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**Research Article**

# CONVERSION OF BLEACHING AND DYEING EFFLUENTS SLUDGE AND TEXTILE SPINNING MILLS WASTE INTO FUEL

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**Abstract:** Increase in population and rise in industrial establishments caused increase in demand for water. Due to industrialisation and discharge of solid and liquid wastes the quality of water and soil are affected. One firm wastes are another firm raw materials. Waste is not a waste material but, it is resource to another. The wastes are to be collected, treated, stored properly and are to be reused by the other firms. Biological Effluent Treatment Plant (ETP) sludge from bleaching and dyeing unit, wood chips, droppings wastes, cotton mud waste from spinning mills and green waste are mixed proportionally and made as briquette in cake form of 120 mm x 120mm x 75mm which are having high calorific values more or less equivalent to coal. The cake is fed into boiler of bleaching and dyeing unit for producing steam. It is a successful project using waste materials by which the ecology and the environment is improved.

**Key words:** Secured Landfill Facility, fuel, Sludge, Wood chips, green waste, cotton mud, standards

## INTRODUCTION

Environmental concerns have in the recent past drawn great attention of the public and planners in India. There is a plethora of environmental legislations under implementation; amendments of the legislations are made from time to time. Environmental awareness among the public in general and non-governmental agencies drive the implementing agencies to enforce the rules, guidelines and directions of the Ministry of Environment & Forests and Wild life, Government of India. Legislations public interest and negative impacts of environmental pollution on environmental resources like, land, water and air directly impede the developmental activities of the region. India being a populous country has to face the challenges particularly in alleviating poverty. The poverty is essentially linked to natural resources. Land resources shrink year after year due to expansion of urban sector, industrial promotion, harnessing of land for mines, reservoirs, roads etc. Barring 20% of the 326 million hectare of the land area occupied by the forests, the rest (260 million hectare) is for anthropogenic activities as cited above. The industrial revolution and green revolution helped economic development grow. At the same time, crises start mounting energy and environment top the list of crises. Generation of waste materials are parallel with increase in human population, industrial and urban development. The shrinking land being essential resource for food production has to accept enormous quantity of waste emanated from industrial units and domestics.

In India Textile sector is flourishing and is bringing foreign exchange to the country. These units are functioning in many states viz. Tamil Nadu, Maharashtra, Gujarat, Karnataka, Kerala, Andhra Pradesh and the Union Territories Chandigarh, Delhi, etc. Because of the large demand of cloths in India as well as abroad the textile sector units such as spinning, knitting, bleaching, dyeing, sizing and printing units are engaged busily. In Tamil Nadu about 4000 Nos. of bleaching and dyeing units are functioning and are spread over Coimbatore, Tiruppur, Erode, Namakkal, Salem, Virudhunagar and Tiruchy districts. Similarly, more than 300 spinning and weaving mills are located all over Tamil Nadu.

The process involved in bleaching and dyeing units are scouring, bleaching, dyeing, drying and packing for despatch. In the process of bleaching and dyeing trade effluents are generated which are non-biodegradable and toxic in nature. The physio-chemical characteristics[1] of the raw trade effluents are pH (12).BOD (580 mg/l), COD (1500 mg/l), TSS (200 mg/l), TDS (6000 mg/l) and chloride (2500 mg/l), cyanide (<0.001 mg/l), etc. The effluents contain heavy metals too; they are harmful to living organisms and also to affects plant growth photosynthesis activities when the concentration of the metals is exceeding threshold limits[2]. As per the Government of India norms the trade effluents are to be treated and disposed off. During treatment of the trade effluents solid waste known as sludge is generated which are toxic. The bio-sludge is to be disposed off scientifically by means of secured land fill facility or to a Common Treatment, Storage and Disposal Facility. The scientific sludge disposal cost is very high i.e. about Rs. 10,000 per ton of sludge.

M/s. K.G. Fabrics Limited group of industries having head quarters at Coimbatore have come forward to involve in the above study by using the raw materials generated by the group of industries and the study

commissioned during July/2013. M/s. K.G. Fabrics Limited, SIPCOT, Perundurai, Erode district, is carrying out bleaching and dyeing of denim fabrics and is generating trade effluents of 534 KLD from the process. The unit is generating 250 ton/year of bio-sludge and it has accumulated quantity of 1500 ton. The wood chips generated from the unit are about 500 ton per year. The Proximate and ultimate analysis of bio-sludge is furnished as below: [3]

