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UTILIZATION OF ETP SLUDGE GENERATING FROM PHARMACEUTICAL INDUSTRY WITH SUITABLE ADDITIVES IN A HAZARDOUS WASTE MANAGEMENT AND TREATMENT FACILITY

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Abstract:
The Co-Processing of Hazardous Wastes for Energy generation in high heat intensive industries especially in cement production process has become an irreversible trend worldwide. This procedure support treating the waste and converting it into energy as fuel which can be replaced for conventional energy production and helps to treat the waste in sustainable manner. In This study we analyzed the Effluent treatment sludge characteristics as per CPCB guidelines for Co-processing of waste to know the value of waste which could be reused as a fuel in cement kilns. Also tested the characteristics of spent carbon and expired medicines to use as additives to prepare composite sample and HW receiving from surrounding pharma industries of waste management facility. The three wastes combination in proportionate ratios pre-processed as per CPCB criteria. The present study supports to reuse the preprocessed waste as a co-processing in cement kilns otherwise which is generally managed and treated by landfill and it also ideal option to reuse the hazardous waste via substitute of fossil fuels in high heat intensive industries.

Keywords - ETP Sludge, Central Pollution Control Board (CPCB).

Introduction:
The Regulatory body CPCB studies individually class of industries, depending on type of waste generation it categorizes, quantifies and characterizes the effluents, solid waste and emission streams. The manufacturing process is also studied in detail so as to suggest in-plant control measures, such as changes in raw material, process, operating conditions, reuse, recycling, etc. Many of the environmental problems we are dealing with today are an accumulation of decades managing the residuals of our industrial outputs in the ways that we know to be inappropriate (Blackman Jr, 2016). As per literature survey data shows that the percentage wise wastes generating in India namely 72% municipal solid waste (MSW); 11% Industrial Hazardous Waste; 8% biomedical waste (BMW); 8% plastic waste; and 1% electronic waste (Dixit and Srivastava, 2016). Hazardous waste management is a global problem comprising developed and developing countries (Moyers, 1993; Babu et al., 2007; LaGrega et al., 2010). The very real problem that hazardous waste has created and is creating is compounded by the commingling of technological obstacles, limited financial resources, risk assessment, regulatory affairs and procedures. Utilization of hazardous waste by co-processing in cement kiln as a supplementary fuel as well as an alternative raw material is treated as a constructive viable option (CPCB, 2017). Segregation of waste at source through dedicated processing facilities to separate recyclable materials plays a vital role (Kumar, 2017). In India, alternative fuel technologies are gradually flourishing like using different types of hazardous waste after

pre-processing and co-processing in cement kiln as a fuel and also ash as a raw material in the processing of cement in place of lime (Sadala et al., 2019).
In the recent year's hazardous waste generating industries trend sets/focuses on other alternatives for disposing their waste or which can be utilize in other process, making it a less burden upon traditional treatment schemes. Co-processing waste will prevent the possibility of less significances and support the reduction of greenhouse gas emissions (de Queiroz Lamas et al., 2013). Industries can be practiced utilization of wastes for resource or energy in an eco-friendly manner, however waste utilization through co-processing in cement kilns is ideal option. There is a win-win advantage in co-processing of wastes in cement kilns, such as waste can be used as a substitute as a fuel and as well as an alternative raw material. Waste materials used for co-processing in a cement plant are defined as alternative fuel and raw materials (AFRs). Which are generally obtained from sources like Hazardous waste generating industries, Municipal, Agricultural and it can be used in cement industries could be both liquid and solid and should have suitable chemical contents (Baidya, R., & Ghosh, S. K. (2019). The producer of industrial waste pays a certain tipping fee on per/ton basis and also provides free transport of the waste to the plant. The types of industrial waste which are co-processed as alternative fuel and raw material are. The trade rejects mainly consists of expired products like shampoos, coffee sachet, napkins, toothpaste, noodles, sauce etc from major FMCG companies. There are also other non-industrial wastes which are added as impregnation to reduce the water content, which includes saw dust and rice husk (Baidya, R., Ghosh (2016). Present paper focuses on the reuse of ETP sludge which is receiving from the surrounding pharma industries to waste management facility, pre-processing for reuse of HW by finding its suitable additives to be used as an alternative fuel in Cement Kilns.

Methodology:

Hazardous waste Sample collection: Hazardous wastes was received at the facility in loaded trucks such as Effluent Treatment Plant Sludge (ETP sludge) and Spent carbon from surrounding pharmaceutical industries, a representative individual sample was collected from different trucks by using coning and quartering method for reducing sample size, it was homogenized and conducted finger print analysis.

