Means to Increase Pulp Production and An Alternative Raw Material for Pulping

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Abstract

The production of pulp can be substantially increased by addition of anthraquinone as a catalyst in kraft and soda pulping. However, a greater benefit can be achieved in soda pulping. In assessing jute fibre as an alternative raw material for pulping, it shows a promising prospect. The use of neutral sulphite anthraquinone process can make conifer-like pulp from jute fibre.

সারসংক্ষেপ

প্রচলিত ক্র্যাফট ও সোডা মণ্ডিকরণ পদ্ধতিতে রাসায়নিক প্রভাবক হিসাবে এনথ্রাকুইনন ব্যবহার করে মণ্ডোৎপাদন উল্লেখযোগ্য পরিমাণে বাড়ানো যায়। তবে সোডা পদ্ধতিতে এর প্রয়োগ অধিক লাভজনক। মণ্ড তৈরীতে পাটের আঁশ নতুন দিগন্ত উন্মোচন করতে পারে। নিউট্রাল সালফাইট এনথ্রাকুইনন পদ্ধতিতে পাটের আঁশ থেকে উৎপাদিত মণ্ড আমদানিকৃত 'কণিফার' বৃক্ষ প্রজাতি থেকে প্রাপ্ত মণ্ডের সমতুল্য।

Key words: Anthraquinone, jute fibre, kraft pulping, neutral sulphite anthraquinone pulping, soda pulping

Introduction

Bangladesh is a pulp deficit country. It faces an acute shortage particularly in superior quality pulp. This situation can be improved by using the technology which leads to a higher production and at the same time enhances the properties of the pulp. Another approach in this regard is to search for a suitable process for an easily available fibrous raw material which can produce conifer-like pulp. This article gives an insight in these two approaches.

Means to increase pulp production

The largest single cost factor in pulp manufacture is the price of fibrous raw material. For this reason it is of vital importance to maximise the yield producing pulp with optimum properties. It is well recognised that soda pulping results in a lower yield and an inferior quality pulp. The dramatic role of anthraquinone (AQ) in alkaline pulping in preserving the yield and enhancing the rate of delignification has been well documented (Holton 1977, Holton and Chapman 1977, Fossum

et al. 1980). A small addition of AQ in the order of 0.05-0.15% on oven-dry (OD) wood is sufficient to provide the benefits. The catalytic effect of AQ is more effective in soda pulping (Fossum *et al.* 1980, Kubes *et al.* 1980, Hanson and Michaels 1978) than in kraft. It is not unlikely that soda-AQ pulp can surpass the conventional kraft in respect of delignification and pulp yield (Fossum *et al.* 1980, Kubes *et al.* 1980). Thus, there is a good potential in Bangladesh to use soda-AQ pulping in Sylhet Pulp and Paper Mills (SPPM) and North Bengal Paper Mills (NBPM) where pulping is done by normal soda process.

AQ is less beneficial at normal sulphidity (25%-30%) kraft pulping. But the benefits increase as the sulphidity decreases (Bhowmick *et al.* 1991a. Rao 1983, Van Allen *et al.* 1981). Even AQ and sulphidity are interchangeable (Bhandari *et al.* 1980, Blain 1979). In Karnaphuli Papar Mills (KPM) kraft pulping with a sulphidity between 8-17% is used (Bhowmick *et al.* 1991). This is much below the normal sulphidity range. As such there is a good prospect of using AQ in KPM.

It is reported that the effect of AQ is species dependent (Akhtaruzzaman 1984, MacLeod 1979). With a view to assess the response of AQ with the species grown in Bangladesh vigorous research has been conducted (Akhtaruzzaman *et al.* 1987, Akhtaruzzaman and Chowdhury 1991, Bhowmick *et al.* 1991. Bhowmick *et al.* 1991a, Bhowmick *et al.* 1992, Das *et al.* 1990).

A study with *Acacia auriculiformis* (Akhtaruzzaman *et al.* 1987) shows that with the use of 0.05% AQ in soda pulping, the pulp yield increases by 3.1% on OD wood. AQ addition in normal kraft pulping of this species amounts to an yield gain of 1.4%. The authors claim that the use of soda-AQ pulping in SPPM can make an additional profit of about Tk.32 million (US$ 1= Tk. 46.30). In a study with *Paraserianthes falcataria* (Akhtaruzzaman and Chowdhury 1991) an addition of 0.05% AQ in soda pulping increases the yield by 4.0% on OD wood. In bagasse pulping the yield increment is 2.5% (Das *et al.* 1990).

AQ is found equally suitable with muli bamboo, a common raw material in KPM. Use of 0.05% of the catalyst in soda pulping of muli bamboo, the gain in yield is 3.0% on OD bamboo (Bhowmick *et al.* 1992). On addition of such a low dose of AQ in low sulphidity (15%) kraft pulping of the bamboo species, the yield surpasses the normal kraft by 0.8%. Compared with the control, in low sulphidity kraft pulping the yield increase is 2% on OD bamboo on using AQ (Bhowmick *et al.* 1991).

