PHYSICO-CHEMICAL CHARACTERIZATION OF SPENT WASH EFFLUENT AND ITS DILUTION EFFECT AT DIFFERENT LEVELS

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ABSTRACT: *One of the most important environmental problems faced by the world is management of wastes. The study was conducted to evaluate the physico-chemical characterization of spent wash effluent and its dilution effect at different levels.* *The results regarding to pH contents in before and after treatments of mathnation in distillery was found 4.0 to 4.17 in before and 7.77 to 8.18 in after treatment further revealed that, the pH slightly increased with decreasing concentration of effluents samples collected before as well as after treatment. Electrical conductivity (dS m^{-1}) was found 39.15 and 47.70 in samples of 100% concentration of before and after. While, the EC value was decreased with decreasing concentration of both treated and untreated effluents samples. The total suspended solid (TSS), organic matter (OM), sodium (Na), potassium (K) and phosphorus (P) concentration in spent wash effluents samples of higher values 99.04 and 53.05 g l^{-1} (TSS), 87.12 and 73.55 gl^{-1} (OM), 6.98 and 1.014% (K), 3093 and 6053 mgl^{-1} (Na) and 360.81 and 323.67 mgl^{-1} (P) were found in 100% concentration of both treated and untreated effluents samples, respectively. Whereas the values of TSS, OM, Na, K and P were decreased with decreasing concentration of both effluents samples. Moreover, themetals concentrations were also found higher in untreated effluents as compared to treated effluents except chromium concentration. In addition, the higher concentrations trend was found by Cd<Pb<Cr. It is concluded from the data spent wash can be applied directly to the land as irrigation water as it helps in restoring and maintaining soil fertility, increasing soil micro flora, improving physical and chemical properties of soil leading to better water retaining capacity of the soil.*

Keywords: Physico-chemical, Effluent, spent wash, Electrical conductivity and Organic matter.

INTRODUCTION

Industries happen to be the major source of pollutants to the ecosystem. Different industries create a variety of wastewater pollutants; which are difficult and costly to treat. Wastewater characteristics and levels of pollutants vary significantly from industry to industry. The use of industrial waste as soil amendment has generated interest indecent time. The wastewater produced continuously could cater the needs of irrigated crops production of ethyl alcohol in distilleries based on sugarcane molasses constitutes a major industry in Asia and South America [1, 2]. The world's total annual production of alcohol from sugarcane molasses is more than 13 million m^3. The aqueous distillery effluent stream known as spent wash is a dark brown highly organic effluent and is approximately 12-15 times by volume of product alcohol. The disposal of distillery spent wash is of serious concern due to its large volume and high biological oxygen demand (BOD) and chemical oxygen demand (COD). Due to high concentration of organic load, distillery spent wash is a potential source of renewable energy [3,4]. The effluent does not contain any toxic heavy metals as it is a waste from plant materials. It contains high amount of nutrients such as nitrogen, phosphorous, potassium, sulphur and a large amount of micronutrients. The land application of distillery spent wash often benefits water pollution control and utilization for agricultural production [5]. So it can be applied directly to the land as irrigation water as it helps in restoring and maintaining soil fertility, increasing soil micro flora, improving physical and chemical properties of soil leading to better water retaining capacity of the soil. The effluent is ideal for sugarcane, maize, wheat and rape seed production. It has been reported that wastewater from different industries produced continuously could cater the needs of irrigated crops [1]. Thus, the distillery spent wash will not only prevent waste from being an environmental hazard but also served as an additional potential source of fertilizer for agricultural uses. The study was plain to evaluate the physico-chemical characterization of spent wash effluent and its dilution effect at different levels**.**

MATERIAL AND METHOD

Collection and characterization of distillery spent wash: The distillery spent wash sample was collected from the Noon Sugar Mills Ltd., Bhalwal for to evaluate basic characterization used in agricultural as source of nutrition values. The physico-chemical properties of spent wash were analyzed by standard methods of [6].

