*International Research Journal of Environment Sciences*_____E-ISSN 2319–1414
Vol. **5(5),** 18-21, May **(2016)** *Int. Res. J. Environment Sci.*

Residual Effect of Post Biomethanated Spent Wash on Soil Properties of Entisol

Sunil Jawale[1], Santosh Patil[2*], Deepak Patil[2] and Sunil Joshi[2]
[1]Department of Soil Science & Agriculture Chemistry, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India
[2]BAIF Development Research Foundation, Uruli Kanchan, Pune 412 202, Maharashtra, India
santosh86patil@gmail.com

Available online at: www.isca.in, www.isca.me
Received 22nd January 2016, revised 30th April 2016, accepted 2nd May 2016

Abstract

An investigation was conducted on farmer's field with an objective to study the "Residual effect of post-biomethanated spent wash on properties of soil solum and yield of Pearl millet" in the jurisdiction of Padmashri Vitthalrao Vikhe Patil Sahakari Sakhar Karkhana, Pravaranagar, Taluka-Rahata, Dist. Ahmednagar during 2007-08. Ten farmers from factory area of Pravaranagar and Gogalgaon village were selected, where spent wash was applied @ 70-75 m^3 ha^{-1} before kharif season. Soil profiles were dug in the treated farms at harvest of the crop to study the residual effect of post biomethanated spent wash application on soil profile characteristics. The untreated fields were selected, adjacent to treated fields, where no spent wash was applied and were treated as control check to assess the effect of spent wash treated profiles in comparison to untreated soil profiles. The effect of spent wash application was assessed for pearl millet which was grown as test crop. The result revealed that post biomethanated spent wash was neutral in reaction with high concentration of soluble salt. The application of post biomethanated spent wash showed improvement in bulk density, hydraulic conductivity and water retention, while no residual effect on soil texture was observed. Slight build-up of salinity with distillery effluent application. The application of distillery effluent showed improvement in properties of soil. The Mean Weight Diameter (MWD), saturated hydraulic conductivity, water retention, field capacity and available water content were significantly higher, while bulk density (BD) and penetration resistance of the surface soil were significantly lower.

Keywords: Post biomethanated, Spent wash, Bulk density, Entisol, Soil solum, Hydraulic conductivity.

Introduction

With the development of agriculture, agro-based industries have contributed enormously to boost economy of the nation. One of the agro-based industries i.e. distilleries in India producing ethyl alcohol generate large volume of foul smelling, red coloured waste water known as spent wash. The post biomethanated spent wash that comes out after biomethanation is neutral in pH (7.6), contains high organic loads (43 dSm^{-1}). Since the colour of effluent is dark brown, it induces immediate reaction of fear amongst the farmers. However, the colour has nothing to do with the toxicity as it is primarily the colour of the sugar produced due to burning of starch during sugar manufacturing process. If post biomethanated spent wash used for irrigating follow land or for pre sowing irrigation, a good amount of organic carbon and nutrients would be added to the soil for increasing fertility and at the same time, the effluent would be disposed off safely to enrich the soil health. It was observed that the depth of soil (P. No.1 to 6) was 0-20 cm with notation of Ap horizon, however, the depth of pedon (No. 7 to 10) were 0-15 cm and 15-35 cm with notation of A1 horizon indicating the absence of B-horizon. As per seventh approximation and derivation noted the soil of Entisol order have little developed horizonation indicating as a young profile and parent material which is very resistant to weathering. The boundary may have remained unaltered due to negligible effect or no effect on soil weathering process. Similar, observations have been reported by Bhaskar[1]. Application of post biomethanated spent wash resulted in change of colour from 10YR 3/2 (very dark grey wash brown) to 10YR 3/1 (very dark gray) when the soil is dry. Similar observations have been recorded by Pillai *et al.*[2] are close conformity with above finding. This indicates that application of post biomethanated spent wash had no effect on soil texture and structure. In the horizon Ap, (P. No.1, 2, 5, 6, 9 and 10) a wet slightly plastic soil condition was noted where as in untreated (P. No. 3 and 7) and treated (P. No. 4 and 8) fields were plastic in nature. Data on soil effervescence in Table-7 revealed that soils from pedon No. 1, 2, 3, 4 and 7 recorded moderate effervescence and Pedon No. 5, 6, 8, 9, 10 recorded strong effervescence at Ap horizon. However strong effervescence was absent at A1 horizon. The strong effervescence was observed might be due to the calcite layer present in control as well as the treated fields.

