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Comparative analysis of vegetable crop yield by using industrial waste and treated water

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Abstract
Water is essential for plant growth, Nowadays more amount of water are wasted by domestic and industrial purpose. In that situation treat wastewater. Various types of treatment process are used to treat the waste water like screening, flocculation, sedimentation, filtration and various chemical process is used to remove colour, odours, salinity and other, this study investigates the effects of industrial effluents on vegetables grown. Unprocessed waste water from textile, ghee, and other industries is discharged into rivers and land, and can negatively impact the quality of the crops. Different concentrations of effluents have been observed to affect the seedling and root lengths of various vegetables, with high concentrations resulting in reduced germination and growth. Untreated effluent from the textile industry has been found to decrease the biomass of roots and shoots, while treated effluent has been observed to improve growth, as well as increase the sugar and protein percentages. Additionally, heavy metals such as Ni, Cr, Zn, Cd, Cu, As, and Pb that are found in the effluents can accumulate in the vegetables, leading to inhibited root growth, a decrease in yield due to less water and nutrient uptake, and a decline in plant growth and seed germination rate. Due to various chemical process naturality of water will spoiled. Henceforth, we used organic mixture of liquid (ECOCLEAN 2300) in the treatment process. ECOCLEAN-2300 is a single dose herbal reagent for sewage water flocculation, sedimentation and disinfection of water. It not only induces flocculation and causes separation of both suspended and dissolved solids but also disinfects the water and also compare the plant growth & yield of various characteristics of water.

Keywords: Industrial effluents, ecoclean-2300, total suspended solids, herbal reagent, plant growth

Introduction
Vegetables are essential for meeting the global food requirements due to their rich content of minerals, dietary fibers, and vitamins [1]. Turnips and radishes are especially beneficial for health, as their roots and leaves are packed with vitamins A, B6, C, E, and folate, dietary fiber, copper, and calcium, and can help to prevent a myriad of health issues, such as whooping cough, gastric discomfort, cancer, coughs, constipation, dyspepsia, liver problems, arthritis, gallbladder problems, gallstones, intestinal parasites and kidney stone [2]. Unfortunately, vegetables grown in soils affected with toxic heavy metals such as nickel, chromium, copper, lead, arsenic, cadmium and zinc are prone to accumulate elevated amounts of these metals, as they can absorb them through their leaves [3]. The city effluent, which is often used for irrigation of vegetable crops due to water scarcity, is a major source of these metals [4]. If left untreated, its continuous use for vegetable production can result in their accumulation in phytotoxic amounts, leading to a variety of physiological and biochemical disorders in plants [5]. For example, the ecotoxicological and interactive effects of chromium and aluminum have been observed on growth, oxidative damage and antioxidant enzymes of two barley genotypes differing in aluminum tolerance (Soil Sci Plant Nutri, 57:68-79; Ecotoxicol Env Safety, 70:185-191) [6]. The use of untreated city effluents for irrigation in the textile and paper industry can be detrimental to vegetable and fodder production due to the presence of metals in phytotoxic amounts [7]. This can lead to a variety of health issues, including but not limited to typhoid, cholera, leukemia, brain damage, dysentery, diarrhea, vomiting gastroenteritis, lung cancer, ulcers, hypertension, pregnancy toxemia, pigmentation of fingers and nails, impaired growth, heart failure, low blood pressure [8], hepatic neurosis, skeletal abnormalities, bones disorders, myocardial infestation, dermatitis, alcopia tumor, hair loss, depression, and Parkinsonism [9]. To avoid these impacts and to create a healthy environment through the safest recycling method of waste water has been formulated [10]. In this research focuses on ECOCLEAN-2300 an organic mixture of liquid designed to be used in the treatment of effluent water.

It induces flocculation and sedimentation, resulting in the separation of both suspended and dissolved solids, while also providing disinfection and promoting beneficial plant growth and yield in the treated water.

