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Quality Assessment of Effluent Discharged from Sugar Mill and its Impact on Oryza Sativa

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Abstract: ***Various physio-Chemical characteristics like colour, odour, pH, EC, total hardness, BOD, COD, TDS, Na, K, P, Chloride, Sulphate, and Metal concentration like Cr, Fe, Cu, Ni, and Pb were assessed in the effluent samples collected from sugar mill at Sekhupur, district Badaun (U.P) India. The effect of sugar mill effluent was studied on biological nutrients in the grain of oryza sativa. In the present study, the seeds of Oryza sativa were raised through pot trails with percentage concentration of effluent ranged from 0-100. It was observed that concentrations of 25% and 50% had a stimulatory effect on biological metabolites, like Crude protein, total Nitrogen, albuminoid Nitrogen, total free amino acids and ether extract. A further increase in effluent concentration after this showed a deleterious effect. This may be due to the presence of heavy toxic metals which would have caused inhabitation in the cereal nutrient growth.***
Keywords: Sugar mill effluent, physio-chemical parameters, biological metabolites, Oryza sativa.

I. INTRODUCTION

India is the largest producer of sugarcane in the world, 220 million tons cane per year and total sugar production 13.5 million tons per year. After completing the production process a huge amount of effluent is discharged which contains organic toxic materials. Sugar industries effluents are commonly used for irrigation farm practices, so it is necessary to determine the response of these effluent on farm crops (1, 2).

The cereal crop rice is a staple diet of common people in North India region. The effluent of industries has ultimate disposal in agricultural field, which can alter the soil properties and crop yields (3). Therefore the effect of Shekhupur Sugar mill (located at Baduan district in Uttar Pradesh) effluent on some biological metabolites of crop plant Oryza Sativa was studied in this project undertaken.

II. EXPERIMENTAL

Samples were collected from the exit point of the effluent discharged from the mill and was analysed for various physico-chemical parameters and heavy metals using standard methods (APHA 1994)(4). pH was determined using pH meter (AE Max 962P) while EC was measured using conduct meter (AEMAX 976). TDS and TSS were measured using standard methods (5). Calcium, magnesium, total alkalinity, total hardness were measured titrimetrically whereas potassium and sodium were determined employing flame photometer. Chloride and fluoride were determined by silver nitrate method and by ions selective meter. Phosphates were determined spectrophotometerically whereas sulphates were estimated gravimetrically. DO and BOD were measured by modified Winkler's method while COD by dichromate reflux method. Heavy metals were determined using Atomic absorption spectrophotometer (AAS-300, Perkin Elmer). The experimental values were determined and compared with standard value recommended by World Health Organization (WHO) (6).

The seeds of chosen varieties of Oryza sativa viz NK-3325 and PHB-71 were procured forms syngenta India Ltd. and Pioneer seeds Ltd. respectively. The crop was raised in pot trials in replication of three. The crop was grown by using effluents of various dilution (25%, 50%, 75% and 100%) along with control (0%). The grains at maturity were thrashed and properly preserved for further analysis of various biological metaolities i.e. crude protein (CP), total nitrogen (TN) albuminoid nitrogen (AlN) total free amino acids (TFAA) and ether extract were performed as per standard methods laid down in AOAC (2004) (7). The experiment performed in Kharif season 2014. The representative soil samples was analysed in regional soil testing laboratory, Bilwa (Bareilly, U.P.) and was found to contain.

Soil pH	-	7.42
Available nitrogen	-	72kg/ha
Available phosphorus	-	203kg/ha
Available potassium	-	28kg/ha

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Organic matter - 0.31%

The data thus obtained was subjected to statistical analysis employing ANOVA technique (8).

III. RESULT AND DISCUSSION

The results obtained after the analysis of sugar mill effluent samples are given in table-1. The effluent discharged from the main outlet of sugar mill was pale yellow in colour and had a pungent smell. The pale yellow colour may be due to the presence of iron content which was abnormally high and pungent smell may be due to the presence of sulphure compounds (9). The pH was acidic in nature because of the use of phosphoric acid and sulphuric acid during clarification of sugarcane juice (10).