Materials and Methods

Five soil pedons were opened in untreated field (control pedons) and five in treated field. The layer wise soil samples were collected and analysed for physical properties. The data in respect of physical properties was presented in Table. Application of post biomethanated spent wash resulted decrease

in bulk density. From the results obtained it can conclude that application of post biomethanated spent wash decrease bulk density of soil due to addition of organic matter. The average decrease in bulk density due to application of post biomethanated spent wash. A significant decrease in bulk density was observed in the 0-15 cm layer of the treated field. Bulk density decreased significantly due to addition of significant organic load from post biomethanated spent wash. A decrease in bulk density at 15-30 cm layer of treated soil was observed which indicate seepage of post biomethanated spent wash in lower layer of Entisol, which is result in organic manure addition leading to decrease. It shows that the application of post biomethanated spent wash resulted slightly increase in hydraulic conductivity at surface level but does not show any effect on 15-35 cm layer of soil. The increase in hydraulic conductivity might be due to improvement in soil organic matter content which might have resulted in increase. Similar findings have been recorded by Joshi *et al.*[3] and Hati *et al.*[4]. It shows that the application of post biomethanated spent wash resulted slightly increase in hydraulic conductivity at surface level but does not show any effect on 15-35 cm layer of soil. The increase in hydraulic conductivity might be due to improvement in soil organic matter content which might have resulted in increase. Similar findings have been observed by Joshi *et al.*[3] and Hati *et al.*[4]. Percent sand, silt and clay fractions were ranged from 37.5-57.65, 28.29-35.21 and 16.7-29.53 respectively. Therefore, the particle size analysis data indicate that the soils of the area were of sandy clay loam. Similar observations have been reported by Joshi *et al.*[3], Basava *et al.*[5] and Shamsunder *et al.*[6]. An increase in water retention capacity in treated soil may be due to an increase in pore space and micro capillaries due to the addition of organic load from post biomethanated spent wash. Application of post biomethanated spent wash resulted slightly increase in water retention in 0-15 cm layer at both 33 kpa and 1500 kpa but does not show any effect on 15-35 cm layer. It shows that the application of post biomethanated spent wash resulted slightly increase in hydraulic conductivity at surface level but does not show any effect on 15-35 cm layer of soil. The increase in hydraulic conductivity might be due to improvement in soil organic matter content which might have resulted in increase. Similar findings have been recorded by Joshi *et al.*[3] and Hati *et al.*[4].

Results and Discussion

Entisol soil depth of 0-15 and 15-35 cm with notation Ap and A1.The boundary width of Entisol soil was recorded clear smooth while in Inceptisol, it varied with increase in soil depth from clear smooth to gradual wavy and finally gradual irregular. The colour of soil in dry condition was varying with depth from 10YR 3/2 to 10YR 3/. In moist condition it varied from 10YR 3/2 to 10YR 3/3. The soil texture of all horizons in was observed to be sandy clay loam. While, the soil structure was observed to be medium sub-angular blocky with varying grade .The application of post biomethanated spent wash has no any residual effect on soil texture and structure. In the horizon Ap the soil consistency was observed to change from wet slightly plastic to wet non-plastic.