Sample analysis: ETP sludge sample, expired tablets or batch failed medicines and spent carbon analyzed individually for the important parameters as per CPCB criteria for co-processing of waste namely pH (SW-846-9045C), Loss of ignition (LOI)(APHA 2540 E), Loss of drying (LOD)(APHA 2540 B), Calorific value (CV)(IS 1350:1970), Sulphur (%) (CHNS-Analyzer) and Chloride (%)(CHNS-Analyzer)and heavy metals. Composite sample has prepared with the above three combination HW wastes with a blending ratio 2:1:1 in tones and the parameters analysed as per CPCB criteria and finally compared with CPCB acceptance criteria for co-processing to reuse in cement kilns. Pre-processing of Hazardous waste at site is shown in Figure 1.

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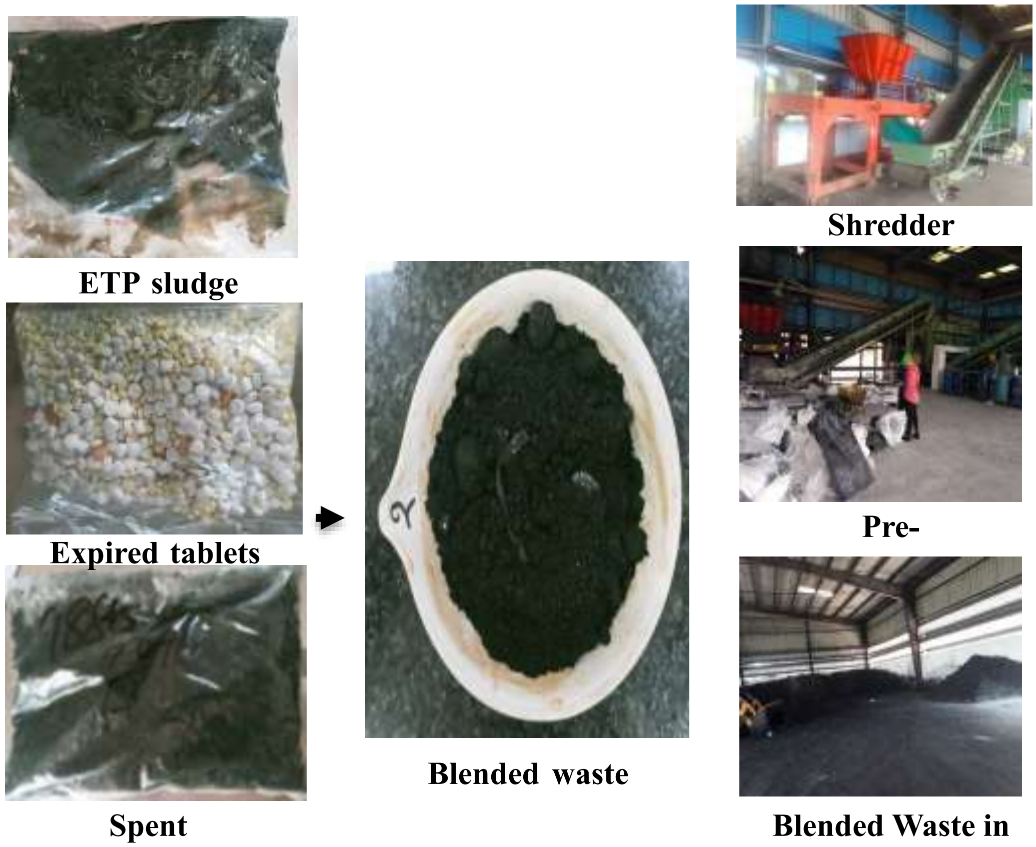

Fig- 1 Pre-Processing of Hazardous Waste at Site

Results & Discussions:

Before blending of HW in pre-processing facility, proper handling and operation of HW their characteristics taken into account. As explained through figure 2, composite sample prepared with a blend of three Hazardous wastes such as ETP sludge (HW1), Spent Carbon (HW2), Expired drugs & Medicines (HW3) combination by taking ratio of the sample is 2:1:1 tones. Firstly, to reduce the size of HW1 through shredder mill, foreign materials separated through magnetic separator and solid materials in granules or powder form have taken for mixing or blending.HW2 & HW3 combination additives added for free flowing and blending of waste for adjust to the standards as per co-processing. A solid blend composite sample in powder form prepared by using the above combination. Results are shown for individual sample in table.1 & for composite sample in table 2.

