THE IMPLEMENTATION OF SOUTH AFRICAN SUGAR TECHNOLOGY: THE WORLD'S LARGEST SUGARCANE DIFFUSERS

By

I. VOIGT
Bosch Projects (Pty) Ltd, 203 North Ridge Rd, Durban
voigti@bproj.co.za

KEYWORDS*:* Diffusers, Extraction, Brazil, Technology, Chainless, South Africa.

Abstract

CANE diffusion gained popularity in South Africa in the 1960s and 1970s using European technology. Local research and developments led to the development of locally designed diffusers and to the South African industry achieving the highest extraction rates in the world. The largest diffusers in the South African industry were installed at Felixton 2 in 1984, being 12 metres wide and rated (conservatively) at 350 t/h. The first real change to the fundamentals of diffuser design since then took place when Bosch Projects introduced the 'chainless diffuser' concept in 2006. Of the nine chainless diffusers to be installed in Brazil between 2008 and 2010, two are similar in size to those at Felixton and six are larger. The first of the 12 metre diffusers (at UNP and rated at 500 t/h) was commissioned in September 2008. The diffusers at Brenco, Cosan Jatai and Meridiano are 15 metres in width, are rated for 98% extraction at 625 t/h and will be the largest cane diffusers in the world. The diffusers in Cosan and Meridiano will ultimately process 875 t/h. The successful sales of the chainless diffuser in Brazil is evidence that South African sugar technology and engineering continue to play a leading role, even in the most competitive sector of a fast-changing world industry.

The history of cane diffusers

It is reported that cane diffusion has been in use for over 100 years, first in batch form and more successfully as a continuous process. Continuous diffusers were well accepted in the beet industry before they made their way into the cane industry. Their acceptance in the cane industry became more common in the 1960s, first as bagasse diffusers (where one or two mills preceded the diffuser) and then later as cane diffusers.

As an indication of the increasing interest in this alternative extraction technology at the time, the proceedings of the 12th Congress of the ISSCT in Puerto Rico in 1965 contains numerous papers by researchers and engineers reporting on early continuous diffusers around the world.

- The Diaz-Compain diffuser, from a Puerto Rican designer, was working in a factory in East Pakistan. (Diaz-Compain, 1966). The principle of operation was to fully submerge the cane in a very large slat conveyor, and rates of extraction of over 99% were claimed.
- The first DDS cane diffuser had been operating for a few months at TPC in Tanganyika (Weng and Bruniche-Olsen, 1966). It was based on the DDS beet diffuser and consisted of twin screw conveyors that transported the bagasse counter-current to the juice. Clarifier mud was recycled to the diffuser.
- A Silver Ring diffuser was reported as operating in its second season in Hawaii (Townsley and Cheatham, 1966). This was a hugely successful installation and their understanding of the important requirements for successful diffusion was years ahead of its time, as reported by Payne (1968).

- E. Gulbaran (Turkey) proposed his diffuser for cane and beet (Gulbaran, 1966).
- The operating results from three 150 tch bagasse diffusers at Nag Hamadi in Egypt were presented, while a 200 t/h unit was under construction. (Tantawi, 1966). The Egyptian diffusers were of the style that ultimately became popular in South Africa, using a stationary perforated plate floor; chains for the conveyance of bagasse inside the diffuser; a 1–2 m bed depth at 0.7–1.5 metres per minute; and independent juice collecting tanks below the screen.

In South Africa, diffusion started in 1927 when Duncan Fletcher supplied a diffuser to the Tinley Manor factory (Buck, 1965). In 1966, Union Co-operative installed a BMA bagasse diffuser in their new sugar factory based on the very promising performance of the Egyptian diffusers, and De Smet diffusers were installed at Entumeni and Nchalo (Buck, 1965). In 1967, a BMA diffuser was installed at Empangeni mill and a De Smet diffuser at Malelane. (This was a period of substantial growth in the industry, and new milling tandems were commissioned at Amatikulu, Noodsberg and Sezela) (Perk, 1966).

By 1974, there were seven diffusers operating (or under construction) in the industry as follows (Fitzgerald and Lamusse, 1974):

Union Co-op:	60 t/h BMA bagasse diffuser (1966).
Entumeni:	48 t/h De Smet bagasse diffuser (1966).
Empangeni:	205 t/h BMA bagasse diffuser (1967).
Malelane:	225 t/h De Smet bagasse diffuser (1967).
Umfolozi:	80 t/h Saturne bagasse diffuser (1971).
Pongola:	150 t/h FS/van Hengel bagasse diffuser (1973).
Amatikulu:	400 t/h Huletts cane diffuser (1974).

