"Economics of Chemical Recovery in Medium Scale Pulp & Paper Mills"

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A lot has been presented on the subject matter in this forum by many authors and learned persons, therefore, without going into the process description of chemical recovery system, the idea of this paper is to emphasise the long term benefits for the mills, national interest and social obligation in avoiding pollution problem.

Looking back, when finding an alternate raw material for Bamboo and forest woods for paper making the bagasse and straw were accepted as good proposition and concept of small pulp and paper mills come into reality. Now when sufficient success has been achieved by these paper mills and a time has come to celeberate the victory, we observe that ultimate disposal of black liquor is posing a serious problem to the mills and the surroundings. Therefore it has become the need of the hour to recover the Chemical and energy values of the black liquor to succeed over the problem. Obivious remedy to this problem is installation of Recovery System. The economics of chemical recovery system, indigeneously manufactured, has already been established in big paper mills. But it had remained matter of debate for small paper mills based on Agricultural residues. Unfortunately indigeneous manufacturers have not come forward with suitable proposal for the small mills. May be because of common belief that Recovery system is normally economically viable for 80 to 100 TPD pulp mills only. Therefore an effort has been made in this paper to look at viability of installing recovery system for 30 MTD pulping units based on bagasse. As the roasters already installed in few mills could not prove to be economical, therefore a conventional recovery system including evaporators/Boiler/Causticizing units has been selected.

Calculations :

Basis : 30 TPD Pulp mill based on bagasse.

Assumptions : 1) Raw Bagasse moisture — 50%

2) Depithing losses. — 20%

3) Caustic Soda consumption on O.D. depithed bagasse. — 13% by weight.

4) Bleached pulp yield on O.D. depithed bagasse. — 42%

5) Chemical Recovery. — 70%

Economics :

a) O D. Depithed bagasse required for 30 Tonnes of bleached Pulp $= \frac{30}{0.42} = 71.5$ T.

b) Raw Bagasse required $= \frac{71.5 \times 100}{80 \times 0.5} = 180$T.

c) NaoH required per day $= 71.5 \times 0\ 13 = 9.3$ T.

d) NaoH required per annum $= 9.3 \times 330 = 3012$ T.

e) Cost of purchased NaoH @ Rs. 6000/- per ton $= 3012 \times 6000$
$= 180.72$ lacs per annum.

f) Out of which 70% are being recovered $= 180.72 \times 0.70$
$= 126\ 50$ lacs per annum.

Sludge coming out of causticizing section can be disposed to mini cement plants.

Cost for recovering the above quantity of NaOH.

1) Interest @ 18% on a capital investment of Rs. 3.50 crores (details of Rs. 3.50 crores as below) = 63 00 lacs

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Details of cost of Recovery system,

Two mild steel W.B.L. storage tanks (2000 m^3 each). (based on 7 days storage)	= 45 lacs.
Evaporators (5 effect)	= 25 lacs.
One condenser	= 5 lacs.
Concentrated Black liquor. Tank—2 nos. ($50m^3$)	= 3 lacs.
Boiler including building. (Taken on prorata basis from recent offer for a 60 TPD Recovery Boiler.)	= 175.0 lacs.
Smelt Dissolving tank.	= 5 lacs.
Causticizing unit.	= 30 lacs.
Sludge filter.	= 10 lacs.
Pumps (Vac. Pump, liquor pumps etc.)	= 10 lacs.
Piping; insulation.	= 2 lacs.
Electrical.	= 40 lacs.
Total	= 350 lacs.

2) **Cost of Lime.**

1.3 t. of 60% available CaO is required per ton of recovered caustic and cost of lime is Rs. 800/- MT.

∴Total lime required $= 1.3 \times 9.3 \times 0.7 \times 330 =$ 2792.79MT per annum.

∴Cost of total lime required $= 800 \times 2792.79$
$= 22\ 34$
$= 22.35$ lacs.
$= 22\ 35$ lacs.

3) **Cost of Power.** (It takes about 400 units of power) to runa Rec. system.

Power cost @ 400 KWH and @ Rs. 1/KWH.
$= 400 \times 24 \times 330 \times 0.8 \times 1$
$=$ Rs. 25 34 lacs.
$=$ 25.35 lacs. = 25.35 lacs.