**TABLE – 1: The Proximate and ultimate analysis of bio-sludge**

| Sl. No. | Parameters | % |
|---|---|---|
| | **Proximate analysis** | |
| 1. | Moisture content | 10.72 |
| 2. | Ash content | 56.96 |
| 3. | Volatile matter | 27.14 |
| 4. | Fixed carbon | 5.18 |
| | **Ultimate analysis** | |
| 1. | Carbon | 9.61 |
| 2. | Hydrogen | 1.11 |
| 3. | Nitrogen | 0.13 |
| 4. | Sulphur | <0.01 |
| 5. | Oxygen | 25.34 |
| 6. | Gross Calorific value(Kcal/Kg) | <200 |
| 7. | Heat Calorific value(Kcal/Kg) | <200 |
| 8. | Mineral matter | 63.8 |
| 9. | Chloride as $C_l$ | 0.08 |
| 10. | Fluoride as F | 10.15 |
| 11. | Sodium | 1.65 |

The effluent treatment plant sludge is containing heavy metals and have been analysed and results are furnished as below:[4] When the heavy metals are burnt oxides of the concerned metals are assonated which are non-toxic comparing the heavy metals.

**TABLE – 2:HEAVY METALS CONTENTS**

| Sl. No. | Parameters | Concentration $m_g/k_g$ |
|---|---|---|
| 1. | Cadmium as Cd | <0.10 |
| 2. | Chromium as $C_r$ | 32.79 |
| 3. | Copper as $C_u$ | 29.22 |
| 4. | Cobalt as $C_o$ | 8.09 |
| 5. | Manganese as $M_n$ | 912.33 |
| 6. | Nickel as $N_i$ | 2.01 |
| 7. | Lead as $P_b$ | 17.89 |
| 8. | Zinc as $Z_n$ | 151.33 |
| 9. | Arsenic as As | <0.10 |
| 10. | Mercury as $H_g$ | <0.10 |
| 11. | Selenium as $S_e$ | <0.10 |
| 12. | Antimony as $S_b$ | 0.25 |
| 13. | Vanadium as V | 16.67 |
| 14. | Titanium as $T_i$ | 0.18 |
| 15. | Tin as $S_n$ | 0.40 |
| 16. | Iron as Fe | 5.13 |

The unit M/s. K.G. Fabrics Limited is having 5 spinning mills as sister concerns at many locations in Tamil Nadu. The units are generating 1000 ton of cotton mud waste in loose form per year with good calorific value. Another waste known as dropping waste is generated from the spinning mills to a tune of 2000 ton/year which is having high calorific value and one more waste viz. green waste of 250 ton per year is generated from trees.

It has been proposed to utilise the ETP sludge, wood chips, cotton mud, mud waste and dropping wastes by mixing them proportionally and compacting the wastes in cakes form. Boilers burn the fuel at 900 to 1000$^o$C and the

fuel retention time till it burns completely as ash is about an hour. A fuel mixture consists of textile mill cotton trash wastes and the ETP sludge waste in the ratio of 95 % to 5%.

## MATERIALS AND METHODOLOGY:

### MIXING:

The wastes have been mixed in the following percentage:

| Sl. No. | Name of wastes | Percentage |
|---|---|---|
| 1 | Dropping waste from spinning mills | 60 |
| 2 | Cotton mud waste from spinning mills | 30 |
| 3 | ETP biological sludge from dyeing unit | 05 |
| 4 | Green wastes from unit's premises | 05 |

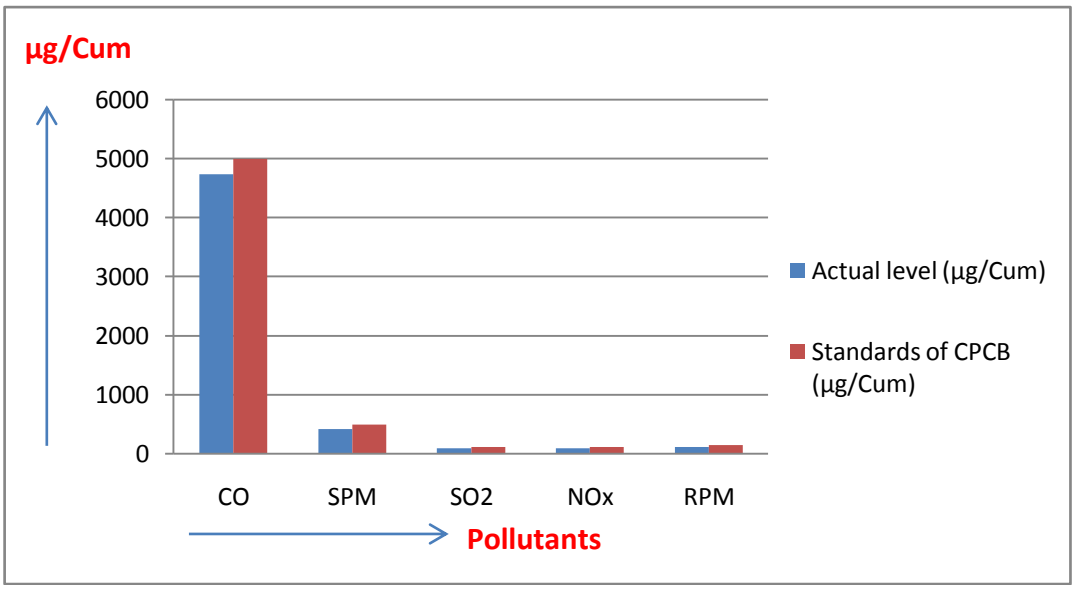
The calorific values[5] of the wastes coal have been compared and tabulated as below:

