A Study of Impacts Caused By Effluent From Raichur Thermal Power Plant on Krishna River Basin

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Abstract- *The Thermal power plants are the major source of energy in India. In India about 70-80%of total power demand is satisfied by coal based thermal power plants. In the power plants huge amount of water is used for several different processes, which is then discharged as a process waste. The present study is aimed at determiningphysico-chemical parameters and heavy metals of the effluent, at outlet of bottom ash pond (fly ash slurry) and disposal point in Krishna River at downstream and upstream side. Thus it evaluates the effluent impacts on Krishna River. The power plant is located 18 kms away from the Raichur city, Deosugur village at right bank of Krishna River Karnataka. Under this study various parameters such as Temperature, pH, Turbidity, Electrical Conductivity(EC), Total Dissolved solids(TDS), Total Hardness, Dissolved Oxygen(DO), Bio-chemical Oxygen Demand(BOD), Chemical Oxygen Demand(COD) and Heavy Metals such as Chromium(Cr), Copper(Co), Iron(Fe), Lead(Pb) and Zinc(Zn) are considered for the study. By test results shows that parameters Temperature, pH, Turbidity, EC and COD are exceeded permissible limits as per CPCB and BIS effluent standards, even though other parameters are within the safe limits. The concentration of heavy metals such as Cr and Pb are exceeded the permissible limits, its concentration depends on type of coal or quality of coal used and other than all the parameters are within the safe limits. It is concluded that the effluents from RTPS plant alters the physico-chemical and heavy metal parameters of Krishna river thus it causes harmful effects on human life and aquatic life's, hence river water is not fit for drinking, bathing, fisheries and irrigation purpose. Hence it is necessary the effluent needs primary treatment and maximum reutilization of the watershould be done to prevent environmental pollution and reduces health hazards.*

Keywords- Thermal Power Plant, Ash slurry, KrishnaRiver Water, Physico-Chemical Parameters, Heavy Metals.

I. INTRODUCTION

The Thermal Power Plants are the major industries in India. Which is used for generation of power or electricity and it is basic demand for our society, industries and agricultural activities. In India about 70 to 80% of total power demand is satisfied with the coal based thermal power plants. Coal is the basic source of power generation for thermal power plants and the fly ash is the by-product which it is obtained by combustion of pulverized coal, ash content in the Indian coal is found to be in the range of 30 to 50%. The quantity of fly ash produced depends on the quality of coal used and operating conditions of the thermal power plants. Presently fly ash production annually in India 112 million tones with 65000 acres of land being occupied by ash disposal ponds and it is expected to cross 225 million tons by the year of 2020. This is the challenging problems in the form of land usage, health hazards and environmental concerns and it pollutes the surrounding environment such as air, soil and water. Also part of waste generated from steam generation, ash slurry waste, condenser cooling, auxiliary cooling, cleaning and gardening etc. thus it discharge huge amount water as process water. The disposal of slurry waste and heated water from thermal power plant causes the impact on water bodies by changes the physical-chemical properties of water. It contains more hazardous and toxic chemicals it causes harmful impacts on water bodies. The thermal power projects are mega project, it not only require huge capital amount but also requires natural resources like fossil fuels and water, thus it creates an immeasurable impacts on the surrounding environment and tremendous stress in the local eco system. The present study is conducted that the impacts caused by effluent from Raichur Thermal Power Plant (RTPS) on Krishna river basin. Which it is situated Deosugur village right side bank of Krishna River, 18kms away from the Raichur city Karnataka state, India. It is operated by Karnataka Power Corporation Limited (KPCL) it was the first thermal power plant to be setup in the Karnataka state and RTPS having total of 8units out of which 7units having a capacity to generate 210mw electricity each and 1unit has a capacity to generate 250mw of power so totally it generates 1720mw of electricity per day. The coal supply for this plant from Andhra Pradesh, Telangana and Maharashtra states. It requires 18000-24000 tons of coal per day. The rate of power generation 1720mw per day and it fulfils 40% demand of the Karnataka. The source of supply of water to plant from Krishna River for its various processes such as condenser cooling, bottom ash supply and other cleaning

