Recent Trends in Wastepaper and Hog Fuel Handling and its Safety

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ABSTRACT

The demand for paper and paper products is increasing by manyfolds due to growing world population and diversified utilisation. The Pulp and Paper making process involves too many inputs due to the rising cost of these the "Handling and safety" in industry and cannot be oversighted.

Wastepaper utilisation is one of the best method of conserving the forests, chemicals etc., but the wastepaper handling and safety has become a bottleneck to the industry due to its bulky character and inflammability. Wastepaper is being handled in baled form weighs 450 kgs to 900 kgs/bale since long time the economical transportation and efficient utilisation has led to various developments—one such is Pelletization of wastepaper

Constant and enduring efforts of Papakube of USA successfully invented the process which can be outlined as follow soothing, shredding, metering, cubing of pelletizing and storage. Twice the amount of product can be handled with pelletization as compared to conventional method of baling The strength properties of the pelletized fiber is good If fire breaksout it can be restricted to certain areas only as the pelletized wastepaper can be stored in large vertical silos.

In past, when natural gas and fuel oil were cheap and plentiful, little emphasis was placed on systems to deliver woodwaste fuel from reclaim to the furnace

However, with the diminishing supplies and increasing prices of gas and oils, much more emphasis is being placed on utilisation of woodwaste or hog fuel. For reliable, consistant flow of hog fuel to the furnace, there are six elements required which are

—reclaim
—transport
—surge or storage
—distribution,
—feeders; and
—furnace distributor.

The paper describes and highlights-the merits and demerits of hogfuel handling and safety.

The demand for Paper products has increased by manyfolds due to diversified utilisation and growing worldwide population. The need for economical and safe handling of the inputs and outputs with the industry cannot be overlooked. The process of utilisation of WASTEPAPER ane Hog fuel is not new in paper industry.

Each wastepaper bale weighs about 450 to 900 kgs whereas hog fuel is stored in piles. The need for economical, safe and efficient handling of these material has led to various methods of handling. One such method is "Pelletization of wastepaper". "PELLETIZATION" is a process of cubing the waste paper into size of 31.5×31.5)mm in cross section and 50 mm in length.

In 1973 Papakube of 'U.S.A.' under the direction of Gerald B. Nelson the inventory of process successfully accomplished the process of pellatization whereby loose bulk wastepaper could be compressed into cubbets/pillets. Similarly C.C. Dalton in 1979 (USA) introduced the new system to handle hog fuel.

Handling and safety of the above materials is dealt in detail separately in this paper.

I. PELLETIZATION OF WASTEPAPER :

PROCESS :

The process has been proven to work well on large volumes of low grade wastepaper such as newsprint,

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O.C.C. and mixed grades. Basic layout of the process is as follows :

i) Sorting
ii) Shredding
iii) Metering
iv) Cubing/Pelletizing
v) Storage.

The entire process is automated except sorting

i) Sorting :

Tramp metals, stones, bottles are removed manually during sorting in order to prevent shutdown of the process.

ii) Shredding :

From the sorting table the wastepaper is carried by the conveyors to a shredder which reduces paper to size of 50 to 70 mm. This leads to uniform power consumption and for longer equipment life. The shredded material is blown to a cyclone and accepts are taken to metering box.

iii) Metering :

Serves two purposes – one is uniform addition of moisture which is essential to process also it regulates flow to cubing machine.

iv) Cubing/Pelletizing :

Cubing machine with the aid of the press wheel forces/extrudes wastepaper through dies to form compact dust free flowing cubettes measuring approx. 31.5×31.5mm in cross section and 50 mm in length.

v) Storage :

Cubettes are vertically lifted from cubing machine by a mechanical conveyor into a storage tower/silo. Air is drawn over cubettes for several hours to reduce their temperature hence excess moisture.

FIBER STRENGTH OF CUBED & BALED WASTEPAPER :

Fiber demage occurs to certain extent during cubing process due to high pressure and high temperature application (upto 700 kg/cm² and 80°C) Mills utilising 100% recycled paper find it difficult to run with 100% cubed wastepaper where as if virgin pulp is blended, the required properties can be obtained. The table gives the test results conducted with cubed OCC and baled OCC.

TABLE—1.

Comparision of fiber strength of cubed and baled O C.C.