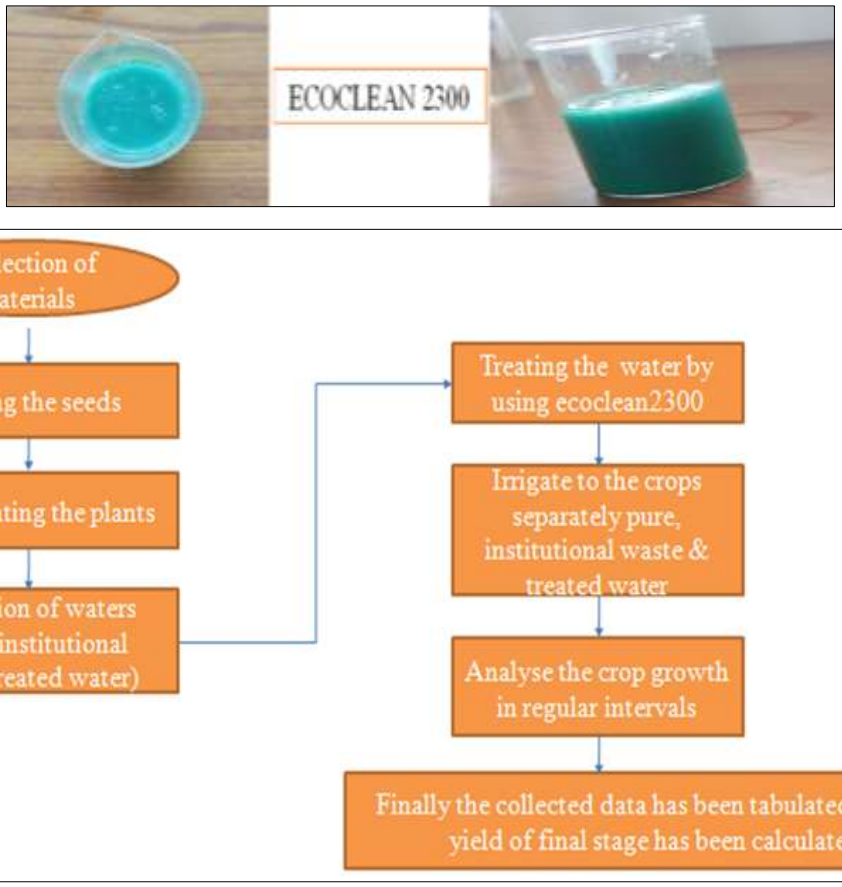

Fig 1: Schematic Diagram of ECO CLEAN 2300 Water Treatment Process

Materials used

- Poly grow bags
- Ecoclean 2300
- Tomato seeds and plants
- Industrial waste water
- Water
- Treated water.
- Fertilizers.

Eco-clean consist of

- Azadirachta indica (Neem).
- Moringa Olifera (Drumstick).
- Strychnos Potatorum (Cleaning nut).
- Occimum Sanctum (Tulsi).
- Melaleuca Alternifolia (Tea tree oil).
- Stabilizer [14]

Waste water collection

Planting process

Planting the tomato plants in the poly grown bags was the first step of the experiment [15]. The soil was filled into the poly grown bags and 6 tomato plants were taken for testing. Finally, water was poured to the soil to ensure the plants were given the necessary hydration

Fig 2: Normal Water, b) Industrial Waste Water, c) Treated Water

Process on planting

- Transplanting the 30 days plant in polybags,
- Daily irrigation has been done,
- After 6 days observation 4 plants has been spoiled and dead because of atmospheric condition.
- By that new plants has been collected and transplanted in polyhouse.
- Before transplanting the plant parameters has been taken.
- Weeding done at every 5 days.

Before transplanting

- Plant height= 6 cm per plant
- No. of. Leaves= 6 per plant.

Table 1: Data on After Transplanting Plant Parameters

AFTER TRANSPLANTING PLANT PARAMETERS

PARAMETERS	DURATION (DAYS)	NO.OF. LEAVES	HEIGHT (CM)	PLANT GIRTH (CM)	MAX. LENGTH OF LEAF (CM)	MAX BREADTH OF LEAF (CM)
PURE WATER	8	25	22	1.5	6	3
WASTE WATER	8	6	8	1	2	1
TREATED WATER	8	12	14	1.2	4	2
PURE WATER	13	31	30	2	8	3.5
WASTE WATER	13	10	10	1.5	2.5	1.5
TREATED WATER	13	17	18	1.5	5	2.5
PURE WATER	18	50	42	2.5	10	5
WASTE WATER	18	20	12	2	3.5	2
TREATED WATER	18	33	28	2	7	3
PURE WATER	23	75	52	3	11	5.5
WASTE WATER	23	50	29	2.5	8.5	4
TREATED WATER	23	70	35	2.5	6.5	3