The values of pH, TSS, TH, TDS and BOD were within while EC and COD and total alkalinity values were on higher sides of the standards laid by the WHO.

Even among Chloride (Cl^-), Florid (F^-), Sulphate (SO_4) and Nitrate (NO_3^-) the values were within the range of WHO standards except PO_4^- which showed on excess value compared to WHO. Sodium and potassium ions were found in moderate value and calcium & magnesium were within the range of WHO standards. Heavy metal chromium was not detected in the effluent and even lead was found to be much below the standard WHO recommendation. Other analysed metals viz. copper, zinc and iron were marginally in excess to WHO standards.

The estimated values for biological metabolites in rice grains of the two chosen cultivars V_1 (NK-3325) and V_2 (PHB-71) showed some basic trends except NPN and TFAA. Crude protein (CP), Total nitrogen (TN) and AlN were found to increase significantly in variety V_1 at 50% while in variety V_2 at 25% diluted effluent treatments. NPN and TFAA showed no significant trend among all the effluent treatments. However, ether extract showed a decreasing trend with the increase in the % dilution of effluent.

IV. CONCLUSION

The results clearly depicted that the dilution of 25% to 50% is recommended for farming practices regarding rice cultivation in field surrounding Shekhupur Sugar mill in Badaun district. This would enhance the nutritional value of rice grains being consumed and would also solve the prevalent problem of malnutrition among masses in this region. Besides this, there is also an advantage of reducing cost of fertilization by farmers and increasing the yield by raising the above experimental rice varieties in the district using the disposed effluent by the sugar mill.

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Table 1: Physico-chemical parameter of effluent.

Parameters	Effluent	WHO
Colour	Pale Yellow	Colourless
Odour	Pungent small	Odourless
Temp	28^0C	-
pH	6.8	6.5-8.5
Biochemical oxygen demand (BOD)	92	30
Chemical oxygen demand (COD)	352	250
Dissolved oxygen (DO)	Nil	-

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Electric conductivity	548	300
Total suspended solid	134	200
Total dissolved solid	490	1000
Total hardness	402	500
Alkalinity	262	200
Chloride	56	250
Fluoride	101	1.5
Sulphate	248	400
Phosphate	1.8	0.1
Calcium	630	200
Magnesium	94	150
Sodium	65	-
Potassium	48	-
Copper	0.08	0.05
Iron	0.06	-
Lead	0.02	0.05
Chromium	ND	0.05
Zinc	5.91	5.0

all values are expressed as mg/L except colour, Odour, temperature pH and conductivity.

ND = Not detected

Table 2: Chemical constituent in grains of *Oryza sativa (% on dry matter basis).*

Chemical Constituent	Varieties	Control (0%)	25%	50%	75%	100%	CD at 5% level
T.N.	V_1	1.26	1.34	1.38	1.26	1.19	0.17
	V_2	1.22	1.39	1.34	1.24	1.11	0.18
C.P.	V_1	7.86	8.36	8.61	7.74	7.43	0.74
	V_2	7.61	8.67	8.38	7.71	6.92	0.72
Aln.	V_1	1.04	1.12	1.15	1.14	1.10	0.14
	V_2	0.88	1.10	1.07	1.04	1.01	0.11
NPN	V_1	0.22	0.22	0.23	0.12	0.09	NS
	V_2	0.33	0.29	0.27	0.20	0.10	NS
TFAA*	V_1	4.68	4.74	4.86	3.99	3.76	NS
	V_2	4.38	4.64	4.36	3.72	3.56	NS
Ether extract	V_1	1.52	1.42	1.45	1.33	1.21	0.08
	V_2	1.33	1.28	1.21	1.13	1.05	0.10

