IMPACT OF MOLASSES WASTE WATER FROM ALCOHOL DISTILLATION ON PLANT ABUNDANCE AND DIVERSITY IN DITCH OKOLE WETLAND-LIRA MUNICIPALITY

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Abstract

Ditch Okole wetland, is a major tributary of Okole wetland system, which originates around and drains Lira Municipality, then flows to the Kyoga Nile. It is vital but critically threatened due to several factors notably uncontrolled discharge of molasses waste water from expanding local distillation, which is a major source of income for an increasing urban population. The purpose of the research was to build more knowledge and understanding about the impacts of molasses waste water discharge into Okole wetland to inform future management interventions in solving similar problems. The research aimed at to assess the impact of molasses waste water from alcohol distillation on plants diversity and abundance in Ditch Okole wetland in Lira Municipality. Study methods were qualitative and quantitative, involving group interviews, direct sampling, measurement of molasses waste water / wetland physical chemical parameters and wetland plants; computer aided data analysis and report writing.

Research findings were:- An estimated 6,511 ± 2,247 liters/ day of molasses waste water (MWW) was discharged into Ditch Okole wetland due to alcohol distillation activities in Temogo and Baronger wards of Railways division in lira Municipality. MWW contained high concentrations

of COD (24,000 mg/I), EC (20,000µs/cm), Colour (6000 Pt –Co.), TN (32.6mg/I0, NO_3-N (21.9 mg/I), and NH_3 –N (16.8 mg/I) exceeding the National effluent discharge standards. This implied high COD load of 156,264,000 mg/day (that is 6,511/ day x 24,000 mg/I COD); Total Nitrogen load of 212,259 mg/day (or 6511/day x 32.6 mg/I) and Nitrate-Nitrogen load of 142,591 mg/day (or 6511 1/day x 21.9 mg/I) into Ditch Okole wetland. The efficiency of alcohol distillation in Temogo and Baronger, Railways Division, Lira Municipality was low (estimated at 50%). Most wetland physic-chemical parameters before MWW discharge namely Colour (336.8 ± 244.2 Pt-Co), Electrical conductivity (221.7 ± 84.4 µs/cm), Chemical oxidation demand (195.2 ± 167.5 mg/I), Nitrate Nitrogen (0.53 ± 0.48 mg/I), Total Nitrogen (8.9 ± 3.7 mg/I), Phosphorous (0.61 ± 0.73 mg/I) and Total Phosphorous (3.26 ± 2.33 mg/I) increased significantly ($p < 0.05$), to 868.4 ± 1249.7 Pt-Co (Colour), 507.2 ± 937.3 µs/cm (EC), ± 1510 mg/I (COD), 1.08 ± 1.60 mg/I ($N0_3$-N), 14.26 ± 0.79 mg/I (TN), 2.21 ± 4.80 (P) and 6.05 ± 8.40 (TP) respectively, after MWW discharge into Ditch Okole wetland. Dissolved oxygen before MWW discharge (0.9 ± 0.9 mg/I) reduced significantly ($p < 0.05$) to (0.7 ± 0.7) mg/I) after MWW discharge into Ditch Okole wetland. A total species richness of 44 wetland plants were recorded out of which 26 species were located after the MWW discharge points, while plant species were located before the discharge.

There was a significantly higher wetland plant diversity (Shannon – H' and Simpson – D indices) and abundance (J index) after as compared to before MWW discharge into Ditch Okole wetland (A Man-Whitney U test revealed $U_{Lower} = 0 < U_{tab} = 37$, $n_1 = 12$, $n_2 = 12$). However, there were more unique species (Unique species mean = 12) before as compared to a unique species mean of 11 after the points sources of MWW discharge. Wetland plant diversity (H' & D) and abundance (J) showed moderately strong positive correlations with only $N0_3$ – N (i.e. r (H') = 0.52, r (D) = 0.60, r (J) = 0.58 before MWW discharge, which revealed to moderately strong negative correlations after MWW discharge (i.e. r (H') = -0.58, r (D) = -0.72, r (J) = -0.15). This probably indicated that before MWW discharge, $N0_3$-N was the limiting nutrient but discharge of MWW had an impact of negatively disrupting of the plant-nutrient balance. Seasonal variations of rainfall and thus storm water runoff flow in and out of the wetland also influenced wetland plant diversity and abundance.

In conclusion, discharge of MWW from alcohol distillation had a significant impact on plant diversity and abundance and it probably disrupted plant-nutrient balance in Ditch-Okole wetland in Lira Municipality. This was due to high loads of COD, TN, $N0_3$-N, NH_3-N in the MWW as a

product of high MWW discharge rate (6511 I/d) and high concentration of COD, TN, NO_3-N, NH_3-N. The research recommended necessity:- - to control the rate of MWW discharge, to sensitize stakeholders about the impact of MWW; to improve the efficiency of distillation; to conduct more research on related subjects; to treat molasses waste water in order to reduce concentrations of Colour, COD, TN, NO_3-N and NH_3-N to acceptable standards before discharging into the wetland and; to monitor and evaluate the status of wetland plant diversity and abundance in Ditch Okole wetland Municipality. The research would guide policy and decision-making regarding interventions for improved environmental management and service delivery for the public especially regarding distillation of alcohol using molasses in Lira and other urban areas.