

B.Tech Pulp & Paper presentations

This year's B. Tech. projects may have been fewer in number than previous years, but they were certainly no less interesting. Nine B.Tech. Pulp & Paper students presented their projects to a panel of judges at the Riverside Hotel, Durban, on 24 October 2011. Here is a sneak peak at each project.

Winning
Presentation

Leachate Desalination Treatment
Kgaugelo Mokhwazo

Leachate is generated in the landfill site as a result of rainfall and waste disposal on the site. The leachate is then allowed to accumulate within the site and is recirculated back onto the waste body for irrigative evaporation. Irrigative evaporation is a temporary solution as the salt load of the leachate accumulates within the waste body and this cannot be allowed to continue indefinitely.

The leachate desalination treatment known as the Rapid Brine Evaporation (RBE) uses natural evaporation techniques and offer permanent solution as it treats the leachate by natural evaporation and converting the leachate into a solid form for easy disposal. For costing purposes, it is also important to check the performance of the RBE system compared to a system were leachate is left to evaporate on it's own without any aid, this is mainly known as an open pond system and can be evaluated using the Penman equation.

The RBE system showed favourable results increasing the evaporation capacity of the open pond system by 300%. The salts formed during the evaporation process will be reused. The RBE system provides an elegant and practical solution for the treatment of leachate.

Jane Molony (Pamsa) congratulates winner Kgaugelo Mokhwazo with the Pamsa trophy for the best B.Tech project presentation.



Simplex TS and WS (md) Curl Correction
Kubenderan Reddy

Paper broke for curl impacts negatively on the paper machine material efficiency resulting in monetary loss to the company. Broke accumulation also becomes a handling constraint in terms of storage and availability of space and additional costs in terms of re-processing the broke.

Broke produced for off specification curl on a fine paper machine needed to be prevented or reduced. The purpose of the research project was to bring about Simplex TS and WS (md) curl corrections to the paper sheet by controlling surface starch pick up on the TS and WS of the paper sheet together with relative drying.

Curl is affected by a number of variables but surface starch application and relative drying was focused on. The investigation needed to be done to develop a concise BOP for Simplex TS and WS (md) curl correction. The BOP will be used in operations to limit or prevent broke production for curl.

This year's group of B.Tech Pulp & Paper students include (from left to right) Marlain Adonis, Kgaugelo Mokhwazo, Xolani Lolwana, Mathias Mtshali, Kubenderan Reddy, Tania Chetty and Poobalan Govender.



The curl samples were tested and the curl results were then evaluated. When the curl was not within acceptable level, an appropriate adjustment was made to correct the curl. Depending on the magnitude of the curl, an adjustment was made to influence starch pick up to the TS or WS of the sheet. This was for coarse control. Adjustments to relative drying (bias) were done for fine control.

From results obtained after curl corrective adjustments, it was then concluded that surface starch application and relative drying could be used as a curl control measure. A BOP has been generated which will be used to control Simplex TS and WS (md) curl.

Effect of changing the Polymer dosing point on Green Liquor Clarification

Tania Chetty

Currently polymer is dosed at the top of the Green Liquor Clarifier and there is inadequate mixing with green liquor and dregs. The main problem experienced with this setup is that dregs are carried over into the strong white liquor. The high levels of solids in the clarified white liquor causes calcium scaling problems at the digester and increased pitch deposition problems in the pulp mill, bleach plant and paper mill.

This research project focused on changing the polymer dosage point to the green liquor line in operation after the transfer pumps at the smelt dissolving tank. This was to ensure efficient mixing of the polymer with the green liquor to increase the settling rate in the clarifier and lower the suspended solids in the green liquor. The objective was to reduce the level of downstream contaminants from entering the causticizers, white liquor clarifiers and digesters. The outcome of decreasing the SS levels in the GL was achieved but not maintained. The proposed positive effects on the causticising circuit were not seen due to the nature of the trial.

