagasse/T Pulp in favour of the former which has practically no significance considering the several advantages of full chemical pulp which would favour the production of more remunerative grades of Paper. Irrespective of : proferred claims for good runnability of stock from a substantial % age of semi-chemical pulp in the furnish and in a fast running paper machine, which has got to be proved through extended commercial operations, no entrepreneur would be interested to sink so much capital for a semi-chemical pulp mill to develop the Newsprint Industry. Therefore it should be logical to look to processes which does not necessarily require a large scale operation and so , heavy investment to develop low cost pulp to the Newsprint Industry. In this context, the

hitherto approaches to produce straight mechanical and or mechanical type of pulp from Bagasse are commendable. Production capacity of such an installation would be tailored, matched and integrated with a paper mill of definite capacity for a comparatively low and modest investment. To achieve this objective, the present technology to produce mechanical and mechanical type of pulp, by the Refiner method, should be vastly improved and gaps in the process should be filled to better its chances of commercial acceptability. As of now, the Refiner Mechanical Method consumes 30% additional power than for Refiner Groundwood, yields a quality of pulp of non-recognisable physical properties as well as of low brightness and involves expensive bleaching sequence to tone up the brightness of pulp. Likewise, mechanical-type of pulp by the Refiner method involves expensive cost operations arising from lower yield of pulp, chemicals for pre-treatment and bleaching and additional consumption of power eventhough possibilities have been established through pilot plant investigations to produce pulp having near physical properties to conventional groundwood. Furthermore, past investigations on mechanical and mechanical type of pulp from Bagasse did not stress on the quality of upgraded Bagasse needed for the Refiner Method of Pulping eventhough processes as well as equipment were available to control the hemi-cellulose content as well as the pith% in the upgraded fibre fraction. Therefore, there is every possibility to improve on past practices and to establish a sound technology to produce mechanical and or

mechanical-type of pulp from Bagasse at low cost provided consistant and reliable work is conducted in a well organised pilot plant atleast for a period of about 2 years. It should be also recognised that Newsprint industry, based on conventinal furnish, achieved high speed operations in paper machine through systematic evolution of process controls as well as quality improvements to the News Stock through several years of development. Therefore, pilot plant facilities should include a high speed paper machine to permit extensive investigations on all aspects of low cost pulp and Newsprint from Bagasse. Till such time a sound technology is developed, Newsprint from Bagasse would only attract academic interest.

The author is grateful to all the institutions mentioned in this document for the valuable information they had given from time to time on their efforts to develop the technology of Newsprint from Bagasse.



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