Analysis of spent wash: Electrical conductivity was analyzed with the help of Model-4070 conductivity meter. EC was noted after standardizing it with 0.01 *N*KCl solution. pH was determined with the help of Orion 720A+ pH meter. pH was noted after standardizing its with 4, 7 and 9 bufer solution. Total Soluble Solids were determined a well mixed sample filtred through a standard glass fiber, and the filtrate was evaporated to dryness in a weighted dish and dried to constant weight at 180 ^{0}C. The increase in dish weight represents the total dissolved solids. Soluble Na and Kwere determined by flame photometer having Na and K filters in place. The instrument was standardized with a series of Na and K standard solutions (0 to 50 ppm). The standard graphs were draw separtely for Na and K. Phosphorus was done byDouble Acid Mixture and read absorbance on Spectrophotometer 21 at wave length of 410 nm.Heavy Metals were analyzed **s**pent wash samples through atomic absorption spectrophotometer (PerkinElmer model no. AAnayst 800) for the determination of cadmium (Cd), chromium (Cr), lead (Pb) and copper (Cu) concentrations.

RESULT AND DISCUSSION

The results regarding pH contents in before and after treatments of mathnation in distillery effluents are presented in Figure 1. The results showed that, the pH was found between 4.0 and 4.17 in before mathanation, and 7.77 and 8.18 in after treatment of mathanation. The results further revealed that, the pH slightly increased with decreasing concentration of effluents samples collected before as well as after treatment of mathanation. Moreover, samples collected before mathanation the pH was observed acidic condition, while in samples collected after treatment of mathanation it was found alkaline in condition. Electrical conductivity (dS m^{-1}) was found 39.15 and 47.70 in samples of 100% concentration of before and after treated mathanation, respectively (Figure 2). The results further showed that, the EC value decreased with decreasing concentration of both treated and untreated effluents samples. The total suspended solid (TSS) and organic matter (OM) concentration in spent wash effluents samples are presented in Fig. 3 and 4. Higher values of 99.04 and 53.05 g l^{-1} (TSS), and 87.12 and 73.55 g l^{-1} (organic matter) were found in 100% concentration of both treated and untreated effluents samples, respectively. The values of TSS and OM decreased with decreasing concentration of both effluents samples. These findings are related to [10] who reported that the pH of raw spent was acidic (4.03) which increased to 7.62. It also contained large amounts of suspended and dissolved solids having high concentration, and also [2] reported that the chemical composition of untreated and primary treated spent wash with acidic (3.8) and alkaline (8.0) reaction. Electrical conductivity of untreated and primary treated spent wash was 30 and 32.5 dS m^{-1} and total solids content in untreated and primary spent wash samples were 90,000 mgl^{-1} and 81,000 mgl^{-1}, respectively. Moreover, [7, 8, 9] reviewed the data on characteristics of the distillery spent wash. They reported that, the values for different constituents were pH 4.24, EC 14.35 dS m^{-1}, total suspended solids (9200 ppm), total dissolved solids (10230 ppm) and high organic matter 7.45 %. Whereas [10], reported that the raw effluent had a very high organic content.The concentration of sodium (Na), potassium (K) and phosphorus (P) in effluents samples are presented in Fig. 5, 6 and 7. Higher values of 6.98 and 1.014% (K), 3093 and 6053 mg l^{-1} (Na) and 360.81 and 323.67 mg l^{-1} (P) were found in 100% concentration of both treated and untreated effluents samples, respectively. The values of Na, K and P decreased with decreasing concentration of both effluents samples. The higher concentration was found by K followed by Na and P concentrations. These findings are related to [2] they were reported that Phosphorus (mg l^{-1}): 260 (untreated) and 260 (primary), potassium (mg l^{-1}): 10000 (untreated) and 11500 (primary) and sodium content of (mg l^{-1}): 400 (untreated) and 510 (primary) in spentwash. While, [11] analyzed distillery effluent for chemical composition. Who evaluate the different constituents were, NO3-N: 2649 mgl^{-1}, potassium: 121.6 mgl^{-1}, calcium:1519 mg l^{-1}, magnesium: 700 mgl^{-1}, sodium: 97.8 mgl^{-1}, total organic carbon: 087 per cent and total dissolved solids : 32 g l^{-1}. Metal concentrations were also found higher in untreated effluents as compared to treated effluents except chromium concentration (Figures 8, 9 and 10). Similarly in case of Na, K and P, the metals concentrations were decreased with decreasing concentration of both treated and untreated with mathanation. In addition, the higher concentrations trend was found by Cd<Pb<Cr. These results related to [12] who analysis of crude and digested spent wash indicated very high concentrations of heavy metals in CSW as compared to those in DSW. Concentrations (μg ml−1) in both DSW and CSW, respectively were 0.004, 0.025 (Cd), 0.95, 0.172 (Cr) and 0.54, 1.24 (Pb). Lead (Pb) in CSW had the highest concentration among all heavy metals analyzed.