* mg% on dry matter basis

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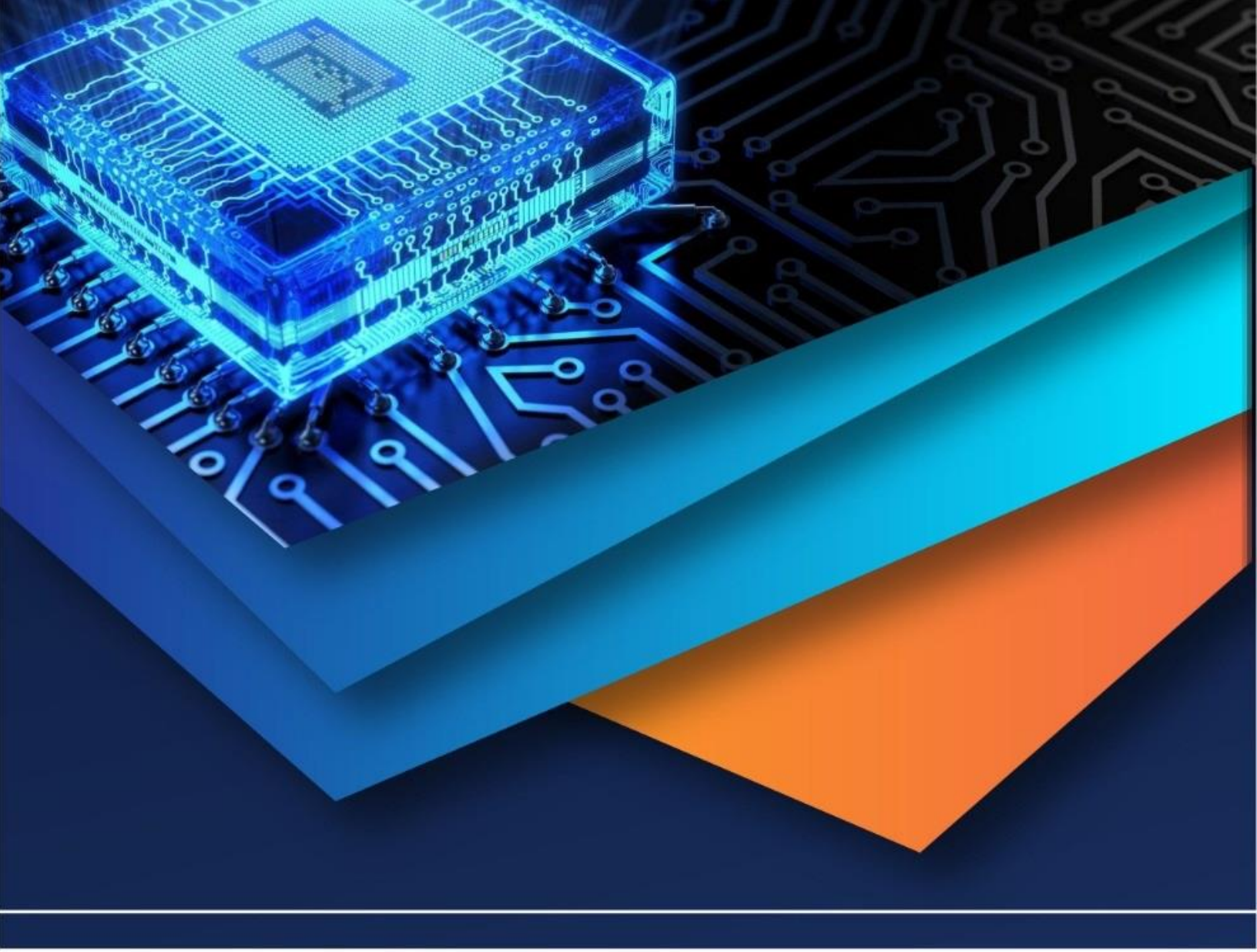

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