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Research Article

EXPERIMENTAL STUDY ON THE REUSE OF DISTILLERY SPENT WASH ON SPROUTING, GROWTH AND YIELD OF NERIUM OLEANDER *(APOCYNACEAE)* FLOWERING PLANT

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ABSTRACT
Sprouting, growth and yield of Nerium Oleander *(Apocynaceae)* flowering plant was made irrigating with distillery spent wash of different concentrations. The spent wash i.e., primary treated spent wash (PTSW), 1:1, 1:2, and 1:3 spent wash were analyzed for their plant nutrients such as nitrogen, phosphorous, potassium and other physical and chemical characteristics. Experimental soil was tested for its chemical and physical parameters. Nerium Oleander *(Apocynaceae)* sets were planted in different pots and irrigated with raw water (RW), 1:1, 1:2 and 1:3 spent wash. The nature of sprouting, growth and yield was studied. It was found that the sprouting, growth and yield of plant was very good (100%) in 1:3 SW irrigation, while very poor (25%) in 1:1 SW, moderate (80%) in 1:2 SW and 95% in RW irrigation growth. This concludes that the diluted spent wash can be conveniently used for irrigation purpose without adverse affect on soil.

Keywords: distillery spent wash, nerium oleander, soil, irrigation**.**

INTRODUCTION
Nerium Oleander *(Apocynaceae)* belongs to Apocynaceae family. Nerium Oleander belongs to the Tribe Wrightieae. It belongs to the Genus Nerium. Nerium Oleander[1] is an evergreen shrub or small tree in thedogbane family Apocynaceae, toxic in all its parts. This the only species currently classified in the genus Nerium. It is most commonly known as Oleander, from its superficial resemblance to the unrelated olive Olea (CF.Oleaster), but has many other names include Adelfa, Alheli Extranjero, and Bangalore). It is so widely cultivated that no precise region of origin, perhaps in southwest Asia, has been identified. The ancient city of Volubills in Morocco took its name from the old Latin name for the flower. Oleander is one of the most poisonous of commonly grown garden plants, and can be very toxic if ingested in sufficient quantity. Oleander grows to 2-6mt tall, with erect stems that splay outward as they mature; first year stems have a glaucousbloom, while mature stems have a grayish bark. The leaves are in pairs or whorls of there, thick and leathery, dark green, narrow lanceolate, 5-21cm long and 1-3.5cm broad, and with an entire margin. The flowers grow in clusters at the end of each branch; they are white, pink to red, and 2.5cm diameter, with a deeply 5-lobed fringed corolla round the central tube. They are often, but not always sweetly scented. Nerium Oleander is native or naturalized to a broad area from Mauritania, Morocco and Portugal eastward through the Mediterranean region and the Sahara to the Arabian peninsula, southern Asia and as Far East as Yunnan in southern parts of China[2]. Theophrastus in his Enquiries into

Plants of ca.300BCE described among plants which affect the mind a shrub he called onotheras, which modern editors render Oleander. In another mention, of “wild bay”, Theophrastus appears to intend the same shrub. Oleander flowers are showy and fragrant and are grown for these reasons. Many cultivars also have double flowers. Young plants grow best in spaces where they do not have to complete with other plants for nutrients. It is a marvelous fact, but the leaves of this plant are poisonous to quadrupeds; while for man, if taken in wine with rue, they are an effectual preservative against the venom of serpents. Sheep too, and goats, it is said, if they drink water in which the leaves have been steeped, will die immediately. Despite a lack of any proven benefits, drawing a warning letter from the U.S. Food and Drug Administration (FDA). Additionally, a Texas based biotechnology company is researching oleander as a potential treatment for skin cancers and as well as an anti-viral treatment. The most significant of these toxins are oleander in and neriine, which are cardiac glycosides.