Minimising ClO_2 usage in bleaching

Shalini Naidoo

Bagasse pulp from Pulp Mill X was used for laboratory work to determine if ClO_2 usage in bleaching could be minimised. An oxidising catalyst was used. Pulp Mill X currently uses a DEP sequence: Chlorine Dioxide, Extraction (caustic and peroxide) and a Peroxide stage. All stages are equipped with washers. Laboratory tests involved pulp at 8 – 10 % consistency being treated with an acidic stage instead of a D-stage and catalyst addition to both peroxide stages. Results show a decrease in kappa number with catalyst and a brightness increase was also observed.

It was recommended to try using a higher peroxide charge, application of a chelant and maybe a higher P-stage temperature to further improve catalyst performance. A mill trial was recommended as the lab trial showed an indication of possible decrease in ClO_2 usage.

The first mill trial could not yield any conclusive results that the catalyst was working as efficiently as expected. Process fluctuations and termination of trial due to strike did not allow sufficient time to evaluate the catalyst and its effect on brightness and ClO_2 usage.

The decision was then taken to redo the mill trial to be able to evaluate the effectiveness of catalyst better. A positive benefit was seen from the second mill trial as chlorine dioxide usage was decreased and the desired brightness was still maintained.

The impact on residual peroxide needs to be scrutinised more carefully as a higher residual lignin means there is more selectivity of the hydrogen peroxide which is what is needed. Additional work is encouraged to confirm the reproducibility of results. The cost saving of chlorine dioxide reduction versus the cost of catalyst needs to be compared as there should be an overall payback.

To investigate a cost effective way to develop fibre for improving strength properties and in particular, bursting strength

Mathias Mtshali

Due to ongoing pressures from competitive market, the paper industry has become more focused on its profitability, resulting in an increasing trend in producing an inherently weaker sheet. This is the result of producing lower basis weights, increasing the use of hardwood pulp, adding fillers and minerals, as well as recycling fibres. Despite this, papermakers continue to strive to maintain or even to enhance paper strength. More recently, strategies involving surface modification of wood fibres have become of interest in papermaking, firstly to reduce refining energy necessary in the refining process as well as to improve paper strength by way of increasing fibre-fibre bonding.

Final sheet strength properties, and in particular bursting strength is not constantly achieved on a medium weight two-ply board at Mill Y with the current variable process conditions, resulting in losses due to poor sheet strength quality.

This paper entails an investigation to find a cost effective way to develop fibres for improving sheet strength properties. This report contains laboratory evaluations on fully bleached hardwood and unbleached softwood using two different fibre modification enzyme products at different addition rates (from 250g/tonne to 500g/tonne). From the laboratory evaluations, it was evident that fibre modification enzymes can develop fibre to enhance sheet strength properties, and can also result in reduction in refining energy consumption.

Implementation of the “voice of the Customer” process to align product specifications to customer needs

Poobalan Govender

This report depicts the effectiveness of the “Voice of the Customer” process (VOC) in any business that wants to develop new products or streamline existing products. The VOC technique is used to determine the wants and needs of a customer, thereby focusing on certain quality parameters that are essential in the customer’s everyday life. It also creates a better understanding of both the supplier’s and customer’s processes and also the machine’s capability of achieving the specification required, with an aim of producing cost effective products.

In the past, new products were developed without much consultation taking place between the customer and the supplier, which resulted in over engineered products. This put the manufacturing business under strain due to high

manufacturing costs to achieve the desired specifications as well as high losses namely rejections and rework.

Five quality parameters were identified as “Critical to Quality” to the customer namely Porosity, Cobb U/S, Cobb T/S, Scott Bond and Scuffing. All five properties either require chemical dosages or refining to achieve specifications, which results in high costs to the business. The data that was collected for a period of three months on four high volume products revealed that most of the properties were distributed away from the target and close to the reject limits.