PARAMETERS	DURATION (DAYS)	NO.OF. LEAVES	HEIGHT (cm)	GRITH OF PLANT (cm)	MAX. LENGTH OF LEAF (cm)	MAX. BREATH OF LEAF (cm)
PURE WATER	28	90	78	3	11	5.5
WASTE WATER	28	60	32	3	6.5	3
TREATED WATER	28	85	60	3	8.5	3.5
PURE WATER	33	120	90	3	11	5.5
WASTE WATER	33	85	45	3	10	5
TREATED WATER	33	100	70	3	7	3
PURE WATER	38	125	92	4	11	5.5
WASTE WATER	38	86	46	3	8	3
TREATED WATER	38	103	75	3.5	9	4
PURE WATER	43	131	93	4	11	5.5
WASTE WATER	43	91	48	3	8	3
TREATED WATER	43	103	80	3.5	9	4

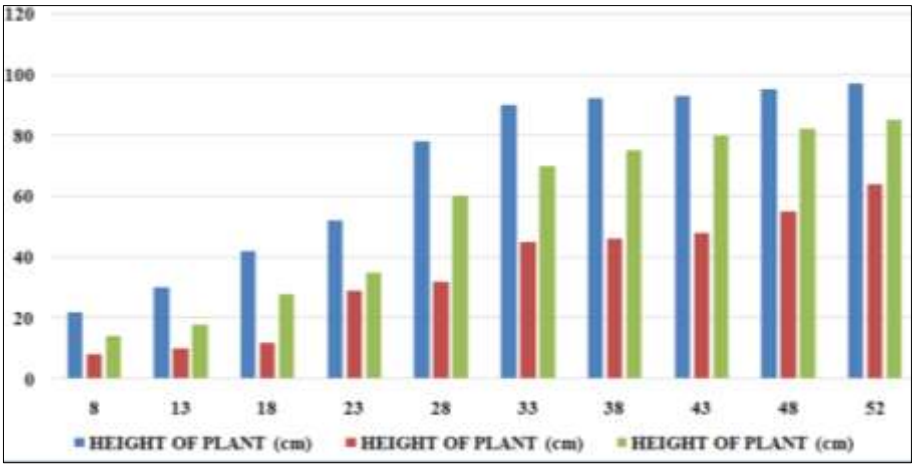

Fig 3: Height the plant variation in different types of water

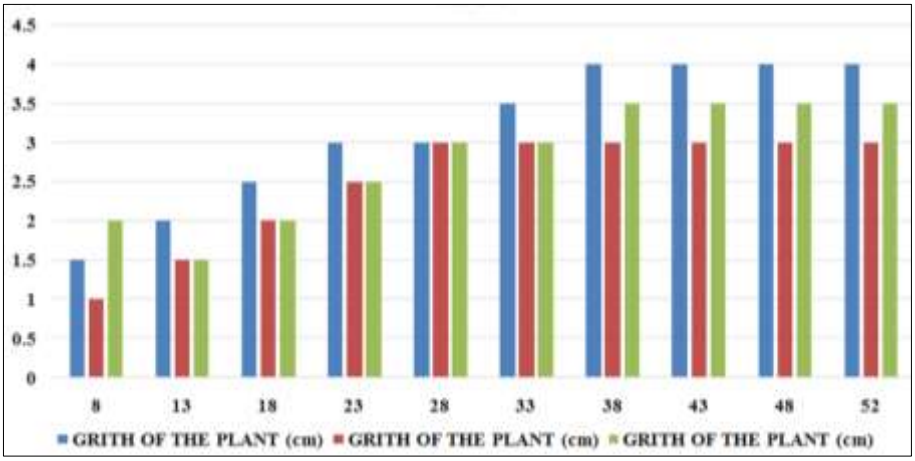

Fig 4: Grith of the plant variation in different types of water

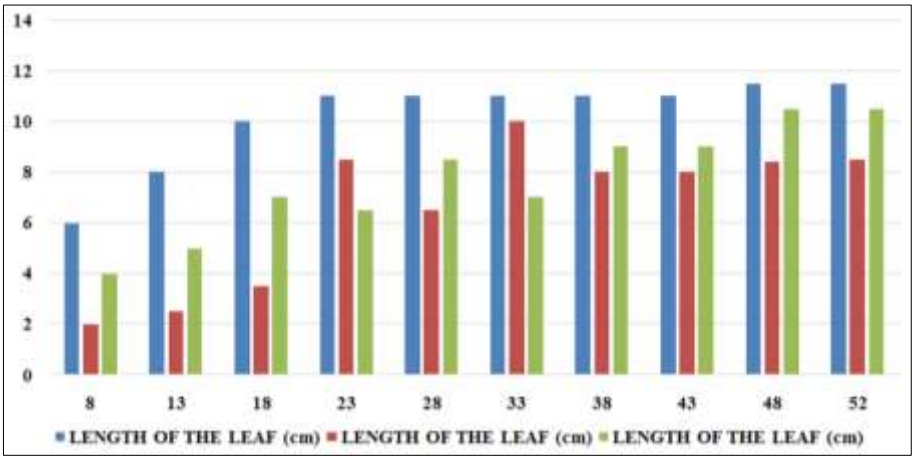

Fig 5: Length of the leaf variation in different types of water

Table 2: Plantation No. of Buds in Pure Water Vs. Treated Water

Duration days	No. of. Buds		
	Pure water	Treated water	Waste water
23	4	0	0
28	8	4	0
33	20	11	7
38	12	8	4
43	12	8	4
48	10	6	4
52	10	6	4

Bud Formation

Fig 6: (a) Pure Water Plant Bud Formation (b) Waste Water Plant Bud Formation (c) Treated Water Plant Bud Formation

Table 3: No. of fruits variation in different water

Duration days	No. of Fruits		
	Pure water	Waste water	Treated water
38	4	0	0
43	4	0	0
48	4	0	0
52	4	0	2

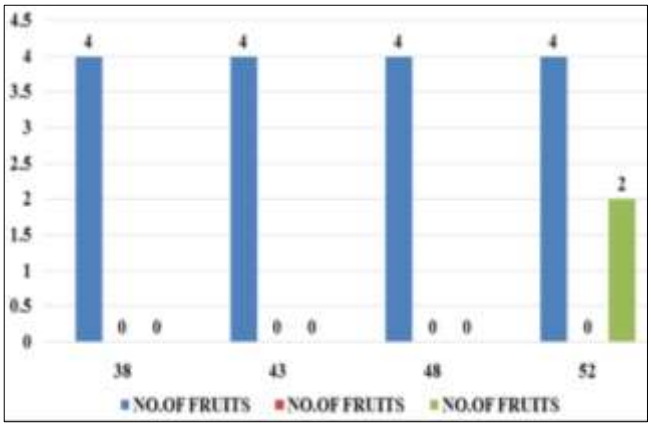

Fig 7: No. of fruits variation in different water

Conclusion

Using industrial waste water for irrigating vegetables poses a risk to both plants and humans. In countries with water scarcity, this method of reusing waste water can be an effective way of meeting food and water needs. However, research has found that using untreated industrial waste water for irrigation of vegetables can lead to the accumulation of toxic heavy metals in the plants, which can cause crop growth and germination to stop, reduce crop yields, and even create health issues. Therefore, this practice must be avoided, or if it is used, it must be done with proper management, such as treating the waste water first. Analysed data shows that the higher yield is on pure water on same time it proves that the ECOCLEAN 2300 treated water produces more yield than the wastewater. Nowadays scarcity of water and food resources for humans and livestock's due to over population. Henceforth, the wastewater has used for cultivation it will affect the nature of the land and yield. ECOCLEAN 2300 is organic mixture fluid it will treat the wastewater to settle down the hard particles and this treated water will increase the yield and reduce the effect on soil.

Fruit formation in wastewater

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