SUCCESSFUL PRODUCTION OF BAGASSE NEWSPRINT NOW A REALITY – VITAL CONCEPTS WHICH MADE IT POSSIBLE

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ABSTRACT

After 130 years of efforts, strewn with failures, successful production of bagasse newsprint, of a quality, which is fully acceptable to the publishers, is now a reality. As a result of the cautious approach pursued by serious and competent investigations, over the past 25 years, combined with their realization of the vital elements required for success in this field, the basic technology has been perfected and large newsprint mills are now operating in India, Indonesia and Mexico, in which a high percentage of bagasse pulps are being used. The four vital concepts which have proved to be essential and which have been adopted by these mills are:

1. The necessity to use a high content of mechanical pulp in the furnish, all or part of which can be produced from bagasse.
2. The necessity to have highly efficient moist and wet depithing systems.
3. The necessity to utilize a good wet storage system which assures anaerobic conditions in the pile to prevent excess deterioration of color and brightness of the bagasse, since the brightness of the depithed bagasse controls the final brightness of the pulp.
4. The necessity to use a bleaching system which maximizes the increase in brightness, with little or no damage to the bagasse mechanical pulp properties.

Key words: Bagasse papers, bagasse newsprint, bagasse pulping, bagasse storage and conservation, bagasse depithing, bagasse pulp bleaching.

INTRODUCTION

Successful commercial production of bagasse newsprint, of a quality which is fully acceptable to the publishers, was a long time coming 130 years to be exact. The history of bagasse newsprint, upon which so many organizations and individuals have devoted a tremendous amount of time and effort over these many years, was strewn with failures until the mid 1980s. However, as a result of
the cautious approach pursued by very serious and highly competent investigators, over the past 25 years, it can be safely proclaimed that successful bagasse newsprint production is now a reality.

The author has followed bagasse newsprint developments, for more than 40 years, including the evaluations of many processes proposed, and participation in development of some of the basic concepts, which have been responsible for the recent success, in this field.

In connection with this work over the years, the author has periodically made comprehensive reviews of the progress made toward successful bagasse newsprint production, including a paper, presented at the XVIII ISSCT Congress in Havana (Atchison\textsuperscript{1,2}). The first reported work on bagasse newsprint was announced in 1856 when Henry Lowe of Baltimore carried out experiments with southern U.S. sugarcane and the resulting paper was used to print the Baltimore Advocate. This effort, was described by West\textsuperscript{3}, in 1920. From that time onward, proposals for producing bagasse newsprint have periodically appeared about every 20 years with much fanfare and publicity. However, none of these early attempts to produce satisfactory bagasse newsprint on an economic basis, were ever successful. All of them were based on using 100\% chemical pulps, including a high percentage of bagasse chemical pulp in the fibrous furnish.

The main reasons for the early failures were:

- Overzealous promotion of the use of bagasse by people who lacked understanding of its properties and limitations.
- The lack of a satisfactory method of depithing, resulting in unsuccessful attempts to produce a saleable paper, because pith and epidermis cells remained in the finished product.
- The lack of a satisfactory method of storing bagasse which resulted in huge losses when attempts were made to store it between sugarcane grinding seasons.
- The lack of understanding of the required properties of newsprint, which are imparted mainly from the use of mechanical type pulp, including straight mechanical pulp (TMP) or chemimechanical pulp.

**ACCEPTANCE OF THE NECESSITY FOR MECHANICAL TYPE PULP IN THE NEWSPRINT FURNISH**

Based on extensive study in this field over many years, it is a conviction of most newsprint experts including the author, that a newsprint sheet produced from bagasse must contain a substantial proportion of mechanical type pulp to provide the necessary qualities which are essential for newsprint, with a minimum of
It was concluded that the only successful methods of producing bagasse newsprint must follow the traditional concept in the newsprint industry, whereby a major proportion of the furnish consist of mechanical type pulp or high yield pulp approaching the qualities of mechanical pulp.

As already known, full scale mills built in Louisiana, Cuba and Peru, based on using a high proportion of chemical or semi-chemical pulp failed to produce newsprint economically.

The author has also carried out many technical and economic evaluation of various bagasse newsprint processes, which have been proposed, based on this same concept. In all cases, such studies, including several full-scale paper machine runs, have resulted in conclusions that such processes would neither produce the quality newsprint necessary to meet world market standards, nor produce it at an economic price.