4)	Operational cost.	= 3.00 ,,
5)	Maintenance spare cost.	= 2.50 ,,
6)	Fuel oil cost (estimated) per annum.	= 3.00 ,,
	Total	= 119.20
	Say	= 119.50 lacs.

We observe from above that there is economic viability, though marginal to the extent of Rs. 7.00 lacs of (126.50—119.50=7.00) per annum. This seems to be low figure but there shall be further accruals from following :—

1. Though Recovery efficiency is assumed at 70% better efficiency is always possible in practice.
2. Today inspite of having capacity to make 30 MTD of bagasse pulp, mills like ours are forced to restrict its pulp production to the extent of 15 MTD due stringent control over disposal of black liquor down the stream. After installation of recovery system sustained 30 MTD pulp production shall be possible. Thereby more excise benefits shall accrue.
3. If Recovery boiler is designed for higher pressure rating (normally 40 kg/cm^2 for pulp and paper industries), power generation is possible. Target of achieving 1 MW of power generation is quite reasonable and practicable.

   In this case, capital cost of Turbine, Interest, operational cost shall have to be taken. But it needs no further explanation that with free availability of steam from recovery boiler the overall economics, including that of recovery system, shall be affected only the extent of increasing slightly in pay back period.

Besides above benefit on the National level shall be two fold as below :—

1. Due to chemical recovery, caustic soda procurement for a 30 MTD pulping unit shall be reduced from 3100MT per annum to (3100—2108)=992MT per annum. Generation and disposal of hazardous chlorine gas also shall be minimised.
2. Power required for making caustic soda is to the tune of 2500 KWH/T. of Caustic soda produced. Thus on account of one 30 MTD pulping unit having installed recovery system, there would be saving in power requirement to the extent of $2500 \times 992 = 24,80,000$ units. This in turn shall save precious fuel for power generation by Electricity Boards.

Extent of benefit on National level can be imagined when outcome of item (1) and (2) as above, are multiplied by number of 30 MTD pulping units in country. Fulfilment of social obligation by avoiding present pollution cannot be measured in

terms of money utb needless to say that it would also be beyond comparision. It is with these long range benefits, following is suggested :

1. As said earlier in the article, activity of manufacturing recovery system indigeneously suitable for 30 MTD pulping unit to beginn with, has to be encouraged. All the problems involved have to be listed, studied and solved. This connot be achieved unless a joint effort by Research Institutes, Pollution Boards and Financial Institutions with IPPTA. Even Electricity Boards and Coal India Authorities be participative in this joint effort as they shall also be highly benefited.

2. Similar encouragement be given for manufacturing suitable continuous digester which are so far imported. In the continuous cooking process, further reduction in Caustic soda consumption is possible.

3. Large paper mills suitably be located, who have replaced old recovery boilers, under expansion programmes, by modern and efficient recovery boilers. An appeal be made to them to make old recovery boiler available for carrying out experiments on bagasse liquor. This even may require to reerect surplus boiler in one of 30 MTD pulping unit.

4. Assuming that a break through is obtained by making recovery boiler to suit 30 MTD pulping unit, availability of Bagasse as Raw Material, is already posing a great problem. This is mainly due to apathy of sugar mills towards improving their Boiler efficiency by installing economiser, waste heat recovery system for bagasse drying. They should be pressurised by respective Govt. Agencies/ Financial institution to adopt these means. Thereby self consumption of bagasse as fuel shall stand reduced and availability of bagasse to paper units shall increase.

5. If financial institutes have not yet classiffed "Recovery with Power Generation" as "Energy Saving Unit" they should consider this favourably. Under the scheme, mills shall get further subsidy.

6. Learned opiniom be obtained whether a Recovery boiler under consideration be designed for 40 kg/cm^2 pressure rating or 12 kg/cm^2 pressure rating. This would help in reducing the initial capital cost.

Thus if problem is attacked in its true perspective and with national interest, a solution can definitely be found out. In that case if economics is even limited to few lacs only (When compared to conventionl Recovery Boiler), there seems to be no hitch on part of 30 TPD pulping capactiy mills to go in for a Recovery system.

Solution have always been found out in crisis with this optimistic note we once again appeal to fight out problem jointly with views as suggested above.