By 1984, there were 10 cane diffusers and four bagasse diffusers in the SA industry out of 21 extraction plants, accounting for 54% of cane processed (Lamusse, 1985). In these early days, the motivation for installing diffusers was the lower capital cost and lower costs of maintenance and operations (Fitzgerald and Lamusse, 1974), rather than improved extraction, since the early extraction benefits were small.

An interesting historical phenomenon is that, while the installation of new diffusion plants and their successes are well documented, the reasons for their failures are not so well recorded. Of the list of seven diffusers in 1974, only Amatikulu remains. The bagasse diffuser at Union Co-op was replaced with a cane diffuser; the Entumeni and Empangeni factories were ultimately closed; Malelane now has a BMA cane diffuser, as does Pongola; and Umfolozi has a De Smet diffuser.

Diffuser development in South Africa

In the early days of this boom in diffusion, South African engineers contributed significantly to the success of the technology, whereas a lack of engineering innovation seems to have doomed diffusers to failure elsewhere. Renton and van der Riet (1971) reported on the improvements made to the 225 t/h BMA diffuser at Huletts' Empangeni mill, which was installed to replace the third and fourth mills of their six mill tandem. Huletts pioneered the use of:

- lifting screws to overcome the problems of flooding in the area of press water return;
- tracer testing of juice percolation using NaCl and the adjustment of stage troughs;
- the use of stage sprays in place of overflow troughs;
- windows for internal observation of the diffuser;
- the elimination of press water clarification;
- the use of two dewatering mills in parallel with each other;
- the use of scraper slats on diffuser chains;

- using water as ballast in the press roller;
- an improved understanding of cane preparation requirements.

In the mid-1970s the FS/van Hengel diffuser was developed, claiming advantages of:

- modular construction allowing for incremental capacity increases;
- lower residence times;
- increased sucrose extraction;
- reduced floor area.

Huletts engineers contributed significantly to the theoretical understanding of the diffusion process. Rein (1974, 1995) and Love and Rein (1980):

- quantified the relationship between cane preparation and extraction;
- studied percolation patterns and juice hold-up;
- quantified the effect of stage juice recirculation, imbibition water rate, temperature and residence time on extraction;
- developed a means of controlling diffuser flooding by measuring the juice level inside the bed;
- quantified the proportion of work done by lixiviation versus molecular diffusion.

The diffusers developed by Tongaat Hulett incorporated some unique features (Moor, 2001 a,b):

- Diffuser dry feeding, eliminating the problematic segregation of fines which was caused by conventional sluiced feeding.
- The elimination of draft juice screening.
- The use of direct contact heating of unscreened press water.
- the introduction of fully adjustable juice sprays (replacing weirs).
- and juice level measurement for automatic spray positioning.

In 1996, Bosch Projects rekindled interest in the old idea of clarifier mud recycling (and branded it ‘Filtrafusion’). Tongaat Hulett trialled the process at its Maidstone factory (Meadows *et al.*, 1998). This proved successful and has since become the standard for diffusers in South Africa.

As a result of many years of focus on the optimisation of diffuser design and operation, the extraction achieved by Southern African mills exceeded all previously accepted norms. The average extraction of diffuser factories in South Africa frequently exceeds 98% over the entire season.

The advantages of diffuser extraction over milling

The rapid adoption of diffusers in South Africa was as a result of many benefits (Rein, 1995; Koster, 1995; Hoeskstra, 1995). Compared to milling, diffusers:

- achieve better extraction results;
- have a lower capital cost;
- are cheaper to maintain and operate;
- absorb less power;
- result in a factory with lower HP steam demand, making more HP steam available for the generation of electrical power.