By using the six sigma statistical method, the data can be analysed and actions taken. During the trial, changes were made to the chemical dosages as well as refining. This had a huge impact on savings thus making the products very cost effective.

The VOC process should be implemented on all existing and new product development, in order to achieve the most cost effective product in the market. This will make the product very competitive and thereby gain market share. This process also improves the relationship between suppliers and customers. It can also be used to justify installation of new equipment to capture current and future products in the markets.

Investigation of alternative size applications

Marlain Adonis

Sustainability and profitability are major focus areas for industries today. This project investigated the use of alternative sizing applications at Mill Z in the form of Alkenyl Succinic Anhydride (ASA) with the aim to (i) reduce the cost of size and (ii) to develop a new product for the mill. Two independent ASA trials were conducted with the cooperation of 2 chemical suppliers to Mill Z.

The results from these trials were then measured against historical data achieved with the current Alkyl Ketene Dimer (AKD) sizing programme. With the use of ASA as sizing chemical, the production of the new product could also be investigated. Successful application of ASA, promises many benefits as it was expected to achieve faster sizing and is the preferred size for the production of the new product.

The outcome of these studies showed promising results. In both the cases sizing were achieved almost immediately. One of the critical success factors selected was the product quality, and specifically Cobb (resistance to water penetration) results. Strength development was still a concern in the one chemicals supplier trial, in one instance, but further studies are recommended to optimise this. The critical success factors for the production of the new product is the achievement of the desired paper properties such as Cobb, porosity, saturation etc. In both trials these properties were achieved.

In summary, these trials were successful in terms of quality, but cost comparisons could not be concluded and further studies are recommended.

Compostability of Paper Board

A. Visser

In this report the degree of biodegradation of a 300gsm paper board sample was determined relative to that of cellulose in a controlled aerobic composting environment. The biodegradation of the samples were measured using reactive absorption of CO₂, which is the gaseous product in the effluent stream of the bioreactors, according to American Standard Test method ASTM 5338-98. The sample preparation according to ASTM D6003-96 for testing biodegradability on laboratory scale was also described.

It was found that cellulose and the board biodegraded 57% and 52% respectively within a period of 55 days. ASTM 5338-98 stipulates that cellulose must achieve a biodegradation of at least 70% at the end of the experiment, therefore the test must be considered invalid. However, the percentage of biodegradation of the board relative to the positive reference (cellulose = 100%) is 88.14% at the end of the test.

Reasons for poor biodegradation of the test samples may be due to the fact that the municipal solid waste (MSW) was not stabilised beforehand, or that inoculum did not perform optimally in the chosen test conditions as well as the lack of internal moisture control which can be a crucial factor affecting the biodegradation rate.

Increasing saveall efficiency in tissue machine

Xolani Lolwana

The pulp and paper manufacturing industry is a highly capital, water and energy intensive industry. Fibre, energy and water are three of the industry's primary resources. Hence this project was aimed at increasing a tissue machine saveall efficiency which forms part of the closed loop white water system. Its improved performance reduces fibre, water and energy costs per tonne of product. It had been noticed that the saveall was not performing given the poor clarity of clear water and overflowing chests.

The aim was to improve saveall efficiency by improving process operation and fixing the equipment as well as by wet end chemistry means. A polyacrylamide chemical was trialled to enhance flocculation and formation of a thick fibre mat to increase efficiency. Thereafter, the saveall machine was fixed through the replacement of a poly disc which was malfunctioning. The polymer was successful but could not be sustained in terms of incurred costs. After thorough maintenance on the machine and addition of the disc, the performance of the machine was found to have improved. The saveall efficiency was evaluated to have increased from 87% to 92%. A small percentage change is significant to the overall saving in fibre costs. Moreover, improved performance leads to more energy and water cost savings. □

For more information on the B.Tech. Pulp & Paper projects, please contact Jimmy Pauck at jimmy@dut.ac.za or contact the Durban University of Technology Pulp and Paper Technology Programme on 031 373 2123.