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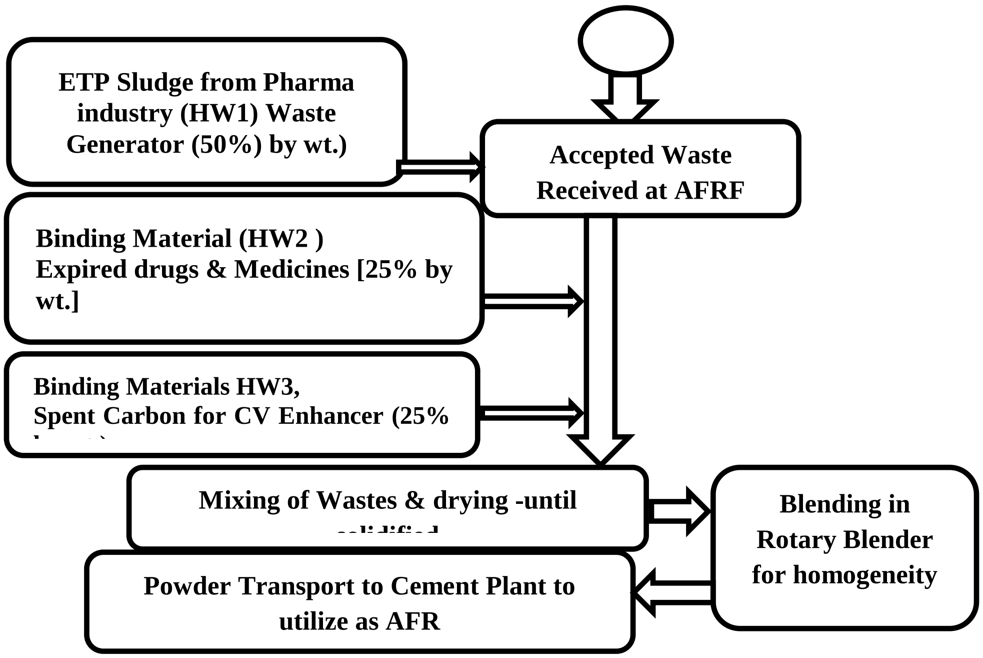

Fig.2 Schematic diagram of the blending of HW Pre-processing facility

Table 1: Individual Sample results:

Type of waste	Qty.kgs	CV (Kcal/kg)	pH	LoI %	LoD %	Cl %	S %	Heavy metals (ppm)
ETP sludge	9810	2106	7.09	66.1	32.0	0.22	0.25	<0.1-7
Expired drugs & Medicines	1100	4916	5.21	95.7	<1.0	0.74	0.11	<0.1-2.3
Spent Carbon	4490	4480	6	85.8	18.0	0.91	0.11	<0.1-<5
Specification of HW for use of energy recovery (Guidelines on Co-processing in Cement/Power/Steel Industry CPCB (2010)	-	>2500	4 to 12	-	-	< 1.5	< 1.5	Hg: <10 Cd+TI+Hg:<100 As+Co+Ni+Se +Te+Sb+ Cr+Sn+Pb+V:< 25,00

Table 2: Composite sample results: The composite preprocessed sample prepared at the facility. The ratio of the sample is 2:1:1 tones:

Type of waste	Qty.kgs	CV (Kcal/kg)	pH	LoI %	LoD %	Cl %	S %	Heavy metals (ppm)
Composite sample	15400	3616	5.8	69.61	19.84	0.95	0.27	<0.5-4.0

Specification of HW for use of energy recovery (Guidelines on Co-processing in Cement/Power/Steel Industry CPCB (2010)	-	>2500	4 to 12	-	-	< 1.5	< 1.5	Hg: <10 Cd+TI+Hg: <100 As+Co+Ni+Se +Te+Sb+ Cr+Sn+Pb+V: <25,00

As per CPCB acceptance criteria for specification of HW for use of energy recovery guidelines for co-processing in heat intensive industries in Table 2, the pH of hazardous waste sample ranges between 4-12, whereas in the present study it shows 5.8, the calorific value given by CPCB is >2500 Kcal/kg, whereas in this study it is 3616 Kcal/kg. In case of both Sulphur and Chloride percentage, the CPCB suggests value < 1.5% and in the present study it is 0.95 % for Chloride and 0.27 % for Sulphur respectively. Heavy metals are also within standards. (Vidya, 1998) characterized the sludge generated from electroplating automotive industry and its pH as 9.6, LOI-3.8% and Organic content 6.7%. (Shiva Prasad, 2016) studied on Solar Evaporation Pond (SEP) sludge, it falls under schedule-III (Part B) which comes from agro based industry contains distillation bottom residues it has given CV -7238 cal/g and sulphur-0.8 %.Other studies discovered the alternate fuel with a CV of >7100 kJ/kg which is mostly used in 80% of cement industry furnaces (deQueiroz Lamas, 2013). Calorific value ranging from 321 to 5396 kcal/kg with combination of waste co-processed with the type of industrial waste such as ETP sludge, grinding muck, chemical sludge, boiler carbon, iron slug, , grinding dust, paint sludge, brake shoe liner, boiler ash, spent carbon, trade rejects, oily rags, ETP bio-sludge (Baidya, R., Ghosh (2016).

Conclusion:

The paper presents a study of pre-processing with three combinations of wastes such as ETP sludge, spent carbon and Expired medicines blended in proportionate ratio. The composite sample prepared through pre-processing method satisfied the CPCB criteria for co-processing in cement kilns as a fuel which supports the effective management of waste in turn reduced carbon foot prints and also save the conventional fuel, which otherwise going to the landfill.

Conflict of interest: The authors state no conflict of interest for this work.

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