Increased output/productivity, Improved performance by the use of chemicals

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SUMMARY

The critical availability of energy, the mounting pressure for preserving environment and ecology and also rising cost of production is a matter of serious concern to the pulp and paper industry. The need for improving the productivity and efficiency at all the stages of the manufacturing process is the prime necessity today. The paper surveys the use of primarily non-capital techniques and specifically the use of chemicals for increased output and improved efficiencies. Economics of use of such chemicals is largely determined by individual conditions and each case has to be evaluated separately.

The pulp and paper industry all over the world is suffering from nearly the same problems. Briefly and mainly these are :

i) concern for energy, environment and ecology

ii) highly capital intensive nature of the industry and low return on investment

iii) fast technological changes that are taking place as a consequence of concern for energy, environment and ecology and also for achieving overall improved efficiencies continuously demands investment on modernisation of plant and machinery

iv) a definite need for increased output/productivity.

To tackle some of the above problems both the capital and non-capital techniques can be employed. Non-capital techniques specifically the use of chemicals though not new but in view of the availability of a spectrum of tailor made chemicals is finding greater acceptance for increasing output/productivity and improving efficiencies. The paper highlights the uses of some such chemicals as to their suitability for use in storage of fibrous raw materials, cooking, bleaching, Chemical Recovery, Stock preparation and papermaking.

Storage of fibrous raw materials is unavoidable and this could be in the form of roundwood or chips. In both the cases appreciable weight loss as measured by the specific gravity takes place. Significant losses both in pulp yield and pulp quality also takes place. In a separate study this has been shown[1,2] both in the case of bamboo and bamboo chips. This has its economic implications if a comparison is made of the losses with replacement bamboo/wood costs, decreased digester capacity or increased alkali consumption Where pulp quality also suffers, the problem of maintaining uniformity of product is also important. The exact extent of the losses of fibrous raw materials during storage in this country is not known since a systematic study has not been done but in all probability it is significant. As the losses are mainly to the action of micro-organisms, certain kinds of preservative treatments for inhibiting fungi have been tried. Hulme & Hatton[3] reported that treatment of hardwood chips with sodium carbonate, Borax, Sodium thiosulphate. Urea and hexamine were the best treatments. Surprisingly some of these treatments improved the digester yields, reduce alkali consumption and shorten the cooking time. Where sodium carbonate was used an added benefit is that the chemical can be recycled as active pulping chemical, allowing much of the cost of treatment to be recovered.

The increasing concern for environment is pressing for adoption of non-sulphur pulping processes. The use of anthraquinone as an additive in soda or low

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sulphidity cooking liquors offers in addition to the benefit of reduced sulphur emissions, the following :

i) Increased pulp production by reducing the cooking cycle, thereby enabling to have more cooks in a day.

ii) For the same pulp production a better and planned preventive maintenance is possible due to greater availability of equipment, as a result of reduction in cooking time and increase in pulp yield.

iii) Since a significant amount of pollutants is generated in the bleach plant[4,5] selective delignification in the digesters for producing pulps of low permanganate number is another possibility. In view of the concern for limiting the total amount of organics and the quantity of chlorinated compounds, it would be desirable to have the pulps of low permangnate number before chlorination.

iv) If digester cycle is not a limitation for the required quantity of pulp, low temperature pulping with extended cooking time is another possibility, resulting in savings in steam/energy

v) Where chemical recovery is a limitation, pulp production can still be stepped up due to reduction in alkali charge and increase in pulp yield.

Low sulphidity i.e. 8-10%, low temperature i.e 150-160°C and low permanganate number i.e. 13-16, pulping possibilities have been studied in detail[6] on bamboo and mixed hardwoods with encouraging results.

Work is also carried out elsewhere on non-sulphur pulping using soda liquor containing either monoethanolamine (MEA) or ethylenediamine (EDA). These compounds also accelerate the rate of delignification. It is also reported recently[7] that in order to improve pulping in the NSSC line use of a chemical based on dimethylamides of long chain fatty acids improved delignification and gave pulps with low shive content at the same yield or alternatively for a substantially reduced energy input produced pulps with a given shive content.

In the conventional bleaching of bamboo/mixed hardwood pulps sulphamic acid as an additive in chlorination[8] and hypochlorite stages[9] is finding increasing acceptance. In the chlorination stage, overchlorination due either to excess dosage of chlorine or to the use of elevated temperatures as a result of greater recycling of chlorine washer filtrate or to the prevalent atmospheric conditions such as in summer months, is detrimental to pulp quality. In the hypochlorite bleaching also use of elevated temperatures, unfavourable pH conditions, excessive retention times, higher charges of chlorine than optimum, would result in significant loss of fibre value. Sulphamic acid as a protector does a good job of preserving the pulp quality when the optimum conditions are not maintained and when this is possible will result in pulps with improved physical and mechanical characteristics

Interest, recently, has also been shown in the use of oxygen/alkali and hydrogen peroxide as prebleaching chemicals. The organics dissolved during the oxygen/alkali delignification and so also hydrogen peroxide delignification are brought into the black liquor recovery system by countercurrent washing, thereby reducing the quantity of pollutants emanating from the conventional bleaching sequence. With medium consistency oxygen/alkali delignification as a proven commercial possibility and the data obtained in France using Hydrogen peroxide as a prebleaching/delignifying agent, there is scope for significant reduction in the quantity of pollutants discharged to the treatment plant receiving stream.

