

Utilization of Sludge of Effluent Water Treatment Plants

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ABSTRACT

The waste sludge taken out from the ETP can be used for many purposes. Most common uses have been in making cheaper grades of mill boards in nearby factories. Where such board mills are too far, the sludge is used for land-filling or it remains a nuisance. However, there has not been a methodical, proper approach for sludge utilization.

Hence, some of the ideas are put forward here for development of useful products. These ideas have already been tried on preliminary scale and have been found practical and commercially viable.

INTRODUCTION

Even in well advanced countries the problem of sludge disposal is not fully solved. In USA, the cost of disposal of the sludge may be to the extent of 60% of the water treatment cost⁽¹⁾. They have developed technologies of drying of sludge but very little work has been done in utilizing it in value added products on a large commercial scale as a regular practice.

In a personal communication⁽²⁾, a reputed Japanese consultant informed that in Japan the sludge is either buried or burnt. Now even burying has become a problem as land is less there. In other countries also it is mostly burnt after drying to about 70% solids. Ash also contain some times hazardous materials. Still burying is most popular way of sludge disposal.

Dhingra & Mohindra⁽³⁾ have given good data on sludge generation and their disposal practices.

Pollution control people⁽⁴⁾ have given the following parameters for the solid sludge to be used as land-fill.

Sulphates	mg / kg, max	1000
Chlorides	mg / kg max	1000
(Cu + Zn + Ni)	mg / kg max	25
Lead, (Pb)	mg / kg max	1.0
Mercury, (Hg)	mg / kg max	0.01

The sludge may contain the above constituents much more than the specified limits depending upon the type of raw materials used. The sludge from waste paper based mills (containing printed and varnished coated board or paper) may contain lead and mercury. Hence, it would be better to check the parameters, and if found in excess then the sludge should not be used for land-filling.

But Sherman⁽⁵⁾ reported that sludge has been

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started to be used as fertilizer or at least as Land-Spread. It was demonstrated that sludge, as land-spread, in forests, sports grounds etc. had at least no harmful effect on soil, trees, animals or birds and vegetation over a period of about five years, Finn⁽⁶⁾ goes further and suggests that the solids can be used as fertilizer or even as animal feed. This is in line with Sherman. In our country it is not advisable unless the sludge is free from chemicals harmful to plants and for animals. Authentic data is yet to be collected.

The material and the problems are very well known in paper industry, hence, it shall be only touched upon to jump over the main matter quickly.

The selection of the item or product to be made will depend upon the quality and quantity of sludge available on an average per week. The sludge generated may have solids content ranging from 10% to 30% according to the method of sludge removal from effluent water. Accordingly storage and handling system would have to be arranged.

A typical indicative analysis of the sludge of a particular mill, based on virgin pulp and waste paper of different grades, was found as given below :-

Moisture content 75%, Ash content 35%, Total SO₄ (as SO₄) 800ppm, Total chlorides (as Cl) - 500ppm.

There are some highly developed technologies⁽⁷⁾ available abroad for drying the sludge. In one such technology, there is a design in which sludge is dried by indirect heat by burning some quantity of sludge and using its heat in indirect heat driers. In this system the dryer consists of a double passage rotating drum which incorporates three concentric cylinders. Heated air flows in the interspace. The wet sludge is fed to the inner cylinder which travels along the length via an interspace returning to its starting point. After drying the sludge becomes homogenous and granular and fully biologically stabilized and sterilised. Dust formed is removed by means of cyclones. Thus, the design is capable of generating its own heat for drying, so that external heating cost is not there, using sludge which is cheapest fuel. But, this design is not very economical in Indian context, mainly because our paper mills are not large enough to take full advantage of this process with respect to plant cost and its operating cost.