purposes. Coal ash is a by-product of generated from the process of combustion of coal at a high temperature of over 1600°C-1800°C the coal is fired in the boilers of power plants. Fly ash is the one of the numerous substances that causes environmental hazards. When pulverized coal is burned it generate heat and itself converted to molten residue contains 80% fly ash and 20% bottom ash. The ash is collected at economizer, a pre heater and Electro static precipitator hoppers below the boiler this can be divided into fly ash and bottom ash. Uncollected finer and coarser particles is fly ash and bottom ash is mixed with water and pumped out in slurry form to large pond and hence known as Bottom Ash Pond Lake. Collected slurry ash further discharged directly into River Krishna and it pollutes river water. Downstream of RTPS the river water is main source of supply along the stretch of river side villages and also irrigation purpose also it is the main source. Hence that polluted river water causes harmful effects on human life, wild life and also on irrigation lands further it contaminants ground water also. Hence study is to access the characteristics and impacts of slurry waste on Krishna River water. The characteristics of waste disposal such as physico-chemical and heavy metals parameters is to be investigated and finally it is reported possible impacts on Krishna River.

Study Area: The Raichur Thermal Power plants is a coal fired power station which is located at a distance 18kms Deosugur village on the right bank of Krishna river from the Raichur district Karnataka, India having Latitude:16º21′18″ and Longitude:77º20′31″. Fig 1 shows the location of sampling stations.

Fig.1 Map Showing Sampling Stations

II. METHODOLOGY

The study has been conducted to determine the impacts caused by effluents discharge from RTPS on Krishna river basin. Data obtained could be helpful in defining pollution extent in the river.the samples are collected during the period of the study that lasted from January 2018 to May 2018 once in a month. The procedure used for sample collection as follows.

A. Sample Collection: The samples were collected to study the physico-chemical parameters and heavy metals in the ash slurry samples at outlet, downstream and upstream points at disposal point in the river. By the method of grab sampling the samples are collected periodically.

- The waste water sample was collected into clean polythene jerry cans of 2 liter capacity from the sampling point and it is ensured that there is no air bubbles inside the bottle.
- Ensured that no floating materials are present at the sampling stations.
- The details of samples are labeled and affixed on the bottle and kept in ice box.
- The samples are carefully taken to the laboratory and are kept in cold room at a temperature of about 4^0C.
- Further samples are taken for the laboratory analysis.

Table2.1: Instrumentation of Various Parameters

Parameters	Units	Instrument
Temperature	^{0}C	Thermometer
pH	--	pH meter
Turbidity	NTU	Turbidity meter
EC	(µS/cm)	Conductivity meter
TDS	mg/l	By Titration method
Hardness	mg/l	By Titration method
DO	mg/l	Winkler's method
BOD	mg/l	Winkler's method
COD	mg/l	COD digester
Heavy Metals	mg/l	AAS

III. RESULTS& DISCUSSIONS

Temperature: The Temperature of samples is fluctuated in the range of 25ºC to 44ºC during the study period. It shows that the temperature is highest in the month of April and least is in January month. The permissible limit of temperature is 40ºC as per BIS and CPCB effluent standards. The variation of temperature from slurry samples may cause due to temperature which coal is burned and by addition of warm

water by various processes like condenser water etc. is released along with slurry samples which alter the temperature of samples. Thus the Temperature is important for its effect on chemical reactions, reaction rate, aquatic life and suitability of water for beneficial uses.

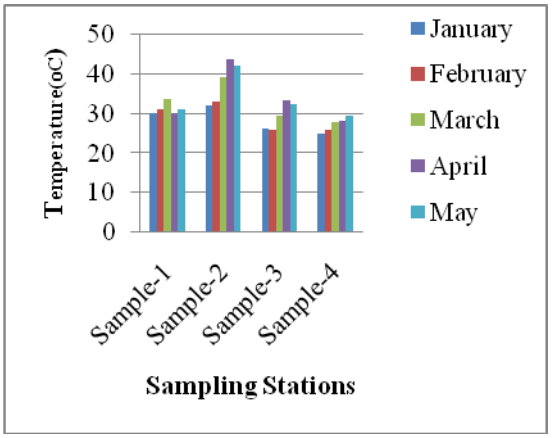

Fig.2 Graphical Representation of Temperature

pH: The pH of samples is to be observed in the range of 6.99 to 8.9. The permissible limit of pH according to effluent standards is 5.5 to 9.0 which is within the safe limits. The variation of pH depends on temperature of slurry waste and it is well known that pH decreases with increase in temperature. This variation may cause due to addition of condenser water or warm water is released along with slurry waste. The pHof all sample points is to be found within the safe limits in all months as per BIS and CPCB for standards during the study periods. The increased level of pH from effluents is disposed into rivers may cause adverse effect on river water and it effects the rate of biological reactions survival for various aquatic life's.