**Processes Proposed for Manufacture of Bagasse Newsprint with a High Proportion of Mechanical Pulp and Successful Mills in Operation Based on That Concept**

**General Comments**

Over the past 25 or 30 years, a number of top-level research organizations and large scale manufacturers of newsprint have become interested in making newsprint from bagasse. Knowing from experience that the key use properties of newsprint are furnished by the mechanical pulp content, the emphasis of the work which these companies and research organizations have carried out has been on utilizing some type of mechanical pulp as a major portion of the furnish. The author should like to review some of these efforts which have led to almost universal acceptance of the fact that for production of bagasse newsprint, it is necessary to have a relatively high percentage of mechanical type pulp, of some type. This is the approach which the author has consistently advocated for the past 40 years.
ACTIVITIES IN BAGASSE NEWSPRINT BASED ON USING BAGASSE CHEMICAL PULP, BUT USING MECHANICAL PULP FROM WOOD

A number of large scale trial runs have been made in Canada, Sweden and Mexico, in which a major portion of the long fibered wood pulp was replaced with bagasse chemical pulp. Runs of this nature took place in Canada as early as 1949, Lathrop, and at Tuxtepec in Mexico in 1960 - 61. In these test runs, it was proven conclusively that bleached bagasse chemical pulp could replace a major portion, if not all, of the long fibered chemical pulp. Sunds Defibrator in Sweden, also reported in 1982 on work with a mixture of bagasse chemical pulp, with chemimechanical pulp from eucalyptus or other hardwoods (Ryberg).

As a result of all of this work, there appeared to be no doubt, even in the 1950s and 1960s that high quality newsprint could be produced with a blend of mechanical wood pulp and bleached bagasse chemical pulp, with only a small amount of long fibered chemical pulp and possibly without long fibered chemical pulp at all. However, these efforts did not go far enough to satisfy many of the developing countries, with limited wood supplies, who insisted upon a much higher content of bagasse based pulps for newsprint.

THE "HAWZELL" PROCESS DEVELOPED BY THE HAWAIIAN SUGAR PLANTERS' ASSOCIATION IN COLLABORATION WITH THE CROWN ZELLERBACH CORPORATION

During the early 1960s, the Hawzell Process for manufacture of bagasse newsprint was developed through collaboration of the Hawaiian Sugar Planters' Association and the Crown Zellerbach Corporation. This work has been described by the author in several papers, and in papers and patents by the HISPACZ Group (Atchison, Meyer, Wethern, Hinrichs, Henderson).

Their approach was to simulate mechanical wood pulp by grinding well depthed bagasse in disc refiners with mechanical treatment only. This pulp, with characteristic similar to the mechanical wood pulp, the major component of standard newsprint, imparted good opacity, good ink absorbency and a good printing surface to a newsprint sheet. In addition, a maximum yield was obtained from the bagasse. The bagasse mechanical pulp was then bleached and mixed in various proportions with semi-bleached softwood kraft pulp and bleached bagasse chemical pulp in the normal fashion for production of newsprint. Their pulp mixtures were similar in properties to standard newsprint.

Intensive efforts were made to develop projects in Hawaii, Egypt and India, in which the author was involved, based on this process, which was sound technically. However, the larger financial agencies were reluctant to finance these
projects unless they could actually see a similar mill in operation on a sustained basis such as Cuba-9, for example. Therefore, after spending several million dollars on this development, the Crown Zellerbach Corporation and the Hawaiian Sugar Planters' Association (HSPA) made an irrevocable decision in about 1966, that they would not devote any further time, energy or money to bagasse newsprint.

For many of the developing countries, this decision was indeed unfortunate, because the development of the optimum formulation for production of an acceptable newsprint with maximum percentage of bagasse pulp of various types was delayed by an additional 20 years. From the standpoint of quality as viewed by the Publishers, no one has yet equalled the work of the HSPA-CZ Group in producing fully acceptable bagasse newsprint without the addition of fillers or opacifiers.