It may be suggested here that the sludge be collected over large shallow beds, covered by sheet

roofing, allowing vapours to escape out. These beds may be dried by solar-heat-reflectors to reduce moisture content, whatever it can. In this matter Ministry of Conventional Energy sources will be of great help and guidance. Of course, there may be manufacturing and drying problems in the rainy seasons when the operation might have to be suspended and run seasonally or suitable drying arrangement, say by baby boiler or by extra steam from main plant might have to be arranged.

An arrangement will have to be made, for removing undesirable material from the sludge to prepare it as raw material. The sludge slurry can be filtered through a Johnsons type vibratory screen where larger pieces, say above 10 mesh, may be filtered out. The slurry passing through 10 mesh should then go to thickening unit where it can be thickened up to desired consistency as required for making the items. The mesh sizes will have to be selected as per requirement for the items to be made. The excess quantity of sludge, than required for production, can be thickened further to maximum consistency in the normal way for storing or stock purposes.

Some of the articles which can be made may be vaguely grouped as follows :

Fluffed stuff for cushion packing : The dried sludge lying under the solar heat driers should be dried upto about 60% moisture and shredded in a large shredder and crumbled into fluffy mass. This fluffy mass can be blown up in a 12" dia MS pipe by solar heated hot air draft to almost complete dryness to about 10% moisture.

Either a fluffy powder or spongy solid lumps can be packed in gunny bags or dry compressed into cakes for easier handling. This material can replace wheat or rice straw, waste paper, saw dust etc. which are used as cushions in packings. This fluffy material would be eco-friendly in comparison to plastic cushioning materials. The crumbled sludge or fluff can be used in brick kilns for brick baking along with cinder (waste coal ash) of the boilers. The sludge will give good simmering heat for brick baking.

Preformed semicylinders of lengths about 2 ft. for insulation of warm and cold pipe lines can be used in place of mineral wool insulation. Here also it would be much cheaper, eco-friendly and much less hazardous.

Packing boxes for grasswares : Sun drying, tailor

made, crude, rough, preformed type boxes or cylindrical packing can be made from wet sludge for glass wares, empty glass bottles etc.

Briquettes (Solid blocks) : The sludge can be mixed with suitable chemicals in a rotary mixer (similar to the one used for concrete mixer) and then poured into brick shape mould of different sizes, compacted on a vibrator and then the blocks can be allowed to dry in solar heated closetts. The bricks can be made of desired strengths, and having special properties, for different applications using different chemicals.

The sludge as such can be formed into small bricks/blocks and pebbles for use as "Janata Fuel" for nearby villages. The briquettes can be used in small boilers and in baby boilers as well. The advantage is its easier storage, easier & cleaner handling than coal/rice husk/saw dust etc., and it saves cow dung/fire wood etc., which should be used for better purposes.

Cement-sludge products : Cement can be mixed with sludge in different proportions and further treated with chemicals or resins depending upon desired properties. Such products like roof top, small decorative lawn flower-pots, decorative hanging pots for artificial flowers or plants, garden bricks for making lining around beds, light decorative articles like waste paper baskets which may be used in the offices and in the factory or in the drawing rooms of company - flats in the colony, can be made. These products can be made at site by using semiskilled workers.

Moulded product : Moulded products can be made with or without chemicals or resins. The products like Fruit - packs with fungicide property for grapes, strawberry etc. can be made. Egg trays, side - protectors for delicate parts like tonner cartridges & electronic parts, case for some bottles and grease resistant boxes for oily and greased materials and side protectors for reels and for sheets in ream packing in the Finishing House.

Paper - mache type toys and dolls can be made from sludge using some binders like starch or tamarind seed gum. There is an institute which provides course on papier-mache in Pune. Govt. agencies like, Village and Khadi Udyog may also help in this field. For papier-mache (light paper toys) artists can be engaged for painting and decoration of toys etc. Chennai is centre for such an art and marketing.

Very small, light weight items like disposable

paper weights, Triangular throw-away type blocks can be made on which names can be pasted to be kept in the conference halls, for seminars & meetings, etc. as substitute of glass or wood blocks.