The limitations of diffusers

Despite the remarkable success achieved in South Africa, diffuser technology never made a lasting impact elsewhere. Cane diffusers were installed far and wide – both BMA and De Smet were very successful internationally. However, although the technology was introduced in most growing sugar industries, it never reached the point of domination over milling extraction, as it had in South Africa, despite the obvious benefits of improved extraction, lower capital cost, lower maintenance and operational costs and improved energy efficiency. The reasons for this vary from country to country and can be fairly difficult to establish. However, the following anecdotal reasons have been given:

- The cane preparation requirements are more demanding for diffusers than mills, and a heavy-duty shredder is essential. This adds to the initial cost of cane preparation equipment and also to the absorbed power for cane preparation.
- It is widely believed that diffusers require higher imbibition water rates than mills, and hence additional exhaust steam demand and evaporator capacity. This is probably because of the high rates used in South Africa, but does not consider the fact that South African imbibition water rates can be high because of excess available bagasse due to long milling seasons, good time efficiencies, high fibre content in cane and the reduced demand for HP steam because of the diffusers in operation.
- In South Africa, we take for granted the sharing of experiences through forums such as the annual SASTA Congress; research performed for the industry by the SMRI; and the constant drive for improved factory efficiencies to cpmpensate for low agricultural yields. In this environment, technological advances in one factory are rapidly communicated and adopted in others, with a good probability of further improvements. Not all countries have a similar structure and culture. For example, in Brazil, factories have traditionally been owned by family concerns and the promotion of new technologies is largely through equipment suppliers. In India, a large proportion of factories were traditionally co-operatives or state-owned, with few incentives to develop technology.
- In countries with milling seasons shorter than that of South Africa, the cane crop is not necessarily large enough to justify the capital expense of more than four mills in a tandem. In these cases, the capital cost of a four mill tandem is compared with that of a diffuser and two de-watering mills, and the economic benefits become more marginal. Not considered is the fact that a smaller and cheaper diffuser could be used for extraction equivalent to four mills.
- The concern that, once a diffuser has been built, its capacity is determined. Any future expansion of the capacity is difficult and costly.

The latter point is, in the experience of the author, the most oft-quoted reason for diffusion not being more readily accepted in industries that have experienced growth.

The reason for the limited expandability of moving bed diffusers rests in the fact that a diffuser’s capacity is related to its dimensions—a larger diffuser can process more cane than a smaller diffuser at the same extraction performance. However, the length of a diffuser is constrained by the limit of chain tension allowed.

Also, any extension to a diffuser’s length will normally require the repositioning of cane preparation equipment or de-watering mills. The height of a diffuser is limited by the depth of prepared cane through which juice can practically percolate. The variable dimension is thus the width of a diffuser, and diffuser capacities are determined by their width. In Brazil, a very simple rule-of-thumb is used to define a diffuser’s capacity: 1 metre of width = 1000 tonnes of cane per day (assuming 100% availability).

(The discussions regarding expandability are generalisations. The diffuser at Triangle in Zimbabwe was expanded to operate at 1800 mm bed depth, and the diffuser at Amatikulu was lengthened by 9.5 metres. However, it is quite obvious that, in both cases, further expansions in capacity are unlikely.)

Every moving bed diffuser has a head shaft at the discharge end of the diffuser. The headshaft drives the diffuser chains and is a rather heavy piece of engineering. (The headshaft of a 12 metre wide diffuser has a mass of about 100 tonnes.) More than any other, this is the component that limits the expandability of diffusers since, for any increase in the width of a diffuser, the headshaft must be replaced with a longer shaft. The economics thereof generally make such an expansion infeasible. Furthermore, in all traditional diffuser designs, the return of the chains is beneath the diffuser, which thus requires a substantial bridging structure, the extension of which is extremely costly.

How wide should a diffuser be?

As previously stated, the capacity of a diffuser depends on its size. The parameters considered for a specified performance are:

- Screen area/tonnes fibre per hour. For extraction performance of 98%, this parameter is in the range of 11–12 m^2/t fibre/h.
- Bagasse retention time. For top performance, 70–80 minutes is considered suitable.

Given an assumed bed depth and an assumed bed speed, these parameters determine the diffuser length and width. The chainless diffusers have a standardised length of 60.25 m, a bed speed of 0.75 m/min and a bed height of 1.5 m. Given these parameters, the conventional width of a chainless diffuser is 5.4 t fibre/h per metre width or 4 t fibre/ h per module. Other diffuser designers have different parameters.

How the chainless diffuser eliminates size constraints

The chainless diffuser concept was developed in 2006 when it was installed into the existing BMA diffuser at UCL (Schröder *et al*., 2007).