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EFForts TO DEVELOP A BAGASSE NEWSPRINT EXPERIMENTAL MILL OR DEMONSTRATION PLANT, 1967-1972

After the projects in both Egypt and India failed to go through, and Crown Zellerbach and HSPA discontinued work on bagasse newsprint in 1966, the author became convinced that the next step in this development should be a large pilot plant or semi-industrial demonstration plant for studying bagasse newsprint. With such a plant, all of the proposed processes could be tried and rigidly evaluated so that optimum technology for bagasse newsprint production could be developed, as a solid basis for convincing the financial institutions of the feasibility of full scale projects. Therefore, during the period from 1967 through 1972, the author made a concentrated effort to convince one of the existing bleached bagasse pulp and paper mills to install a bagasse mechanical pulping line so as to be able to demonstrate the feasibility of producing bagasse newsprint. These efforts were made in Argentina, Egypt, Venezuela, Mexico and India. Unfortunately, however, even with the promised support of the United Nations Development Programme, for such a project, it was not possible to develop such a demonstration plant during this period. The breakthrough came unexpectedly, when the Cuban Government presented such a project to UNDP for financial support in 1971, which eventually resulted in the Cuba-9 plant.

ACTIVITIES OF ICIIDCA AND THE CUBAN RESEARCH CENTER FOR INDUSTRIALIZATION OF SUGARCANE BAGASSE (CUBA-9)

The historical development of the Cuban Research Center for the industrialization of sugar cane bagasse, commonly referred to as Cuba-9, has been covered by the author in a number of papers (Atchison1,2,7). Other papers describing the
excellent work being carried out by the Cuba-9 project have been presented by various members of the ICIDCA and Cuba-9 staff in previous ISSGT Congresses (Villamizar12,14, Fernandez13, Molina15, Fernandez18, Lopez17, Bamabanaste18). Fortunately the author has been involved in some way in this project, on behalf of UNDP, since its conception and until 1988, and has been greatly impressed with the excellence of the work carried out. Needless to say, they adopted the mechanical pulping approach to produce chemimechanical pulp from well depithed bagasse.

THE TAMIL NADU NEWSPRINT AND PAPER PROJECT IN INDIA

The 300 T/D bagasse newsprint mill, which was preceded by intensive development work starting about 1978 also adopted the mechanical pulping approach. This mill which started up in 1985, has been very successful, as a bagasse newsprint producer. A number of papers have been presented, at various pulp and paper conferences, on the Tamil Nadu development (Atchison19, Venkataraman20,21,23, Rao22).

THE P.N. KERTAS LECE S BAGASSE NEWSPRINT MILL IN PROBOLINGGO, EAST JAVA, INDONESIA-LECES IV

This 300 T/D bagasse newsprint mill also was officially inaugurated in 1985. After the usual start-up problems, the mill is now producing newsprint of a quality which has been fully acceptable to the Indonesian publishers, using a fibrous furnish consisting of 40 to 50% bagasse mechanical type pulp, up to 25-30% bagasse chemical pulp and the remainder being rice straw chemical pulp and long fibered pulp. This mill also must be considered a success.

THE MEXPAPE MILL IN MEXICO

Although the Mexicana de Papel Periodico (MEXPAPE) mill in Mexico, was initially designed to use a relatively high content of bagasse chemical or semichemical pulp, the process/design and equipment were chosen with sufficient flexibility so that new technology developments could easily be incorporated in the mill, and so that mechanical wood pulp could be used, to produce a good quality offset printing paper. In recent years this mill has become even more successful, as a newsprint producer by installing deinking facilities to recycle old newspapers, and thus to obtain a high mechanical pulp content from that source. This mill has been described by Ullom24.
General comments

In all of the serious work which has been carried out on the production of high yield mechanical type pulp from bagasse, it has been found that very complete depithing is essential. To accomplish this, not only is efficient moist depithing essential, but a final stage washing and wet depithing is likewise necessary or even two stages of wet depithing if the moist depithing stage is not used.

It is predominantly the pith in bagasse which results in low opacity when producing any type pulp from bagasse, including mechanical pulp. The pith cells themselves, when separated out, have proven to have extremely low opacity. On the other hand the good bagasse fiber, if the pith is all removed, results in opacity as high as pine or spruce, when converted into mechanical pulp. Therefore, the greater the pith removal the higher the opacity and light scattering properties of bagasse mechanical pulp. It has been proven conclusively that any appreciable amount of pith in refiner mechanical or chemimechanical bagasse pulp is highly detrimental to pulp properties.

DEPITTHING PROCEDURES AVAILABLE FOR MOIST AND WET DEPITHING

There are now a number of excellent bagasse depithers available on the market, most of which are of U.S. design because the technology for bagasse depithing was entirely an U.S. development of the 1950s. The importance of efficient depithing processes has been stressed in the literature from 1941 to the present time, including a number of papers, presented at previous ISSCT Congresses (Atchison7,27,31,32, Keller25, Knapp29, Lengel26, Lois30).