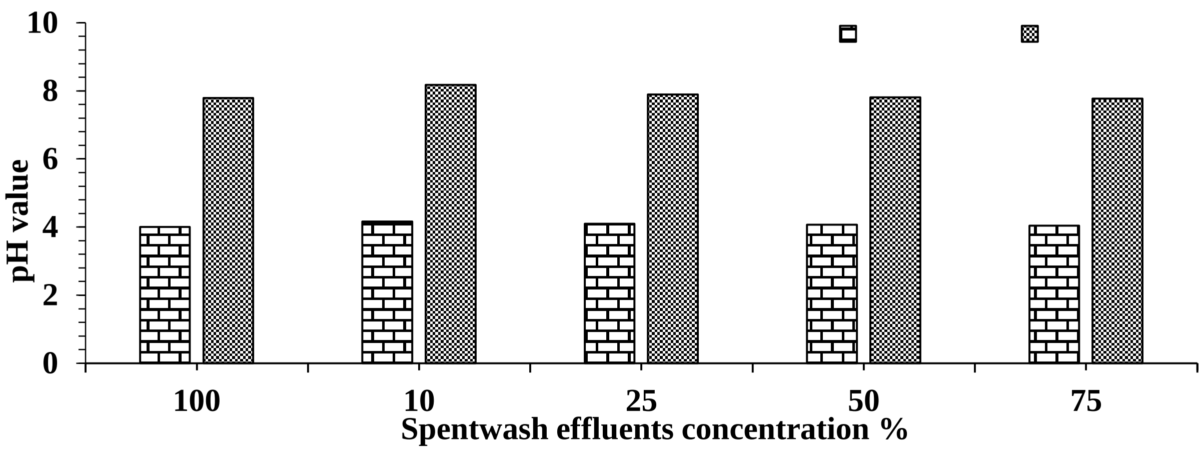

Figure 1. pH values content in distiller spent wash collected before mathanation (Primary) and after mathanation (Secondary)

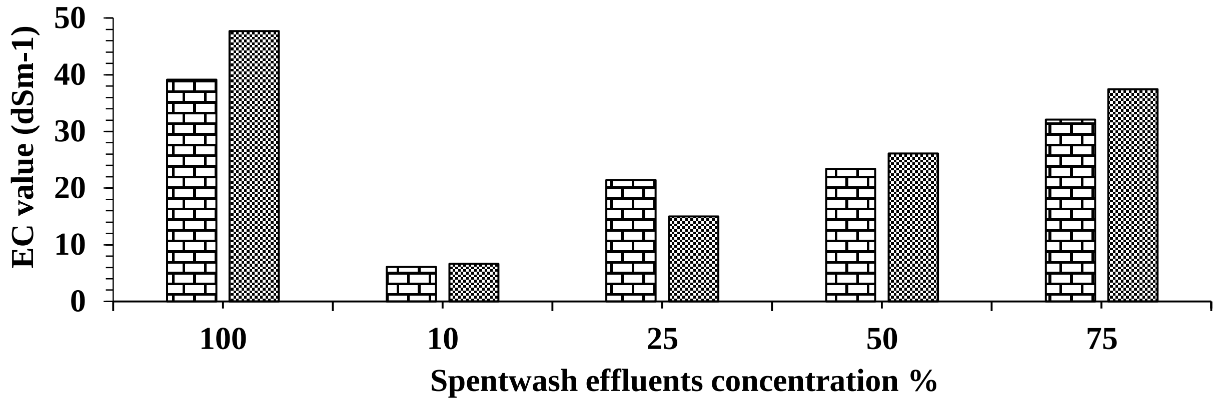

Figure 2. EC values content in distiller spent wash collected before mathanation (Primary) and after mathanation (Secondary)