Table-1
Effect of Post Biomethanated Spent Wash on Soil Properties of Entisol

Treatment	Depth (cm)	B.D. (Mg m^{-3})	Sand (%)	Silt (%)	Clay (%)	water retention		Hydraulic conductivity (cm hr^{-1})
						33 kpa	1500 kpa	
Pedon 11 and 12								
Untreated	0-15	1.38	45.7	28.32	24.72	27.25	15.23	1.16
	15-30	1.42	42.5	29.45	26.72	29.84	16.72	1.12
	30-45	1.39	40.34	31.27	20.9	30.27	17.85	1.02
	45-60	1.37	47.3	31.89	21.4	26.34	15.73	1.2
Treated	0-15	1.36	43.5	28.97	27.34	27.34	15.17	1.17
	15-30	1.39	47.82	30.17	24.27	28.72	15.57	1.05
	30-45	1.37	42.73	33.47	22.37	28.94	16.27	1
	45-60	1.52	52.32	37.42	21.73	26.42	14.89	1.42
Pedon 13 and 14								
Untreated	0-15	1.27	47.62	32.52	20.54	26.79	15.37	1.11
	15-30	1.25	42.72	30.89	19.32	32.47	15.89	1.08
	30-45	1.25	50.82	27.92	18.32	30.45	14.78	1.07
	45-60	1.38	52.32	25.34	17.34	21.34	14.24	1.42
Treated	0-15	1.24	48.73	37.21	22.42	26.24	14.8	1.24
	15-30	1.2	46.32	38.23	20.32	29.56	15.78	1.18

	30-45	1.32	52.31	38.37	18.59	27.34	14.89	1.21
	45-60	1.4	54.43	25.34	16.73	31.78	17.23	1.34
Pedon 15 and 16								
Untreated	0-15	1.29	40.54	34.53	27.34	28.58	14.37	1.27
	15-30	1.34	48.83	32.27	24.32	28.92	15.04	1.2
	30-45	1.32	48.32	38.72	22.78	30.47	16.72	1.17
	45-60	1.53	50.37	39.98	20.42	27.45	14.57	1.25
Treated	0-15	1.24	42.87	35.72	25.78	29.42	15.24	1.25
	15-30	1.37	46.27	37.42	23.82	31.72	16.79	1.14
	30-45	1.34	45.34	39.73	21.45	28.08	14.03	1.18
	45-60	1.62	52.83	40.83	20.78	27.78	14	1.2
Pedon 17 and 18								
Untreated	0-15	1.36	42.32	32.73	25.72	30.76	18.37	1.37
	15-30	1.32	40.79	33.72	27.37	31.25	19.89	1.13
	30-45	1.4	45.24	30.17	22.72	28.42	16.12	1.42
Treated	0-15	1.32	42.24	34.58	24.82	29.43	18.02	1.24
	15-30	1.28	48.72	30.24	20.34	30.72	15.82	1.18
	30-45	1.43	47.34	37.73	17.38	28.27	14.32	1.32
Pedon 19 and 20								
Untreated	0-15	1.49	48.93	32.83	26.17	27.32	15.72	1.24
	15-30	1.53	42.37	30.17	28.32	28.72	16.84	1.13
	30-45	1.63	50.34	31.45	21.27	26.47	15.25	1.37
Treated	0-15	1.46	47.32	30.54	24.14	30.43	15.93	1.17
	15-30	1.48	42.72	31.74	27.32	32.79	17.45	1.07
	30-45	1.68	53.34	31.83	24.27	28.52	16.25	1.17
Range								
Untreated	0-15	1.27-1.49	40.53-48.93	28.32-32.83	20.54-27.34	26.79-30.76	14.37-18.37	1.1-1.27
Treated	0.15	1.24-1.46	42.24-48.73	28.97-37.21	22.42-27.37	26.24-30.43	14.8-18.02	1.17-1.25
Untreated	15-30	0.25-1.53	40.79-48.83	39.45-38.72	19.32-28.32	28.62-32.47	14.04-19.89	0.05-1.18
Treated	15-30	1.2-1.48	42.72-48.72	30.17-38.23	20.32-27.79	28.75-32.79	15.75-17.45	1.05-1.18
Untreated	30-45	1.25-1.63	40.34-50.82	27.92-38.72	18.32-22.78	26.47-30.47	14.78-17.85	1.02-1.42
Treated	30-45	1.32-1.68	42.73-53.34	31.83-39.73	17.38-24.27	27.34-28.98	14.03-16.25	1.0-1.3
Untreated	45-60	1.37-1.53	47.3-52.37	39.89-25.34	17.34-21.4	21.34-27.45	14.24-15.73	1.2-1.42
Treated	45-60	1.4-1.62	52.32-54.43	40.83-25.34	16.73-21.73	26.42-31.78	14.00-17.23	1.0-1.42
Mean								
Untreated	0-15	1.35	45.02	32.18	24.89	28.14	15.81	1.23
Treated	0.15	1.32	44.93	33.40	24.90	28.57	15.83	1.21