For mechanical pulp or chemimechanical pulp, in addition to efficient moist depithing, it is also necessary to wash the moist depithed bagasse thoroughly and to carry out a final wet depithing step at the pulp mill just before the bagasse goes to the mechanical or chemimechanical pulping process. This system can follow immediately after the moist depithing stage during the sugarcane grinding season if the bagasse is to be pulped immediately, or it can be applied to the moist depithed bagasse being brought back from storage during the period between cane grinding seasons. The author has also described in some detail, excellent methods of washing and wet depithing of the bagasse in a number of papers (Atchison7,27,31,32). All of the successful projects for production of bagasse newsprint use washing and wet depithing of the bagasse before it is converted into mechanical or chemimechanical pulp.
THE CRITICAL NECESSITY FOR A GOOD BAGASSE STORAGE SYSTEM TO PRESERVE STRENGTH AND BRIGHTNESS OF THE BAGASSE FOR PRODUCTION OF MECHANICAL PULPS

In general it has been found that for best preservation in storage the bagasse must be either dried to a moisture content below 20% and kept covered during storage or kept wet to 80% moisture content or below during the entire period of storage. By both of these methods, the essential element is the control of the fermentation process, involving the residual sugar, which remains in the bagasse when it leaves the sugar mill, so as to preserve the bagasse fiber to the greatest extent possible and to minimize the losses in storage. A comprehensive report on modern methods of bagasse storage was presented by the author at the XIV ISSCT Congress (Atchison). This information has been updated in other more recent papers (Atchison).  

SPECIAL PROBLEMS IN STORING BAGASSE FOR PRODUCTION OF MECHANICAL TYPE PULP

In addition to losses in quality, which have been solved satisfactory for chemical pulp, there are other special problems which arise when storing bagasse for manufacture of mechanical type pulp. These relate to color and brightness.

When bagasse comes fresh from the sugar mill, and the moist depithing is efficient, the moist depithed bagasse is usually light in color, with a brightness exceeding 40° ISO and sometimes as high as 45° ISO, if the cane is relatively clean. However, by the traditional bale storage methods or moist bulk storage methods, as fermentation proceeds, the bagasse becomes very dark and may lose 20 more points in brightness, bringing it down to 20° ISO or below. Since the brightness of the bagasse mechanical type pulp depends almost entirely on the brightness of the well depithed bagasse reaching the refiners, this means that with traditional storage methods, the mechanical type pulp will also have a very low brightness when produced from stored bagasse. Therefore, since the maximum brightness increase which can be achieved by the use of peroxide or hydrosulphite or a combination of the two, is about 20 points, this means that if the stored bagasse has a brightness of only 20° ISO to 30° ISO the maximum brightness which can be achieved for the bleached bagasse mechanical pulp will be 40° ISO to 50° ISO which is not adequate for newsprint. On the other hand if by proper storage methods, this brightness of the bagasse can be maintained between 35° and 40° ISO while still maintaining a good open structure, the mechanical pulp can then be bleached to 55° ISO and 60° ISO respectively, at which brightness is acceptable.
THE RITTER BIOLOGICAL PRE-TREATMENT PROCESS FOR STORAGE OF BAGASSE IN BULK

The Ritter biological pre-treatment process for wet bulk storage of bagasse, which was developed by the late Mr. E.A. Ritter and his collaborators in South Africa, or modifications of it, are now being used in all of the successful bagasse newsprint developments. The process has been described in detail by MacDonald, Möbius, Salalabel, Wang, Botes, Bruijn, et al., Lois Correa, as well as by the author (Atchison). The general principal, of the Ritter Process, or modifications of it, involves the impregnation of the bagasse with a biological liquor and flushing the dilute suspension to a bulk storage area through elevated channels or by means of a pump-up device.

The key to the success of wet bulk storage appears to be the distribution of the bagasse in dilute suspension, the use of cross channels in the storage slab to assure vertical drainage and a high degree of compaction and recirculation of the drainage fluid. When these critical procedures are followed, as they are at Ledesma, in Argentina, the Mondi Mill at Felixton, South Africa and at Cuba-9, excellent preservation of the bagasse results.

In view of the many proven advantages of the Ritter system and variations of this system for wet bulk storage of bagasse, it is believed that this method of storage and preservation of bagasse will be used more and more especially for mills which produce bagasse mechanical or chemimechanical pulp for newsprint.