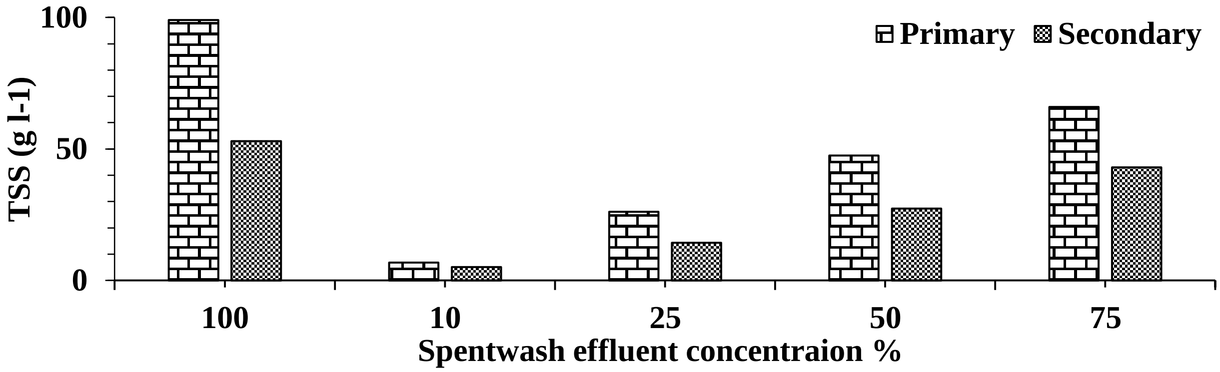

Figure 3. Total Suspended Solids content in distiller spent wash collected before mathanation (Primary) and after mathanation (Secondary)

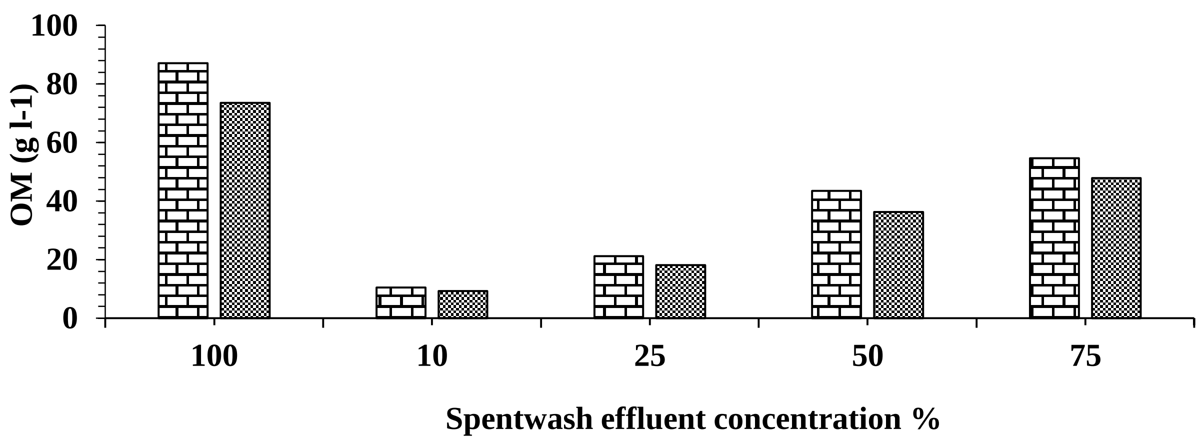

Figure 4.Organic Matter contents in distiller spent wash collected before mathanation (Primary) and after mathanation (Secondary)

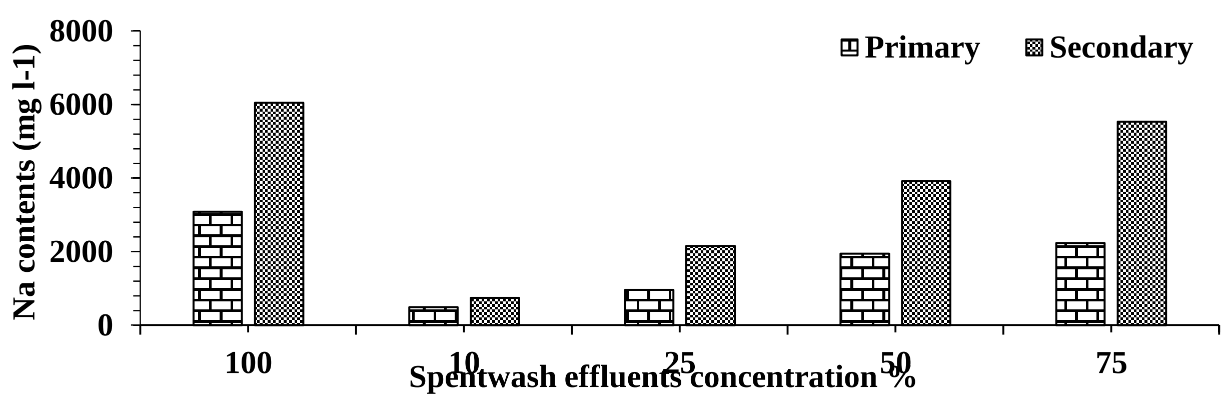

Figure 5.Sodium content in distiller spent wash collected before mathanation (Primary) and after mathanation (Secondary)