Molasses (one of the important byproducts of sugar industry) is the chief source for the production of ethanol in distilleries by fermentation method. About 08 (eight) liters of wastewater is generated for every liter of ethanol production in distilleries, known as raw spent wash (RSW), which is known for high biological oxygen demand (BOD: 5000-8000mg/L) and chemical oxygen demand (COD: 25000-30000mg/L), undesirable color and foul odor[3]. Discharge of RSW into open field or nearby water bodies results in environmental, water and soil pollution including threat to plant and animal lives. The RSW is highly acidic and contains easily oxi disable organic matter with very high BOD and COD[4]. Also, spent wash contains high organic nitrogen and nutrients[5]. By installing biomethanation plant in distilleries, reduces the oxygen demand of RSW, the resulting spent wash is called primary treated spent wash (PTSW) and primary treatment to RSW increases the nitrogen (N), potassium (K), and phosphorous (P) contents and decreases calcium (Ca), magnesium (Mg), sodium (Na), chloride (Cl^-), and sulphate (SO_4^{2-})[6]. PTSW is rich in potassium (K), sulphur (S), nitrogen (N), phosphorous (P) as well as easily biodegradable organic matter and its application to soil has been reported to increase yield of sugar cane, wheat and rice[7], Quality of groundnut[8] and physiological response of soybean[9]. Diluted spent wash could be used for irrigation purpose without adversely affecting soil fertility[10], seed germination and crop productivity[11]. The diluted spent wash irrigation improved the physical and chemical properties[12] of the soil[13] and further increased soil micro flora[14]. Twelve pre-sowing irrigations with the diluted spent wash had no adverse effect on the germination of maize but improved the growth[15]. Diluted spent wash increases the growth of shoot length, leaf number per plant, leaf area and chlorophyll content of peas[16]. Increased concentration of spent wash causes decreased seed germination, seedling growth and chlorophyll content in Sunflowers (*Helianthus annuus*) and the spent wash could safely used for irrigation purpose at lower concentration[17]. The spent wash contained an excess of various forms of cations and anions, which are injurious to plant growth and these constituents should be reduced to beneficial level by diluting spent wash, which can be used as a substitute for chemical fertilizer[18]. The spent wash could be used as a complement to mineral fertilizer to sugarcane[19]. The spent wash contained N, P, K, Ca, Mg and S and thus valued as a fertilizer when applied to soil through irrigation with water[20]. The application of diluted spent wash increased the uptake of Zinc (Zn), Copper (Cu), Iron (Fe) and Manganese (Mn) in maize and wheat as compared to control and the highest total uptake of these were found at lower dilution levels than at higher dilution levels . Mineralization of organic material as well as nutrients present in the spent wash was responsible for increased availability of plant nutrients. Diluted spent wash increase the uptake of nutrients, height, growth and yield of leaves vegetables[21], nutrients of cabbage and mint leaf[22], nutrients of top vegetable[23], pulses, condiments, root vegetables, of some root vegetables in untreated and spent wash treated soil, yields of top vegetables (creepers). However, no information is available on sprouting, growth and yield of Nerium Oleander flowering plant irrigated by distillery spent wash. Therefore, the present investigation was carried out to study the influence of different proportions of spent wash on the sprouting, growth and yield of Nerium Oleander.

MATERIALS AND METHODS

Physio-chemical parameters[24] and amount of nitrogen (N)[25], potassium (K),[26] phosphorous (P)[27] and sulphur (S)[28] present in the primary treated diluted spent wash (1:1, 1:2 and 1:3 SW) were analyzed by standard methods[29]. The PTSW was used for irrigation with a dilution of 1:1, 1:2 and1:3. A composite soil sample collected prior to spent wash irrigation was air-dried, powdered and analyzed for physico-chemical properties[30]. Flowering[31] plants[32] selected for the present investigation were Nerium Oleander. The sets were planted in different pots (30(h), 25(dia)) and irrigated (by applying 5-10mm/cm^2 depends upon the climatic condition)[33] with raw water (RW), 1:1 SW, 1:2 SW and 1:3 SW at the dosage of twice a week and rest of the period with raw water as required. Cultivation was conducted in triplicate, in each case sprouting, growth and yield were recorded.