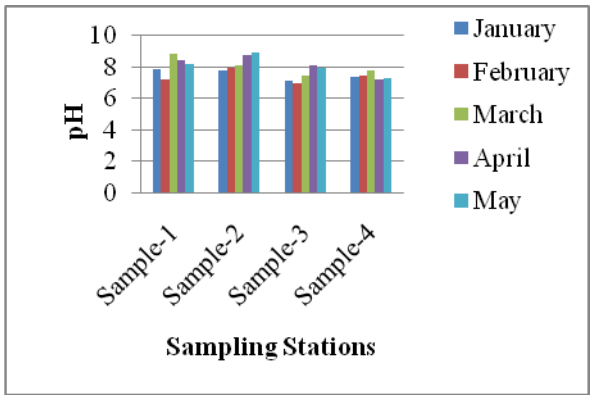

Fig.3 Graphical Representation of Ph

Turbidity: The Turbidity of samples during the study is to be observed in between the 2 NTU to 145 NTU. The maximum turbidity is obtained 145 NTU in the month of March at sample station 1 and minimum is of 2 NTU in the month of February at sample point 4. The permissible limits of turbidity 1-5 NTU according to BIS effluent standards and CPCB standards for surface water quality; hence it is exceeded at al sample stations the reason may be slurry waste contains more solids of ash content. Thus river water is not fit for Drinking, Bathing, Fisheries and Irrigation purposes. More turbid water will reduces the penetration of sunlight in the river and reduction of DO levels which is harmful to aquatic life and also spoils aesthetic view of river. The station point 4 shows river water is not contaminated at u/s side thus it is pure.

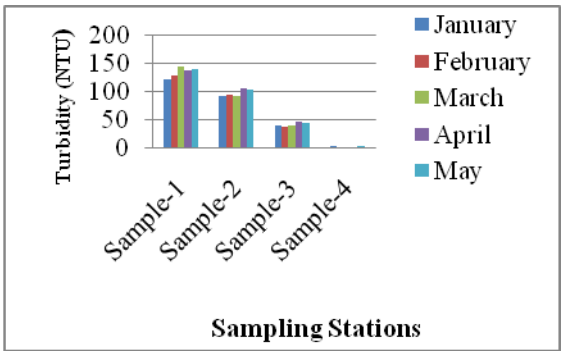

Fig.4 Graphical Representation of Turbidity

COD: The variation of COD is to be found in the range of 21.30mg/l to 117.60 mg/l. The prescribed limit of COD is 120-250mg/l by BIS and CPCB effluent standards, hence COD is within the safe limits at all sampling station. The variation may be cause when slurry waste is disposed into river it undergoes chemical reactions further it resists the biodegradation thus it forms inorganic substances like acids, alkalis and phenols etc., but these are insoluble state in slurry waste thus it shows minimum COD in sample station 1 at all months.

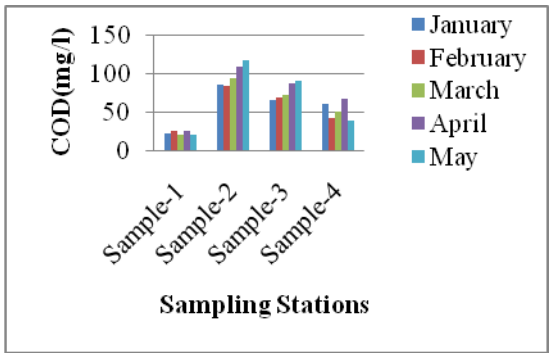

Fig.5 Graphical Representation of COD

Chromium: The concentration of chromium is found 0.001 mg/l to 0.34 mg/l. the permissible limit of chromium as per effluent standards is 0.05-1.00 mg/l, for sample station 1 is exceeded at all months reason may be the percentage of chromium is more in raw coal thus it depends on quality of coal is used. Then sample station 4 shows minimum in all

months because the river water is not contaminated at an upstream side of contaminated zone hence it is pure. Although chromium concentration is exceeded at downstream side hence it causes adverse impacts on river.