THE NECESSITY FOR A GOOD BLEACHING SYSTEM TO INCREASE THE BRIGHTNESS TO THE MAXIMUM EXTENT WITHOUT DETRIMENT TO THE QUALITIES OF THE PULP

Excellent bleaching systems for the bagasse mechanical pulp have been developed by the Cuba-9 Group, and are also being practiced by Tamil Nadu, in India and Leces in Indonesia. Use of hydrogen peroxide, by various techniques, is the key to successful bleaching of bagasse mechanical pulps. These procedures have been described in detail in the literature, including a paper at the XVII ISSCT Congress (Fernandez).

CONCLUSIONS CONCERNING THE WORLDWIDE IMPACT OF SUCCESSFUL TECHNOLOGY FOR PRODUCTION OF BAGASSE NEWSPRINT

With the commercial success of the Tamil Nadu Mill in India, the Leces Mill in Indonesia, the Mexpape Mill in Mexico, the pilot plant success of the Hawaiian-
Crown Zellerbach work, and the tremendous amount of work at the Cuba-9 demonstration plant in optimizing the process for production of bagasse newsprint, there appears to be no question but that bagasse newsprint has arrived.

Fortunately, all of these organizations have come to realize the critical factors, which must be considered to be successful in production of bagasse newsprint, and have implemented the necessary procedures.

The impact on these countries, resulting from the successful solutions to the bagasse newsprint problem, could be very great indeed. The availability of adequate newsprint from domestic sources is vital to every country, for both their economic and cultural development.

REFERENCES


LA PRODUCTION DE PAPIER JOURNAL À PARTIR DE LA BAGASSE A MAINTENANT ÉTÉ RÉALISÉE AVEC SUCCÈS – LES CONCEPTS VITAUX QUI L’ONT RENDU POSSIBLE

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RESUME

Après 130 ans d’efforts parsemés d’échecs, la production de papier journal d’une qualité totalement acceptable aux imprimeurs est maintenant une réalité. Grâce à l’approche prudente de chercheurs sérieux et compétents pendant les 25 dernières années, et à leur appréciation des éléments essentiels au succès dans ce domaine, la technologie de base a été mise au point, et d’importantes usines de papier journal travaillent maintenant en Inde, en Indonésie et au Mexique. Elles utilisent une forte proportion de pâte de bagasse. Les concepts vitaux qui se sont révélés essentiels et qui ont été adoptés par ces usines sont:

1. La nécessité d’utiliser une forte proportion de pâte mécanique dans l’alimentation, dont la totalité ou une partie peu être produite à partir de la bagasse.
2. La nécessité d’avoir une séparation très efficiente au défibrage en milieu humide ou liquide.
3. La nécessité d’utiliser de bons systèmes de stockage en milieu humide pour d’assurer de conditions anaérobiques dans la bagasse entassée et empêcher une détérioration excessive de sa couleur et de son éclat puisque l’éclat de la pâte dépend de l’éclat de la bagasse.
4. La nécessité d’utiliser un système de décoloration qui augmente au maximum l’éclat avec peu ou pas de réductions des propriétés mécaniques de la pâte provenant de la bagasse.

Mots clefs: Bagasse, papier journal.
Después de 130 años de esfuerzos, llenos de fracasos, ya es una realidad la producción exitosa de papel periódico de bagazo, de una calidad aceptable para los editores. Como resultado del cauteloso enfoque seguido por serias y competentes investigaciones, durante los últimos 25 años, combinado con la realización de los elementos vitales requeridos para éxito en este campo, se ha perfeccionado la tecnología básica. Grandes fábricas de papel periódico están operando hoy en India, Indonesia y México, en las cuales se utilizan altos porcentajes de pulpa de bagazo. Los 4 conceptos vitales que se ha demostrado que son esenciales y que se han adoptado en estas fábricas son:

1. La necesidad de utilizar un alto contenido de pulpa mecánica en el "furnish", la que puede producirse de bagazo total o parcialmente.
2. La necesidad de tener sistemas de desmedulación en húmedo y en mojado de alta eficiencia.
3. La necesidad de utilizar un buen sistema de almacenamiento húmedo que asegure condiciones de anaerobiosis en la pila y eviten el excesivo deterioro del color y brillantez del bagazo, dado que la brillantez del bagazo desmedulado controla la brillantez final de la pulpa.
4. La necesidad de utilizar un sistema de blanqueo que maximice el incremento de brillantez, con poco o ningún daño en las propiedades de la pulpa mecánica de bagazo.

Palabras claves: Bagazo, papel periódico.