		Cubed	Baled	Method.
Penetration time without agitation	(Min.)	45	5	T-227-M-58
Freeness	(CSF)	585	550	T-404-OS-79
Tear strength	(M)	3913	3918	T-404-OS-74
Elongation	(%)	3.0	2.5	T-403-OS-74
Mullen factor		124.4	128.5	T-414-TS-65
Double fold		45	51	T-511-SU-69
Fiber length	(MM)	1.6	2.1	T-232-SU-68

MERITS OF CUBING :

1. Cost of pelletisation is favourable to that of conventional baling.
2. Substantial cost savings are achieved through greatly reduced handling equipment cost, such as fewer trucks, forklifts etc.,
3. Less man power requirement and lack of need for baling wirss.
4. Cubed wastepaper stacks 1.64M³/T to 2.05M³/T whereas baled wastepaper storks 2.05 to 3.85M³/T. This is because of free flowing ability of cubettes to fill open air spaces.
5. At mill site additional cost saving results from not having to open bales and sort paper with relatively high cost labour.
6. Cubed wastepaper can be stored in vertical silos offers two significant advantages : a reduced potential for fire hazard if a fire should occur the potential damage would be restricted to a small area. Secondly, lower storage cost through reduced storage area (in vertical large silos).
7. Cubettes can be poured into hopper railers or trucks and shipped like chips.

DEMERITS OF CUBING :

1. Initial investment for cubing equipment does for somewhat higher than baling equipment.
2. Energy consumption for cubing is quite high.
3. Usage is restricted to lower grade.

EVIDENCES :

Let us review in brief the investigatory practice carried out by PAPHKUBE CORP. Sandiego, U.S.A. A pilot plant was started in 1976 and run around-the-clock for 6 months. During the 6 months, Papakube successfully produced 5000 M.T. of cubed wastepaper. The cubed wastepaper was stored for six months in large vertical silos and no signs of fiber or cube surface damage was found. During pulping, it was observed with newsprint virtually no difference between pelletized and baled wastepaper. However with pelletized O C.C. dissolved slower in cold water and with warm water little difference in time was seen. The per ton cost saving in freight was found to be very high of order 100000/month for mill consuming 5000 TPM when cubettes where shipped from USA to Japan.

II. HOG FUEL HANDLING :

Hog fuel consists of wood waste - be it bark, saw dust, shavings, chip screenings or whatever. The utilisation of hog fuel is gaining much momentum due to rise in cost of fosil fuel and oil. There are many hog fuel boilers in operation with different handling system (hog fuel) such system is as follows :

(1) Reclaim
(2) Transport
(3) Surge/storage
(4) Distribution to feeders
(5) Furnace distribution

1. RECLAIM :

Hog fuel is moved into reclaimer by rubber tyred dozers from relatively controlled piles, which are usually stored outside. There are 3 types of reclaimers viz.

(i) Drag chains
(ii) Hydraulic reciprocating ladders ;
(iii) Travelling screws.

Drag chains are of two basic types viz., buried in trench and above the ground. Above ground type is more applicable to large installations, these are 6 to 8 ft. in wide with several strands of chains which prevents bridgings. Variable speed type motors are provided for above ground type. These are provided with shear gates which assists in smoother discharge to transport system, Below ground type is less expensive but discharge from these are rather difficult.

Hydraulic reciprocating ladder type is placed horizontally with wedge shaped rings fixed. Ladder is pulled from under the piles and plug of hog fuel is removed. Usually 2/3 are installed and sequenced. These perform well in very high pile as long as it is not compacted. This system is very messy and fairly costly. Travelling screw type is similar to chips extraction screw. The screw moves in a carriage and as screw rotates a carriage drives move it into the piles allowing it to dig material from pile continuously. As screw is mounted and rotated on carriage, the capacity is limited.

2. TRANSPORT SYSTEM :

For reliable delivery of hog fuel to the furnace good transport system is needed. There are two systems commonly in use today conveyors and pneumatic blowers.

Conveyors are of two types drag chain and belt. Drag chain type is used only for short application because of high cost and maintenance. Belt conveyors are most popular as they are less expensive to install and maintain. Belt conveyors require elaborate support structure when they are high because of limited inclined rates to prevent slippage of material.

Pneumatic blower system is a considerably higher power consumption system than belt conveyors. The materials travel at high speed in the pipes. This system is coupled with fairly complicated blowers and feeder equipments and hence high cost and high maintenance system.