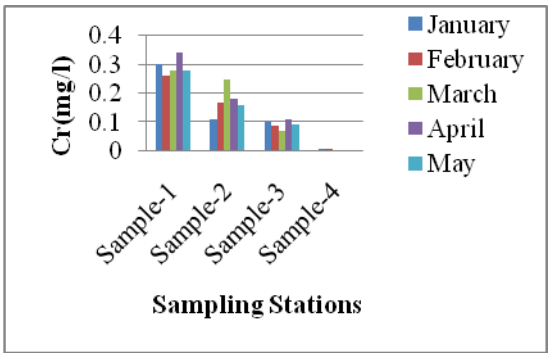

Fig.6 Graphical Representation of chromium

Lead: During the study period the lead content is varied 0.001-0.32 mg/l.The permissible limit of lead as per BIS and CPCB effluent standards is 0.05-0.1mg/lbut at sample station 1 is exceeded, the reason may be raw coal contains more concentration of lead thus it shows maximum in slurry waste and sampling stations 2, 3 and 4 shows minimum which it is negligible the reason may be lead concentration is dispersed over large extent area in the river.

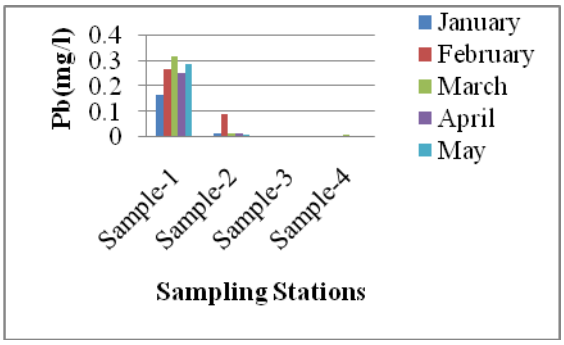

Fig.7 Graphical Representation of Lead

IV. CONCLUSIONS

Thevariation of temperature is observed at all sampling stations, the reason may be discharge of warm water from condenser cooling and also by atmospheric conditions. Hence it causes the reduction of DO level and variation of pH during the study period at all sampling stations. It is well known that pH decreases with increase in temperature. The Turbidity of samples exceeded the permissible limit, may be increases due to maximum ash content and also due to color(whitish grey) of slurry waste thus it pollutes the river water quality. The COD is exceeded due to presence of inorganic substances as per surface water quality standards. By continuous disposal of hard water into river, it interferes with inorganic salts and chemicals thus increases toxicity level and heavy metal concentration in the river water. The concentration of chromium and lead is exceeded thus it depends on type and quality of coal is used. The study is concluded the quality of river water is polluted due to effluent from power plant. Hence the effluent needed primary treatment before it discharged into river.

REFERENCES

[1] ManjuSuthar, Praveen Aggarwal (2017), "Analysis of Heavy Metals in Pond Ash Samples from Haryana",An International Journal of Advances in Mechanical and Civil Engineering, ISSN: 2394-2827, Volume (4), Issue 3, pp 11-13.

[2] MeghaKamdi S, IshaKhedikar P and Shrivastava R R (2012), "Physical & Chemical Parameter of Effluent Treatment Plant for Thermal Power Plant", An International Journal of Engineering Research and Technology, ISSN:2278-0181, Volume (1), Issue 4, pp1-5.

[3] ShikhaShrivastava, LekhikaShrivastava and Akanchha Singh (2015), "The Physicochemical Characteristics of Fly Ash Discharge Water Pond", International Journal of Current Microbiology and Applied Sciences, ISSN: 2319-7706, Volume (4), No. 2, pp 947-955.

[4] SandhyaSonawane M (2015), "Effect of Wastewater and Ash of Thermal Power Station on Hydrological Features of River Tapi at Bhusawal, District Jalgaon, Maharashtra", IOSR Journal of Environmental Science, Toxicology and Food Technology, e-ISSN:2319-2402, Volume (9), Issue 7,Version2,pp19-24.