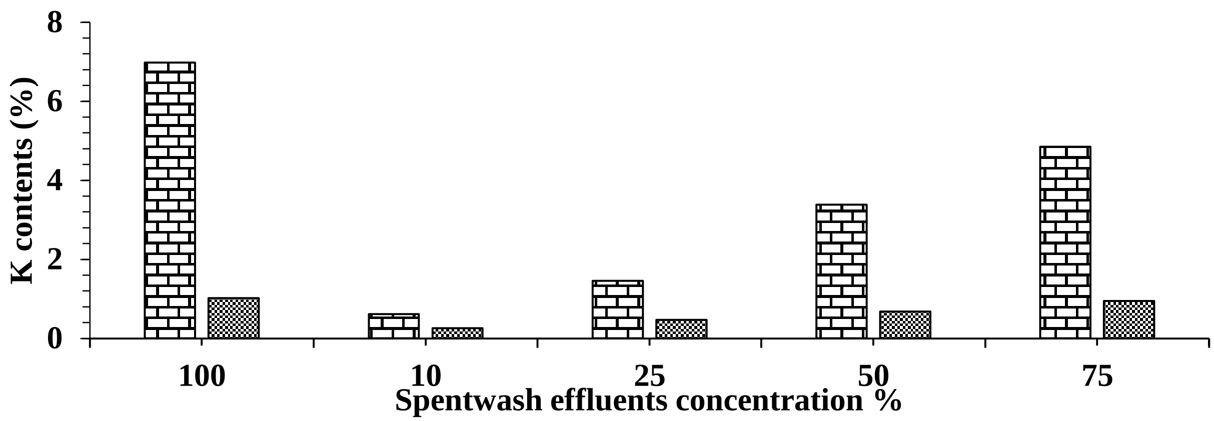

Figure 6.Potassium contents in distiller spent wash collected before mathanation (Primary) and after mathanation (Secondary)

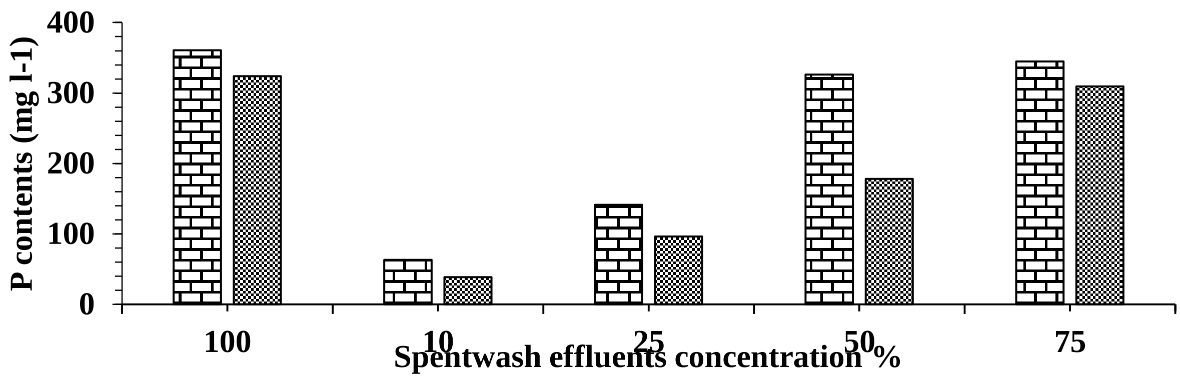

Figure 7.Phosphorus content in distiller spent wash collected before mathanation (Primary) and after mathanation (Secondary)