An addition of 0.05% AQ in soda and kraft pulping also substantially enhances the rate of deligification. This will reduce the alkali demand and/or cooking time.

Considering the above findings. it is seen that a low dose of AQ in the order of 0.05% can be used in soda pulping is SPPM and NBPM, and in low sulphidity kraft pulping in KPM. This will increase the pulp production and improve the quality of pulp. More so, this will bring an additional profit.

Alternative raw material for pulping

There is an alarming scarcity of fibrous raw material in Bangladesh for making pulp. The problem has further aggravated due to non-availability of conifer species in the country. As a result, Bangladesh is to import a bulk quantity of superior quality pulp. Recent studies (Akhtaruzzaman

and Shafi 1995, Akhtaruzzaman *et al.* 1991a. Shafi *et al.* 1993) have shown the inferior quality jute fibre can produce pulp equivalent to or even better than imported conifer pulp.

Jute pulping was previously tried in SPPM. But it was not successful for making chemical pulp because of many drawbacks. These are lumping of the cooked stock causing problems in digester blowing, washing and screening, lower pulp yield and poor pulp strength properties particularly on bleaching. These problems are unavoidable in conventional soda and kraft processes , but can be avoided by using neutral sulphite anthraquinone (NS-AQ) process (Akhtaruzzaman and Shafi 1995, Akhtaruzzaman *et al.* 1991a, Shafi *et al.* 1993).

Unlike the conventional processes, fully chemically fiberized pulp can be produced from jute fibre by the NS-AQ process (Akhtaruzzaman *et al.* 1991a) with an alkali charge as low as 14% as NaOH. Full fiberization of the pulp can be achieved with no screening rejects. No problem in pulp disintegration and screening is faced. The process gives higher unbleached pulp yield by 6.3% on OD jute. Bleaching of the NS-AQ pulp in a three stage chlorine-extraction-hypo sequence leads to 58.0% bleached yield. The corresponding yield is 50.2% with the kraft pulp. Thus, the bleached yield increase is 7.8% on OD jute for the pulp obtained with the NS-AQ process. This pulp is easier to bleach giving 80% brightness compared to 77% with the karft pulp in the three stage bleaching sequence. The unbleached pulp is similar to the kraft pulp in quality. On bleaching, the NS-AQ pulp from jute fibre does not deteriorate. On the contrary, the conventional karft pulp becomes drastically weaker after bleaching. The strength properties on the unbleached NS-AQ jute pulp are similar to or even better than those of the kraft pulps from some commonly used kraft coniferous pulps. It is also observed that no chopping of jute fibre is needed for pulping by this process (Shafi *et al.* 1993). Consequently, manufacture of jute pulp in Bangladesh by NS-AQ process can totally eliminate the need of importing costly coniferous pulp.

On analysing the economics, it is shown that use of the same digester capacity to manufacture pulp from jute fibre, the NS-AQ process can produce additional 135 kg of pulp per ton of bleached pulp than by using the kraft process (Akhtaruzzaman 1988). The additional profit from this gain in pulp yield amounts to over Tk. 2,500 per ton of pulp.

It is noted that compared to bamboo pulping, SMR variety of jute and jute cuttings are cheaper raw materials for pulping by the NS-AQ process (Akhtaruzzaman 1988). The NS-AQ pulp from jute fibre is undoubtedly much superior to bamboo pulp. Consequently, manufacture of pulp from jute by the NS-AQ process can make a breakthrough in this sector, and at the same time an alternative use of jute may be ensured. This utilization of this technology needs setting up of a new industry. The various aspects related to NS-AQ pulping of jute have been summarised by Akhtaruzzaman and Shafi 1995).

In running a pulp mill wholly with jute question may arise as to the fate of the mill in case of an acute shortage of raw material. Research on this aspect has also been conducted (Akhtaruzzaman *et al.* 1991). It is also seen that bagasse also responds well to the NS-AQ process. It is fortunate that the construction of the Jamuna bridge will be completed soon. Then the sugar mill will have the access to natural gas. If the sugar mill boilers are converted to use natural gas, there will be an abundant supply of bagasse which can be used for pulping.

Policy makers should therefore take up the matter for commercial utilization of NS-AQ pulping of jute earnestly. It must be considered seriously for the economic development of the country.

Conclusions

Pulp production can be increased in KPM, SPPM and NBPM by using 0.05% anthraquinone as an additive during pulp manufacture. Then, the quality of the pulp will improve. Economically, the use of this technology is capable of bringing an additional profit.

Import substitute pulp can be manufactured from inferior quality jute fibre using neutral sulphite anthraquinone process. The process has significant advantages over the conventional soda and kraft processes. It has technical and economic superiority.

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