Usually both the systems i.e. conveyors and pneumatic system is coupled to utilise better points of both the system. The smaller or drier material is pneumatically conveyed while larger or wetter material is conveyed by belts.

3. SURGE/STORAGE :

As hog fuel was utilised surge/storage bins were erected, which would hold stock for 30 to 60 minutes, later it was found to give considerable trouble and more often, now no bin is installed Instead systems are being installed which recycle a small per cent of total fuel flow back to pile this system gives adequate fuel to furnace front yet eliminates the bins.

If bins are installed, which are usually of line bottomed of some sort with different feeder system like multiple screw, spiked rolls, hydraulic reciprocating type, travelling screw or drag chain typs. The latter 3 are smaller version of the type used.

4. DISTRIBUTION :

For reliable and efficient combustion of fuel in furnace with a minimum carry over, even distribution of the fuel to the furnace feed opening is essential. If a homongenous mix of fuel is not fed to all the feeder at even rate then a bed of material will form with varying consistency and depth, which will burn at different rates across its cross section giving different flue gas rates and temperature throughout the furnace. These causes greatly particle carryover so distribution is a major step in pollution abatement. There are 3 types of distributions used, vibrating conveyors, swinging spouts and drag flight conveyors.

Hog fuel when burnt in combination with other fuels vibrating type is used which consists of flat decks vibrating at high frequency followed by vertical divider plates. The plate divides the material into number of lanes corresponding to number of furnace openings. To prevent different amount of material feeding, baffles and diverter plates are used. The capacity can be varied by varying vibrating frequency or fed rate.

Swing spout assembly is a rectangular chute several feet long which is pivoted at upper end. The lower free end is automatically swung back and forth through a prescribed arc. Below lower and chutes are provided leading to feed opening of furnace capacity control can be done only through system feeding it.

Feeders are provided on Drag flight conveyors. The distributor consists of 2 continuous chains spaced a few feet apart, placed in upper and lower trough. Wooden flights are connected across the 2 chains to form flight to move the hog fuel. Fuel is dropped on to the trough and pulled along. The lower trough has openings in it to allow the material to drop out to feed chutes to chutes

5. FEEDERS :

To accomplish even controllable flow several types of feeders have been developed. Various feeders are variable speed, utilising D.C. motor or variable frequency drives, hydraulic drives or one of several mechanical drives. Most popular type is screw feeder with two tento twelve inch screws mounted underneath the surge hoppers. These type feeders are proven very reliable and handle wide range of fuel size and species well. This type works fairly con istently on stringy material.

Spiked rolls type are also used on certain application but are very difficult to handle material like green gum or cidar bark as it wraps on to spikes also fines pass out uncontrolled. Rotary star or pocket feeder have been successful only on small and free flowing matrial. The bell type feeder is similar to Rotary star type feeder.

6. FURNACE DISTRIBUTORS :

For proper combustion and equal flow rates to furnace, furnace distributors are used. There are two types of furnace distributors - mechanical and pneumatic type.

Mechanical distributors :—It is a rotating cylinder with protruding fringes on which the material is dropped. This works well only with large and heavy pieces also when larger quantity this distributor segregates the fuel by size from front to back resulting in uneven fuel bed and hence uneven combustion resulting overheating of grates and increased particle carryover. The maintenance cost of this type is high.

Pneumatic distributors :—also known as Air swept spouts. Air is injected underneath the hog fuel stream. The fuel is blown across the furnace with 2 air injectors one uses slow rising and falling air pressure and another constant air pressure. High air pressure in the order of 30" WC is used it tends to segregate the fuel.

SAFETY :

Hog fuel is highly combustible if it comes in contact with fire. Hog fuel is to be handled with utmost care similar to coal. Hydrants etc., should be provided at regular intervals in piles. Hog fuel should not be too wet as it causes fungal growth leading to various different problems.

CONCLUSION:

Many methods are already existing and few are yet being developed to effect economical and efficient ways to handle wastepaper and hog fuel flow to furnace. Wastepaper of lower grades can be easily deinked in pelletized form Also Board manufacturers find it very favourable to use pelletized wastepaper. There have been boilers installed supplying steam of order 2 5 lakhs to 3.0 lakhs kgs/hr which operate normally on hog fuel alone.

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