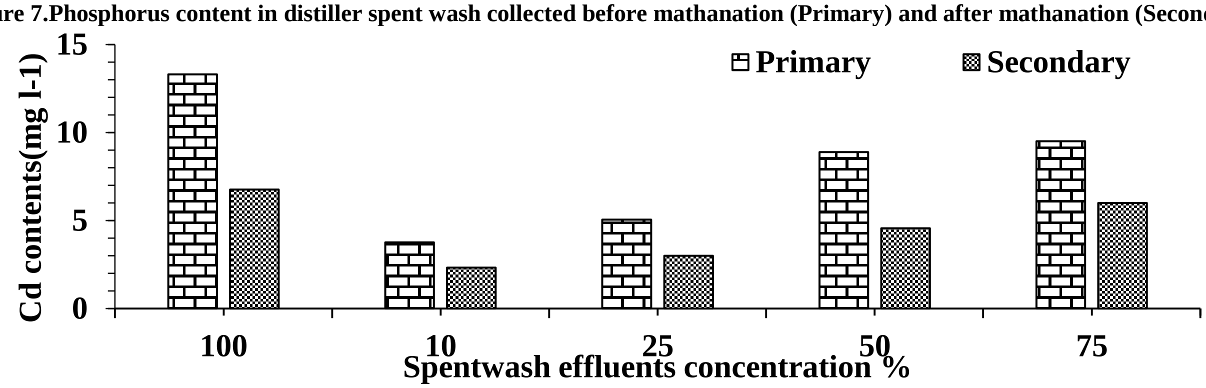

Figure 8.Cadmium content in distiller spent wash collected before mathanation (Primary) andafter mathanation (Secondary)

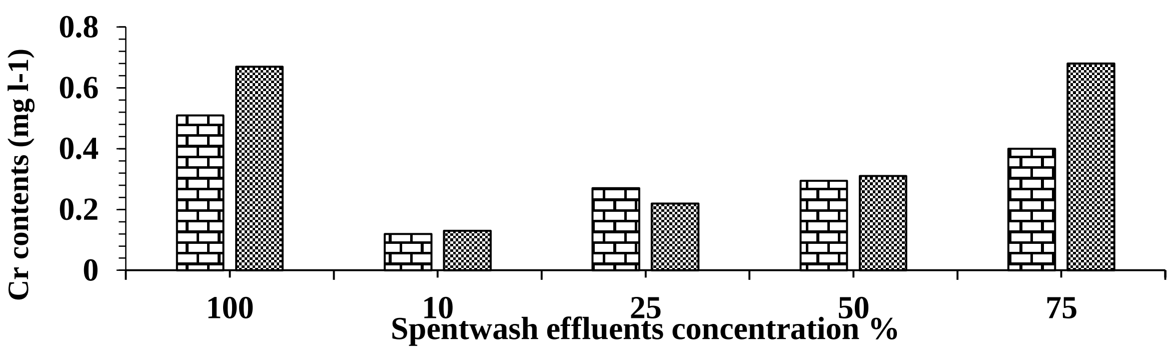

Figure 9.Chromium content in distiller spent wash collected before mathanation (Primary) and after mathanation (Secondary)

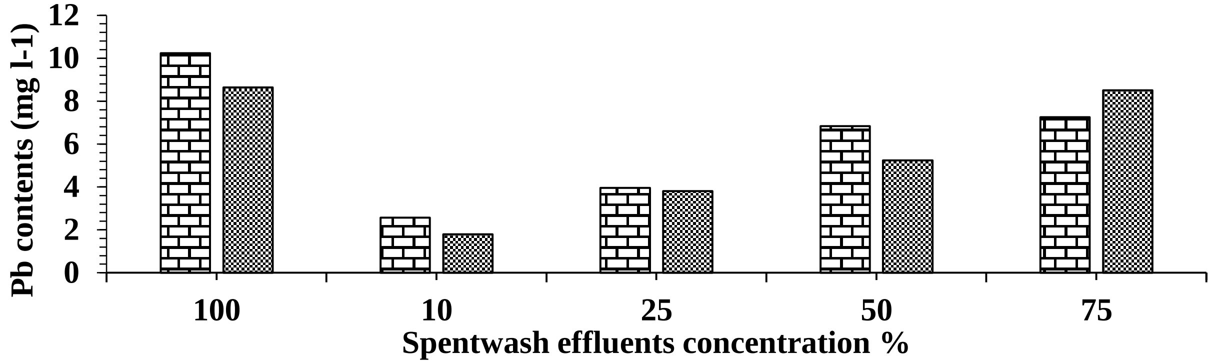

Figure 10. Lead content in distiller spent wash collected before mathanation (Primary) and after mathanation (Secondary)

CONCLUSION

The distillery spent wash is a nutrient rich liquid organic waste obtained from molasses based distillery industries after and before Methanation process. The spent wash, being loaded with organic compounds could bring remarkable changes on the biological properties of soils and thus influences the fertility of soil significantly. Lower concentration of spent wash can be used to agricultural uses for safe metal concentration loading on arable land.

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