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A STUDY ON THE EFFECT OF PAPER MILL EFFLUENT ON GROWTH OF CHICKS

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ABSTRACT

Pulp and paper mill effluents contain various organic and inorganic pollutants. The polluting strength of these effluents are measured as COD and BOD which range between 5000-10000 and 1500-6000 mg/L respectively. In addition to these, heavy metals such as Cd, Cr, Cu, Fe, Ni, Pb and Zn also find place in these effluents. By adopting proper treatment technologies these paper mill effluents can be transformed into environmentally safe and harmless form for disposal. The treated effluents from a paper mill were collected, analysed and tested for their biological safety. Day old broiler chicks were taken for the study. The treatments were 0%, 25%, 50%, 75% and 100% effluent as drinking water. The management practices viz. brooding, feed etc were identical. The treatments were compared for weight gain, feed & water consumption. The effect of replacement of fresh water with treated effluent was found to be innocuous, and birds exhibited normal growth even under 100% water replacement.

INTRODUCTION

Paper mills use significant amount of water for processing of pulp and production of paper. A typical paper mill consumes 2,25,000 liters of water/tonne of paper production (Birdie and Birdie, 1992). Those using Kraft process, discharge dark coloured effluents with characteristically high BOD, COD

and suspended solids along with difficult biodegradable lignin compounds and their derivatives (Gupta *et al*. 2001). Discharge of untreated effluents into water bodies cause depletion of dissolved oxygen endangering aquatic fauna. Besides this they impart persisting colour to the water body hindering penetration of light that is essential for aquatic flora. These water bodies serve the drinking purpose for livestock in rural areas, hence the quality and colour are most important.

High strength paper mill effluents can be subjected to Best Available Technologies (BAT) to render them harmless. Treatment plant consisting sequentially of equalization, neutralization, primary clarification, anaerobic (UASB or filter) followed by aerobic treatment and polishing reduces the polluting strength of the effluents drastically. The treated effluents confirm to the standards prescribed by the state pollution control board. Biosafety of the treated paper mill effluents can be assessed by conducting poultry growth trial.

MATERIALS AND METHODS

Paper mill treated effluent was collected at the out let of final step of the effluent treatment plant before it is let into the water body. Commercial broilers were obtained and were randomly allotted in 5 treatments with 3 replicates each (5 birds/replicate). The chicks were housed in standard battery brooders with flour space requirement of 1 square feet/bird at Poultry Experimental Station, Livestock Research Institute. All broiler chicks were offered standard feed (broiler starter) and management conditions during rearing.

Treated Effluent water was added to drinking water at 0, 25, 50, 75 and 100% dilutions and offered to birds daily. Feed and water was provided *ad libitum*. Water intake was monitored daily. Body weight, feed intake recorded week wise and calculated Feed Conversion Ratio (FCR= feed intake/weight gain) upto 3 weeks of age. The composition of Broiler chick starter feed is presented in Table 1.

RESULTS AND DISCUSSION

The treated effluent was analyzed for pH, Total hardness, Nitrate, Calcium , Chlorides, Copper, Iron, Lead, Magnesium, Sodium, Sulphates, Zinc, BOD, COD, TDS, Manganese as per APHA (1998), 20th edition. Water quality standard for poultry are taken as per the standards laid by the Poultry Water Quality Consortium, (1998). Analysis of treated effluent and water quality standards is given in Table 2. the Data recorded that certain parameters like total hardness, chlorides and sulphates are more and Zn, Fe and total bacterial count, Coli form count are less in effluent water compared to the standard values. Weight gain, feed intake, feed conversion ratio and water consumed week wise is given in Table 3. Cumulative performance at 3 weeks age is shown in Table 4.

Treated effluent on weight gain was significant at the end of three weeks, but other parameters like feed intake, feed conversion ratio and water intake

Table 1
Composition of broiler chick starter feed (%)

Maize, Yellow	60%
Soya bean meal	36.5%
Shell grit	1.5%
Dicalcium phosphate	1.5%
Trace minerals, vitamins and coccidio stats	0.2%
Common salt	0.3%

Table 2
Water quality of paper mill effluent

Parameters	Paper mill effluent water*	Normal water**
pH	7.5	6.8-7.5
Total Hardness	3105	110
Nitrate ($N0_3$~)	22	25
Calcium (Ca^+)	53	60
Chlorides (Cl^-)	315	250
Copper (Cu)	BDL	0.6
Iron (Fe)	0.0784	0.3
Lead (Pb)	BDL	0.02
Magnesium (Mg)	117	125
Sodium (Na*)	32	50
Sulphates ($S0_4^{2'}$)	331	250
Zinc (Zn)	0.372	1.5
Manganese (Mn)	1.38	Not available
BOD	90	Not available
COD	352	Not available
TDS	1775	Not available
Total bacteria (CFU/mL)	64	100
Coliform bacteria (CFU/mL)	43	50

*Analysed, **Poultry Water Quality Consortium(1998), BDL : Below Detected Levels. All the parameters except pH are expressed as mg/L.

Table 4
Cumulative performance of broilers (0-3 Weeks age)

Treatment	Weight gain (gm)	Feed intake (gm)	Feed Conve-rsation Ratio	Water intake (mL)
Tl (control) (0% effluent)	598.9^{aB}	875.6	1.46	2971.3
T2 (25% effluent)	613.9″	877.0	1 .42	2978.5
T3 (50% effluent)	621.3″	900.6	1.44	2970.9
T4 (75% effluent)	619.2″	870.9	1.40	2967.8
T5 (100% effluent)	581.5^{a}	904.6	1.55	2964.8
CD at 5%	25.78	NS	NS	NS

Note: Higher is the Feed Conversion Ratio, poor is the efficiency.

are not significant at the end of three weeks. Body weights in all the treatment groups were comparable with those on control group. Certain parameters such as total hardness, chlorides and sulphates in the treated effluent though not

Table 3
Weekly performance of broiler chicks (0-3 week age) (0-3 week age)

Treatment	First week				Second week				Third week			
	Weight gain (gm)	Feed intake (gm)	Feed Conv-ersion (Ratio)	Water intake (mL)	Weight gain (gm)	Feed intake (gm)	Feed Conv-ersion (Ratio)	Water intake (mL)	Weight gain (gm)	Feed intake (gm)	Feed Conv-ersion (Ratio)	Water intake (mL)
Tl (control) (0% effluent)	112.5	133.8	1.18	831.6	209.1	333.5	1.59	982.1	277.3	408.3	1.47	1157.6
T2 (25% effluent)	115.1	145.6	1.26	833.3	237.6	327.4	1.37	989.9	261.2	404.0	1.54	1155.3
T3 (50% effluent)	115.3	132.4	1.14	829.9	223.0	347.3	1.55	974.4	283.0	420.9	1.48	1166.6
T4 (75% effluent)	114.4	149.5	1.30	828.8	228.1	328.6	1.44	984.1	276.7	392.8	1.41	1154.9
T5 (100% effluent)	112.3	145.8	1.29	833.3	213.1	338.3	1.58	967.4	256.1	420.5	1.64	1164.1

complying to the stipulated standards for poultry use, are found to be harmless. The birds exhibited healthy growth until 3rd week. This can be attributed to the adoptability of the birds to the presence of hardness, chlorides and sulphates to certain extent in the water given to them.

CONCLUSION

The treated effluent at any level of inclusion as drinking water did not show deleterious effect on growth of broiler chicks. The performance of birds did not differ from control, as is evident from the data on feed intake, FCR and water consumption. It is concluded that paper mill effluents can be safe as source of drinking water for broilers.

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