The chainless diffuser eliminates the need for chains and a diffuser headshaft. Instead, the diffuser screen (floor) consists of 750 mm wide modules that run the entire length of the diffuser. Each of these modules moves independently of each other, and by employing the correct sequence of movement the cane is conveyed through the diffuser. These individual modules are actuated by hydraulic cylinders and a specialised control system.

There are additional advantages. Since the diffuser structure no longer needs to allow for the return of the chain below the juice trays, supporting columns can be employed beneath the diffuser. The transverse steelwork beneath the diffuser screens, previously unsupported except at their ends, is supported at 3 m intervals in the chainless diffuser. Thus these components are no constraint to the width of diffusers.

The next possible limitation is the transverse beams that suspend the lifting screws. Since they are above the diffuser bed, they cannot be supported midway. With each lifting screw having a mass of around one tonne, the size of these beams becomes quite large. However, it is a simple problem of structural engineering and, in the 15 m wide chainless diffusers, they consist of plate girders 1.45 m deep. Similarly, the dewatering drum and the discharge kicker need to span the entire width of the diffuser, supported only on the bearings 15.9 m apart. Again, these are relatively simple engineering designs.

In trying to determine the maximum practical width of the diffuser, the final consideration is the feed into the diffuser. It is generally accepted that the bed of cane in a diffuser must be as level as possible in both directions. To achieve a level bed across the width of a 6 or 9 m diffuser may be relatively easy, but what is the practical limitation? The 12 m diffusers at Felixton use scraper conveyors to feed the prepared cane into the diffuser. These conveyors rake the top of the bed and ensure that it is perfectly flat, and the excess cane is returned to the infeed end through a system of conveyors. This concept is also generally used in Brazil. The drawbacks are that these scraper conveyors absorb more power; require additional installed conveyors to return the excess cane; and reduce the ability of operators to easily vary bed depth in the diffuser.

All the more recent diffuser designs, however, use conventional infeed carriers with one of two arrangements. Either the carrier is oriented at an angle to the back plate of the diffuser, or it has adjustable mitre floor plates. In this latter design, which is used in the chainless diffuser, as long as the cane supply into the infeed carrier is evenly distributed over its entire width, the design inherently allows for an even spread across the width of the diffuser. Of course, the wider diffusers require a wider infeed carrier so that the angle of the mitre can be maintained, and a 2.4 m wide infeed carrier for up to 15 m wide diffusers has been selected.

Given that the conventional constraints have been removed and that the possible constraints mentioned above are manageable through diligent engineering, Bosch Projects decided to develop a design for diffusers 15 m wide.

Expandability of the chainless diffuser

As mentioned earlier in this paper, one of the reasons given for the slow adoption of diffusers in other cane sugar industries is that a diffuser cannot have its capacity easily expanded. The alternatives are to build a second diffuser to process additional cane or to process the additional cane through the same diffuser at a reduced rate of extraction.

Since the chainless diffuser consists of 750 mm wide modules that move independently, it is a relatively simple exercise to add more modules. What is required is to:

- Extend the transverse structural steel beams below the moving floor, adding additional supports if necessary.
- Extend the juice trays. The juice trays of the chainless diffuser are based on the arc of a cylinder and are easy to extend.
- Extend the lifting screw beams.
- Move one side wall to its new position.
- Add more screen modules.

The probable expansion of diffusers is assumed during the design stage, unless a client specifically declines this option. To accommodate the future expansion, all of the components listed above are provided with bolted connections on the side of the diffuser that will be extended in future.

Operating results of existing installations

At the time of writing, two chainless diffusers are in operation. The first installation was a retrofit of a BMA diffuser at the UCL factory in South Africa in 2006 (Schröder *et al.*, 2007) which has since completed 3 seasons of operation.

The second is the 500 tch diffuser constructed by Dedini at Usina Noroeste Paulista in Brazil which was commissioned in September 2008. Since the latter has been in operation for less than 12 months, there has been insufficient time elapsed for an objective evaluation of the performance of the diffuser. However, some aspects of the performance of the UCL diffuser can be regarded as representative.

The first season of operation at UCL was carefully documented by Schröder *et al*.(2007) and shortcomings in the original design were identified. Many of these were addressed after the first season, and the regular maintenance costs for the subsequent two seasons may be considered.