MILL BOARD & STRAW BOARDS

Yet the best utilisation is, of course, in the board making. Waste paper pulp may be added to the sludge, if necessary, for making saleable quality product according to market requirement. The board can be used in making such articles where appearance is not important but strength like stiffness & burst are required.

So far, what has been tried is adding the sludge in the furnish as a very cheap substitute in the machine made or hand made, sun drying board making. There are many difficulties being faced in this. Firstly, this becomes a tedious job to collect, transport and unloading in trucks. Secondly, formation of sheet at mould takes a very long time (because of higher water retaining character)⁽⁹⁾. Also it takes a very long time in drying. These sheets made from sludge, get badly curled during sun-drying. So, this also has to be taken care of in the process. So, the board plant should be by the side of ETP or as near as possible.

Where the sludge is recovered in the form of wet sheet e.g. from vacuum filter or belt pressing etc. it can be stored after cutting into small standard sizes and pile it one over the other on flat wire mesh or checken mesh and let them dry in the hot room. The hot room may be made of brick wall with corrugated tin sheets, in such a design that solar heat is directed in the room with ventilation for escaping vapour. The trays may be pushed in and pulled out of the room over rails in the room for drying or may be kept in open in the sun for air drying. The semidried small size sheets can be pressed in a sheet press to make them compact, even, uniform and flat. In this press, a pile of sheets, say about 100 or 50 sheets, with plastic separators, can be pressed for about 10 minutes. Sheets can be separated and again dried to moisture content of about 12%. These sheets are then heavily calendered to make them dense, hard stiff and smooth.

Where the bulk is important, the sheets may not be pressed but only lightly calendered so that bulk is not reduced and sheets become somewhat smooth and even.

The sheets can be calendered cold or hot (80°C) in Calenders once or more till desired finish is achieved. These sheets may be used as backing boards

in photo frames, partition-wall, book binding covers, box files, file-board etc. or as rough packing board for small engineering items like tool (Small screw-drivers, triangular files, hack-saw blades, knives, scissors etc.

A typical project cost⁽⁹⁾ for 10 tons per day board consisting of one former of size about 40 inch deckle, sun drying type, is around Rs. 15 lacs. The total cost including land, power, water, commissioning etc. may be up to Rs. 35 lacs. This cost may be much lower or much higher depending upon some important techno - commercial factors like land cost.

Mill board in the substance range of 250 to 500 gsm with an ash content of about 25% will find different uses while plain board of about 200-300 gsm can be used as protective sheets for paper reams, edge projector, corner protector and side protectors, or for making boxes for shoes, glass items, glass bangles and for rough packing of some scientific glass wares or metallic parts. The plain sheets (500 gsm) can be used for making file covers, rectangular board for wrapping cloth, punch cut out small discs to be put under the beer jugs, tea and coffee saucer, in place of presently used plastic discs, diary covers, and dimensionally stable board for false ceiling etc.

Some boxes can be pasted with kraft paper or with printed and coloured papers using adhesive paste or stickers after making boxes, say for expensive shoes, glass bangles and toys, earthen toys etc.

Hand made board : This method of board making can be utilized where the quantity of sludge is not sufficient for using machine and too large for papier-mache and other low demand articles. The sheets can be made plain, normal or with special properties like water-resistant antifungal, fire retardent, grease proof etc. by adding suitable chemicals in the sludge slurry. These sheets will find special uses. Fireproof or fire retardent boards can be made and used for packing crackers. These boards will not allow flame to continue or spread.

It may not be very attractive for an entrepreneur if he takes only one or two items because of lower turn over. The items can be made alongwith board mill if excess quantity of sludge is there or during

lean periods of board making. It would be better to have few products depending upon the availability, quality and quantity of sludge, facilities available and demand from market and on marketing net work etc.

Whatever it is, the sludge should be utilized for better and advantageous purposes than throwing it as land fill.

More work is required to be done to make the methods and technology perfect & suitable to site conditions.

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