RESULTS AND DISCUSSION

Chemical composition of PTSW, 1:1, 1:2, and 1:3 SW such as pH, electrical conductivity, total solids (TS), total dissolved solids (TDS), total suspended solids (TSS), settelable solids (SS), chemical oxygen demand (COD), biological oxygen demand (BOD), carbonates, bicarbonates, total phosphorous (P), total potassium (K), ammonical nitrogen (N), calcium (Ca), magnesium (Mg), sulphur (S), sodium (Na), chlorides (Cl), iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), cadmium (Cd), lead (Pb), chromium (Cr) and nickel (Ni) were analyzed and tabulated (Table-1).Amount of N, P, K and S contents are presented (Table-2). Characteristics of experimental soils such as pH, electrical conductivity, the amount of organic carbon, available nitrogen (N), phosphorous (P), potassium (K), sulphur (S), exchangeable calcium (Ca), magnesium (Mg), sodium (Na), DTPA iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn) were analyzed and tabulated (Table-3 & 4). It was found that the soil composition is fit for the cultivation of plants, because it fulfils all the requirements for the growth of plants.

Table 1: Chemical characteristics of distillery Spent wash

Chemical parameters	PTSW	1:1 PTSW	1:2 PTSW	1:3 PTSW
pH	7.57	7.63	7.65	7.66
Electrical conductivity[a]	26400	17260	7620	5330
Total solids[b]	47200	27230	21930	15625
Total dissolved solids[b]	37100	18000	12080	64520
Total suspended solids[b]	10240	5380	4080	1250
Settleable solids[b]	9880	4150	2820	3240
COD[b]	41250	19036	10948	2140
BOD[b]	16100	7718	4700	2430
Carbonate[b]	Nil	Nil	Nil	Nil
Bicarbonate[b]	12200	6500	3300	1250
Total Phosphorous[b]	40.5	22.44	17.03	10.80
Total Potassium[b]	7500	4000	2700	1620
Calcium[b]	900	590	370	190
Magnesium[b]	1244.16	476.16	134.22	85
Sulphur[b]	70	30.2	17.8	8.4
Sodium[b]	520	300	280	140
Chlorides[b]	6204	3512	3404	2960
Iron[b]	7.5	4.7	3.5	2.1
Manganese[b]	980	495	288	160
Zinc[b]	1.5	0.94	0.63	0.56
Copper[b]	0.25	0.108	0.048	0.026
Cadmium[b]	0.005	0.003	0.002	0.001
Lead[b]	0.16	0.09	0.06	0.003
Chromium[b]	0.05	0.026	0.012	0.008
Nickel[b]	0.09	0.045	0.025	0.012
Ammonical Nitrogen[b]	750.8	352.36	283.76	178
Carbohydrates[c]	22.80	11.56	8.12	6.20

Units: a – μS, b – mg/L, c- %, PTSW - Primary treated distillery spent wash

Table 2: Amount of N, P, K and S (Nutrients) in distillery Spent wash

Chemical parameters	PTSW	1:1 PTSW	1:2 PT SW	1:3 PTSW
Ammonical Nitrogen[b]	750.8	352.36	283.76	160.5
Total Phosphorous[b]	40.5	22.44	17.03	11.2
Total Potassium[b]	7500	4000	2700	1800
Sulphur[b]	70	30.2	17.8	8.6

Unit: b – mg/L, PTSW - Primary treated distillery spent wash

Table 3: Characteristics of experimental soil

Parameters	Values
Coarse sand[c]	9.24
Fine sand[c]	40.14
Slit[c]	25.64
Clay[c]	20.60
pH (1:2 soln)	8.12
Electrical conductivity[a]	530
Organic carbon[c]	1.64
Available Nitrogen[b]	412
Available Phosphorous[b]	210
Available Potassium[b]	110
Exchangeable Calcium[b]	180
Exchangeable Magnesium[b]	272
Exchangeable Sodium[b]	113
Available Sulphur[b]	330
DTPA Iron[b]	204
DTPA Manganese[b]	206
DTPA Copper[b]	10
DTPA Zinc[b]	55