Hydraulic systems maintenance

The reciprocating diffuser screens are driven by two hydraulic systems, one at the feed end of the diffuser and one at the discharge end. The cost of maintenance of these systems has been recorded. The maintenance consisted of parts replacement and repairs (e.g. filters, seals, hoses and fittings) and the inspection of the condition of the systems during the off-crop; and a service contract with a service provider for a 2-weekly inspection of the systems during the crop period. The maintenance costs were as shown in Table 1.

Table 1—Hydraulic systems maintenance costs of the UCL diffuser: 2007–2008 ($).

	2007	2008
Maintenance cost	44 875	37 868
Service contract	6 750	6 750
Total	51 625	44 618

Wear strips maintenance

The reciprocating diffuser screens are supported on wear strips manufactured from a synthetic polymer material which has low friction co-efficient properties as well as withstanding the elevated diffuser temperatures. The average rate of wear of the thickness of these strips per season has been measured at 1 mm (out of a total useable thickness of approximately 14 mm). During the past three seasons, no wear strip replacements have been carried out due to excessive thinning.

Perforated screens maintenance

The perforated diffuser screens reciprocate with a stroke length of 1 metre. On the forward stroke, there is no relative movement between the diffuser screens and the sugarcane. However, when a diffuser screen retracts, it slides underneath the sugarcane bed and some wear of the perforated screen plates may be anticipated. During the past 3 seasons of operation, no replacement due to wear of perforated screen plates has been required, and no thinning has been measured.

Diffusers in Brazil

With the modern trend toward energy-efficient factories and the sale of electricity, cane diffusion is becoming more popular in Brazil. In 2004, there were eight diffusers in an industry of 347 factories. By 2007, this number had grown to 22 out of 393 factories representing 14 new diffusers in 46 new factories (Oliverio, 2007). The few diffusers in Brazil up to that time were mostly of the stationary screen type manufactured by Sermatec, including four with rated capacities of 12 000 t cane/d. However, the trend in Brazil is for larger units of operation which can process four million or more tonnes of cane per season, preferably in a single preparation/extraction line. Suppliers of mills claim capacities of up to 1250 t cane/h, but investors are aware of the disadvantages of milling tandems – higher power consumption, capital and maintenance costs, and the logistical challenges of getting mill spares from industrial centres located far from their estate operations. In light of this, there is a demand in Brazil for diffusers with capacities approaching those claimed for mills.

The Brazilian cane crop is forecast to grow from 562 million tonnes in 2008/09 to 829 million tonnes in 2015/16. This presents an interesting opportunity for diffuser suppliers who can overcome the size constraints of conventional diffusers.

The first chainless diffuser commissioned in Brazil is 12 m in width, the equivalent to the largest diffusers installed anywhere. It is located at Usina Noroeste Paulista in the state of Sao Paulo, and is designed to process 500 t/h (65 tonnes fibre per hour) and achieve 98% extraction. It is expandable to 625 t/h, or 15 m wide. This diffuser was commissioned in September 2008. Table 2 lists the chainless diffusers currently under construction Brazil.

Table 2—Chainless diffusers currently under construction.

Factory	Design capacity (t/d)	Design capacity (t/h)	Future capacity (t/d)	Commissioning date
Monte Verde	8000	333	12 000	August 2009
Cosan Jatai	17 000	708	21 000	September 2009
Cabrera	12 000	500	15 000	October 2009
Brenco Morro Vermelho	15 000	625	16 500	November 2009
Brenco Alto Taquari	15 000	625	16 500	April 2010
Brenco Perolandia	15 000	625	16 500	April 2010
Brenco Agua Emendada	15 000	625	16 500	April 2010
Meridiano	16 500	688	21 000	June 2010

In considering the list, the following points are relevant:

- The first diffuser was commissioned very successfully in September 2008.
- The first of the 15 m diffusers will be commissioned in September 2009. This will provide immediate answers to the question of cane distribution over the width of a 15 m diffuser.
- Cosan is the largest sugarcane processor in Brazil, with 18 current factories which processed 44 million tonnes of cane in 2008/09. The Jatai factory, in the state of Goias, plans to process four million tonnes per annum.
- Brenco is a biofuels company newly established in Brazil. Ultimately they aim to establish 14 identical cane-to-ethanol plants.
- The diffusers for Cosan and Meridiano are special cases. Although perfectly sized for their initial duties, these diffusers will be expected to process cane at a rate of 875 tonnes per hour in the future at reduced rates of extraction. The diffusers will operate with a design bed level of 1.6 m and a speed of 0.92 m/min, giving a retention time of 65 minutes. The extraction is expected to be 96.5–97%.