| Sl. No. | Fuel/Waste | Calories/ gram |
|---|---|---|
| 1 | Coal | 7755.96 |
| 2 | ETP biological sludge | 8378.79 |
| 3 | Dropping waste from spinning mill | 6556.94 |
| 4 | Cotton mud waste | 6735.19 |
| 6 | Wood chips | 9787.82 |
| 7 | Green waste | 6500.00 |

The waste materials are made in to a homogeneous mixture and fed in the compactor machine. The cakes of 120mm x 120mm x 75mm are obtained to a time of 6 tons per day of fuel. These 6 tons of fuel is equal to 8 tons of fire wood with moisture content. The biological sludge is disintegrated fully at very high temperature. The compacting is done at a pressure of 360 tons with moisture content of 30%, when the weight of the briquette is in the order of 1.0 to 1.25 kg/piece. If the new fuel is used for the boiler, it will help to the country from cutting the trees for the purpose of boiler fuel at rate of 3700 ton annually. The project is an environmentally sustainable one and improves ecology and environment.

### AIR POLLUTION AND CONTROL MEASURES:

When the mixture of fuel is burnt in boiler, emissions will be generated and pollute the environment. The unit has dust collection system, bottom ash collection system with boiler and a chimney to vent out the emissions. However, it has been proposed to check the emissions levels and survey has been conducted for 24 hours duration. The comparison of standards[6] and the actual level for emissions emanation is furnished in graphical representation.




**Legend:**

CO - Carbon monoxide
SPM - Suspended particulate matter
$SO_2$ - Sulphur dioxide
$NO_x$ - Oxides of Nitrogen
RPM - Respirable Particulate matter

Hence, the emission levels during the usage of co-fuelling are within the norms of the Central Pollution Control Board (CPCB).

**GREEN HOUSE EFFECT:**

Human activities, primarily the burning of fossil fuels and clearing of forests, have intensified the natural greenhouse effect, causing global warming. Trees act as a carbon sink by removing the carbon from $CO_2$ and storing it as cellulose in the trunk while releasing the oxygen back into the air. A healthy tree stores about 13 pounds of carbon annually-or 2.6 tons per acre per year. Trees also reduce the greenhouse effect by shading our homes and office buildings and thereby reduction of electricity. This combination to $CO_2$ removal from the atmosphere, carbon storage in wood, and the cooling effect makes trees a very efficient tool in fighting the greenhouse effect. The research avoids the cutting of trees to some extent.

**RESULTS AND DISCUSSION:**

It is time to utilise usable wastes for beneficial uses. In the above one unit only about 3700 ton of wood is saved. During burning of heavy metals oxides of heavy metals are emanated from which no significant effect to the environment is caused (Ref: Indian journal of Pharmacology, May-June-2011) and haphazard disposal of the wastes has been avoided.

If the above wastes are not treated and disposed off scientifically then the environment is affected. It is the time to consider the waste as raw materials. About 4200 (including 30% moisture content) ton of fuel is obtained from the wastes and hence the trees are safeguarded. By safer disposal of the wastes, the environment is safeguarded. The emission level has been checked and the pollutants are within the norms of the CPCB.

**CONCLUSION:**

In India spinning mills, bleaching and dyeing units are functioning. If the wastes are collected, stored and used properly the wastes are wealth of the society. Ecology and the environment are improved; there may be sustainable development to the ecosystems and also housekeeping is improved. Green house effect is minimised.

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