Untreated	15-30	1.36	43.44	31.30	25.21	30.24	16.87	1.13
Treated	15-30	1.34	46.37	33.56	23.21	30.70	16.28	1.12
Untreated	30-45	1.39	47.01	31.90	21.19	29.21	16.14	1.21
Treated	30-45	1.42	48.21	36.22	20.81	28.23	15.15	1.17
Untreated	45-60	1.42	49.99	32.40	19.72	25.04	14.84	1.29
Treated	45-60	1.51	53.19	34.53	19.74	28.66	15.37	1.32

Thus the application of post biomethanated spent wash caused change in plasticity only and there was no change in dry, moist and sticky consistency. Data recorded in Entisol gives moderate effervescence at Ap horizon and strong effervescence at A1 horizon. However in Inceptisol it changes from moderate too strong to very effervescence according to depth. However, the strong effervescence was observed might be due to calcite horizon in control as well as in treated field. The application of post biomethanated spent wash did not show any effect on effervescence. The soil showed typic contact in all soil pedons.

The bulk density of Entisol and Inceptisol varied from 1.36 to 1.35 mgm^{-3} and from 1.35 to 1.32 mgm^{-3} at 0-15 cm, but did not show any change in sub-surface horizon. The application of post biomethanated spent wash resulted decrease in bulk density in surface layer. The bulk density increased with depth indicating compactness in sub-surface. The per cent sand, silt and clay fractions were ranged from 37.5-57.65, 28.29-35.21 and 16.7-29.53 respectively. Therefore, the particle size analysis data indicate that the soil was of sandy clay loam. The application of post biomethanated spent wash did not show any effect on particle size distribution. In Entisol the application of post biomethanated spent wash resulted slightly increase in water retention in surface layer at both 33 kpa and 1500 kpa but does not show any effect of sub-surface layer. In Entisol hydraulic conductivity increased according to depth. The application of post biomethanated spent wash results slightly increase in hydraulic at surface level but does not show any effect on sub-surface layer of soil.

Conclusion

It can be concluded form the study that the application of post biomethanated spent wash did not show any effect on particle size distribution. In Entisol the application of post biomethanated spent wash resulted slightly increase in water retention in surface layer at both 33 kpa and 1500 kpa but does not show any effect of sub-surface layer. In Entisol hydraulic conductivity increased according to depth. The application of post biomethanated spent wash results slightly increase in hydraulic at surface level but does not show any effect on sub-surface layer of soil. However, it needs further studies for confirmation under provision of suitable drainage in future.

References

1. Bhaskar (2004). Proc. Nat. Symp. Use of Distillery and Sugar Industry Wastes in Agriculture. 28th and 29th October (2003). AC and RI, Trichy. 80-88.

2. Pillai M., Pal D.K. and Deshpande S.B. (1996). Distillation of clay minerals and their genesis in ferruginous and black soils occurring in close approximately on Deccan basalt plateau of Nagpur, maharashtra. *J. Indian Soc. Soil Sci.* 44(5), 500-507.

3. Joshi H.C., Pathak H., Choudhary A. and Kalar N. (1996). Distillery Effluent as a source of plant nutrients. Prospects and problems. *Fertilizer News*, November, 1996. 41 (11), 41-47.

4. Hati K.M., Biswas A.K., Bandopadhyaya K.K. and Misra A.K. (2003). Distillery Effluent as a source of plant nutrients *J. Plant Nutrient and Soil Science* 116, 345-347.

5. Basava Raju, Pathak Himanshu and Chaudhari Anita(2005). Distillery and sugar industry waste in Agriculture. 28th and 29th October, 1996. AC and RI, Trichy. 104-109.

6. Shamsunder H.C., Pathak H., Choudhary A. and Kalar N. (2004). Effect of distillery effluent under pre and post sown irrigation on soil health and yield of rice and wheat. *Indian J. Agric. Sci.* 77(11), 726-730.