In addition to this list, Mozambique Principle Energy Ltda has commissioned the design of a 440 t/h chainless diffuser for their Dombe Ethanol and Co-Generation plant. This diffuser will have the largest rated capacity in the Southern African region.

Conclusions

The development of diffusers in the cane sugar industry accelerated during the 1960s and 1970s, and diffusion is now the accepted technology in South Africa. The fact that diffusers are less well accepted elsewhere in the cane sugar world is possibly attributable to the ability of South African sugar technologists and engineers to overcome the problems initially associated with diffusion, whereas those elsewhere were less successful. The improvements made to the technology in South Africa have become universally accepted. However, the fundamental principles of cane transport through diffusers remained largely unchanged, until the chainless diffuser was developed in 2006. Since then, the chainless diffuser has been successfully sold into the Brazilian cane industry, where it meets the industry's requirements of high capacity and low capital and maintenance costs and low power consumption. It is anticipated that, in trying to meet the demand for ever-increasing capacities, diffusers larger than 15 m wide will be developed within the next few years.

It appears that technological innovations from South Africa are as relevant to the world sugar industry as ever.

REFERENCES

Buck, W.R. (1965). Dalton – South Africa's first milling diffusion sugar factory. Proc. S. Afr. Sug. Technol. Ass., 39: 114.

Diaz-Compain, J. (1966). Continuous diffusion for the sugar cane industry. Proc. Int. Soc. Sugar Cane Technol. 12: 1474.

Fitzgerald, J.R. and Lamusse, J.P. (1974). Diffusion in South Africa. Proc. Int. Soc. Sugar Cane Technol., 15: 1486.

Gulbaran, E. (1966). Gulbaran's diffuser for sugar cane industry and elution theory. Proc. Int. Soc. Sugar Cane Technol., 12: 1713.

Hoekstra, R.G. (1995). Energy consequences of diffusion versus milling. Proc. S. Afr. Sug. Technol. Ass., 69: 205–207.

Koster, K.C. (1995). Some downstream effects resulting from diffusion compared with milling as published by the South African sugar industry. Proc. S. Afr. Sug. Technol. Ass., 69: 201-204.

Lamusse, J.P. (1985). Sixtieth Annual Review of the Milling Season in South Africa (1984–1985). Proc. S. Afr. Sug. Technol. Ass., 60: 10.

Love, D.J. and Rein, P.W. (1980). Percolation behaviour of a cane diffuser. Proc. Int. Soc. Sugar Cane Technol., 17: 1900.

Meadows, D.M., Schumann, G.T. and Soji, C. (1998). Farewell to filters: The recycle of clarifier mud to the diffuser. Proc. S. Afr. Sug. Technol. Ass., 72: 198–203.

Moor, B. St C. (2001a). Ten engineering innovations from one sugar factory. Proc. S. Afr. Sug. Technol. Ass., 75: 255–259.

Moor, B. St C. (2001b). Ten process innovations from one sugar factory. Proc. S. Afr. Sug. Technol. Ass., 75: 303–307.

Oliverio, J.L. (2007). Novas technologias do Setor Sucroalcooleiro: Difusor Modular Dedini – Bosch. Simtech 2007.

Payne, J.H. (1968). Cane diffusion – The displacement process in principle and practice. Proc. Int. Soc. Sugar Cane Technol. 13: 103.

Perk, C.G.M. (1966). Forty-first annual summary of laboratory reports of sugar factories in Southern Africa for the 1965/66 season. Proc. S. Afr. Sug. Technol. Ass., 40: 7.

Rein, P.W. (1974). Prediction of the extraction performance of a diffuser using a mathematical model. Proc. Int. Soc. Sugar Cane Technol., 15: 1523.

Rein, P.W. (1995). A comparison of cane diffusion and milling. Proc. S. Afr. Sug. Technol. Ass., 69: 196–200.

Renton, R.H. and van der Riet, B. (1971). The Empangeni diffuser installation: 1967–1979. Proc. S. Afr. Sug. Technol. Ass., 45: 49.

Schröder, K.E., Voigt, I. and Moor, B. St C. (2007). The conversion of a BMA diffuser to a Bosch Projects chainless diffuser – The first season's experience. Proc. Int. Soc. Sugar Cane Technol., 24: (CD-ROM).