Units: a – µS, b – mg/L, c- %

Table 4: Characteristics of experimental soil (After harvest)

Parameters	Values
Coarse sand[c]	9.69
Fine sand[c]	41.13
Slit[c]	25.95
Clay[c]	24.26
pH (1:2 soln)	8.27
Electrical conductivity[a]	544
Organic carbon[c]	1.98
Available Nitrogen[b]	434
Available Phosphorous[b]	218
Available Potassium[b]	125
Exchangeable Calcium[b]	185
Exchangeable Magnesium[b]	276
Exchangeable Sodium[b]	115
Available Sulphur[b]	337
DTPA Iron[b]	212
DTPA Manganese[b]	210
DTPA Copper[b]	12
DTPA Zinc[b]	60

Units: a – µS, b – mg/L,

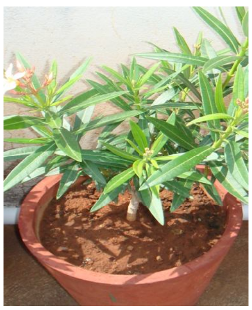
Table 5: Growth of Nerium Oleander plant at different irrigations (cm)

RW 15th 22nd 29th (Day)	1:1SW 15th 22nd 29th (Day)	1:2 SW 15th 22nd 29th (Day)	1:3 SW 15th 22nd 29th (Day)
20, 24, 26	04, 05, 08	28, 30, 33	30, 34, 36

Table 6: Yields of Nerium Oleander Flowers at different irrigations (Average number is taken from the five plants)

RW		1:1 SW		1:2SW		1:3 SW	
No of Flowers	Size of Flowers (cm)	No of Flowers	Size of Flower (cm)	No of Flowers	Size of Flowers (cm)	No of Flowers	Size of Flowers (cm)
20	5	--	--	30	5.5	40	5.8

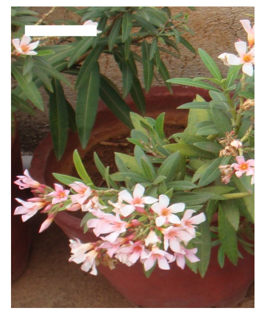
Nerium Oleander plants in different irrigations



RW

1:1SW

1:2SW



1:3SW

Sprouting, growth and yield of Nerium Oleander plant leaves, uptakes of all the parameters were very good in both 1:2 and 1:3 spent wash as compared to1:1, SW and raw water. In both 1:1, 1:2 and 1:3 spent wash irrigation(Table-6) [31], the uptake of the nutrients[32] such as fat, calcium, zinc, copper and vitamins carotene and vitamin c were almost similar but the uptake of the nutrients[33] and parameters such as protein, fiber, carbohydrate, energy, magnesium and phosphorous were much more in the case of 1:1, 1:2, spent wash irrigation than 1:3, and raw water irrigations (Table-5). This could be due to the more absorption of plant nutrients present in spent wash by plants at higher dilutions. It was also found that no negative impact of heavy metals like lead, cadmium and nickel on the leaves of Nerium Oleander plant. The soil was tested after the harvest; found that there was no adverse effect on soil characteristics. Hence the spent wash can be conveniently used for irrigation purpose with required dilution without affecting environment soil.

CONCLUSIONS

It was found that the nutrients uptake in the Sprouting, growth and yield of Nerium Oleander *(Apocyanaceae)* plant were largely influenced in case of 1:1, 1:2 and 1:3 SW irrigation than with raw water. In 1:1 spent wash irrigation sets are not sprouted (100%), this could be due to the formation of thick layer of spent wash on the surface of the soil, which makes the mask on the sets and hence sets are not sprouted. But 1:3 distillery spent wash shows more uptakes of nutrients when compared to 1:2 SW. This could be due to the maximum absorption of nutrients by plants at more diluted spent wash. After harvest, soil has tested; found that there was no adverse effect on characteristics. Hence the spent wash can be conveniently used for irrigation purpose with required dilution without affecting environment and soil.

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