Use of chelating agents as additives in bleaching by lignin retaining methods for brightening of pulp and stabilization of bleaching chemical is also widely advocated. Hart[10] has mentioned the use of few chelating agents like ethylenediaminetetra acetate (EDTA), diethylenetriamine penta acetate (DTPA) etc. by the paper industry. The presence of metal ions viz Iron, Manganese, Copper etc. in the wood, water and further addition of these from the equipment could seriously impair the process of brightening of pulp and use of chelating agents is the only answer for effective control of metal ions, resulting in improved pulp brightness stability and brightness gain.

The Chemical Recovery section of a kraft mill is expected to convert the spent cooking chemicals, black liquor to active cooking chemicals, white liquor. In order to tide over the white liquor production problems such as that of clarity, poor settling of lime mud, poor washing on lime sludge filter etc., the use of chemical is sometimes resorted to. Pavlick & McPherson[11] reported best settling rate and increased efficiency of the lime sludge filter by use of Separan 2610, a synthetic organic water soluble high molecular weight polymer. In some cases starch is added[12] to help precipitate the lime mud in white liquor clarifier for improved settling. Waters and Coates[13] reported improvements in white liquor preparation through polymer treatment.

Such improvements are sometimes necessary when the system is overloaded to meet the additional demand of white liquor for increased pulp production, or alternatively to reduce carry over of calcium to the cooking system which has recently been found to accelerate formation of gumming up substances/ deposits in the evaporators especially when evaporating black liquor of mixed hardwoods. Incidentally some wood species have been found to have a high calcium content and this could also aggravate the problem. There is need for research in this area and whether some sort of chemical dosing would reduce the intensity of the problem.

In the area of fibre preparation for paper making, the main concern is to develop the fibre surface for inter-fibre bonding at minimum expense of power. Pulps from agricultural residues have the advantage that a gently refining will suffice for paper making but for bamboo and hardwoods a harder beating is necessary. Alternatively for getting the same results as obtained by mechanical treatment of fibres Beater Adhesives have been used and their utility can be measured in terms of power substitution value and fibre substitution value. A general effect of gum addition is to advance beating although higher strengths can be achieved with prolonged beating alone. By advance beating through gum addition power for refining can be saved and also higher fibre length due to less refining may permit using a higher percentage of more economical short fibres in place of long fibres. Among the gums the most widely used is Guar gum (Galacto-mannan) with the following desired specification.

At least 80% galactonnan
Not more than 5% protein
Not more than 1% Ash
Not more than 0.7% fat
Not more than 2.0% fibre

In a recent study Dugal & Swanson[14] produced modified guar polymers having mannan/glactan ratios of 1.73, 2.82 and 4.61 (original guar gum had a ratio of 1.49) and found that mannan/galactan ratio of 2.82 & 3.0 produced better fibre bonding. This is an area which should receive the attention of indigenous suppliers of guar gum.

An area which is concerned to a certain extent with the environments is the presence of colour in the paper machine waste water due to the use of dyes, when coloured papers are made. In a mill producing yellow pulp board, using Metanil yellow and Acid Orange, the use of a polymeric compound, enabled to produce waste waters with very low colour intensity and in addition reduction in dyes consumption due to greater retention of dyes offered attractive economics.

The use of chemicals for increased paper and board machine output offers economic attraction and this approach in addition could meet at least partly future increases in demand of paper. Pendrich[15] gave an interesting example of the use of synthetic polymers of (a) Polyamide/Polyamine condensations (b) Polyetheylene amines and (c) Polyacrylamides and modifications for increased machine speed, reduction in steam usage, lower tray water solids, improved formation and overall increase in profitability for a machine which otherwie is restricted in speed by a limitation in drying. Urick & Fishcher[16] also concluded that synthetic polyelectrolytes, particularly cationic polycrylamides offer considerable potential for increasing production on existing paper machines without the expenditure of capital. The effect of these additives in general is that of flocculation of fibres and fines giving better retention on the wire and rducing load on the fibre recovery and effluent treatment system. The stock also becomes more free and the first noticeable effect should be a movement of the dry line towards the slice. The paper will also show increased dryness after the presses and thus extra drying capacity becomes available.

In order to reduce the severity of scaling/corrosion some sort of chemical inhibition treatment would go a long way in improving heat/steam economy and reducing downtime or replacement costs of the equipment. Werzl & Ellow[17] mentions that organophorous esters and the phosphonates are today the most widely used antiscalants. In Scandinavia and other European countries there are a number of applications of such antiscalants for evaporation of spent sulphite or kraft black liquor. These antiscalants are normally added to the weak or medium concentrated liquor and the level of application is 100 to 250 grams per tonne of pulp produced with added benefits of the availability of equipment, savings in energy etc. In addition the need for a chemical which can reduce the corrosivity of recycled water in very closed mills for reduced investment in metallurgy can be indicated.
Based on above it can be concluded that chemicals will continue to play an imortant role for increased output and improved efficiencies of the process. In the end it may be emphasied that for arriving at optimum parameters to get the desired benefit from the chemical a very systematic approach is necessary and may necessitate indepth study of the system.

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