Tantawi, M.H. (1966). The Egyptian sugar cane diffusion process. Proc. Int. Soc. Sugar Cane Technol., 12: 1496.

Townsley, B.T. and Cheatham, S.G. (1966). Ring diffuser at Pioneer Mill Company. Proc. Int. Soc. Sugar Cane Technol., 12: 1505.

Weng, H. and Bruniche-Olsen, H. (1966). Extraction of cane in the DDS-Diffuser. Proc. Int. Soc. Sug. Cane Technol., 12: 1481.

LA MISE EN ŒUVRE DE LA TECHNOLOGIE SUCRIERE SUD AFRICAINE: LES PLUS GRANDS DIFFUSEURS DE CANNE A SUCRE DU MONDE

Par

I. VOIGT

Bosch projets (PTY) Ltd, 203 North Ridge Road, Durban

voigti@bproj.co.za

MOTS-CLEFS: Diffuseurs, Extraction, Brésil, Technologie, Sans Chaîne, Afrique Du Sud.

Résumé

LA DIFFUSION s'est établie en Afrique du Sud à partir de 1960 et 1970, à l'aide de la technologie européenne. La recherche locale et l'expérience ont permis le développement de diffuseurs conçus localement et l'industrie sud-africaine a atteint des taux d'extraction les plus élevés dans le monde. Les plus gros diffuseurs de l'industrie sud-africaine ont été installés à Felixton 2 en 1984, mesurant 12 mètres de large et capable de traiter au moins 350 t/h. En 2006, le premier changement réel des principes fondamentaux de conception a été introduit par Bosch Projects grâce au concept de 'Diffuseur sans chaîne'. Des neuf diffuseurs sans chaîne a être installé au Brésil entre 2008 et 2010, deux ont une taille similaire à ceux de Felixton et six sont plus grands. Le premier diffuseur de 12 mètres (à UNP avec une capacité de 500 t/h) est entre en service en septembre 2008. Les diffuseurs à Brenco, Cosan Jatai et Meridiano sont de 15 mètres de largeur, peuvent atteindre une extraction de 98 % à 625 t/h et seront les plus gros diffuseurs de canne à sucre du monde. Les diffuseurs de Cosan et Meridiano traiteront finalement 875 t/h. La vente de diffuseurs sans chaîne au Brésil est la preuve que la technologie sucrière sud-africaine continue à jouer un rôle de premier plan, même dans le secteur le plus compétitif d'une industrie mondiale, aux changements rapides.

LA IMPLEMENTACIÓN DE TECNOLOGÍA AZUCARERA SURAFRICANA: LOS DIFUSORES PARA CAÑA MAS GRANDES DEL MUNDO

Por

I VOIGT

Bosch Projects (Pty) Ltd, 203 North Ridge Rd, Durban

voigti@bproj.co.za

PALABRAS CLAVE: Difusores, Extracción, Brasil, Tecnología, Sudáfrica.

Resumen

LA DIFUSION de caña ganó popularidad en Sudáfrica en las décadas de 1960 y 1970 usando tecnología europea. Investigación y desarrollos locales llevaron a difusores diseñados localmente y la industria sudafricana alcanzó los niveles de extracción más altos del mundo. Los difusores más grandes fueron instalados en Felixton 2 en 1984 con 12 metros de ancho y tasados conservativamente en 350 t/h. El primer cambio real a los fundamentos del diseño de difusores tuvo lugar cuando Bosch Projects introdujo el concepto del difusor sin cadena ('Chainless Diffuser') en 2006. De nueve difusores sin cadena a ser instalados en Brasil entre 2008 y 2010 dos son similares en tamaño a los de Felixton y seis son mayores. El primero de los difusores de 12 metros (en UNP con capacidad nominal de 500t/h) fue puesto en operación en Septiembre 2008. Los difusores de Brenco, Cosan Jatai y Meridiano son de 15 metros de ancho diseñados para 98% de extracción a 625 t/h y serán los difusores mas grandes de caña en el mundo. Los difusores de Cosan y Meridiano finalmente procesarán 875 t/h. Las exitosas ventas del difusor sin cadenas en Brasil son evidencia que la tecnología azucarera y la ingeniería sudafricanas continúan jugando un papel de liderazgo aun en el sector más competitivo de una industria que cambia rápidamente.