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Waste Water Reuse on crop plant after effective bacterial consortium treatment

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Abstract - Pulp and paper sector is the sixth largest water polluting business in the country, one of the most contaminated sectors. Environmental friendly treatment method is required to make it more usable for irrigation purpose. A different single isolates were screened on the basis of their degradation capability by estimating chemical oxygen demand. The form of pulp and paper water is complicated and thus it is not possible for one isolate to easily degrade the wastewater. Therefore after the screening of single isolate consortium were formulated to increase the efficiency of single isolate. The efficiency of selected consortium was increased by optimizing the different parameters. The selected consortium at 35°C temperature, 72 hrs of incubation time and 300 rpm shows the degradation up to 68%. Bioremediation literal meaning is to remediate the problem completely. This treatment method is the helping hand provided by nature. The literature shows that there is possibility of applying pulp and paper wastewater in irrigation after effective treatment. It's clearly demonstrates that bioremediation and its use in irrigation will increase the efficiency of the pulp and paperboard industry waste. After treatment the treated effluent was applied for crop production and it was observed that 50% consortium treated wastewater gave optimum growth for a crop. Therefore, it is concluded that 50% diluted effluent contains sufficient nutrients for plant growth.

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INTRODUCTION

Water is an integral feature of earthly existence and an abundant tool. That is the root of all life on this earth.

Our Planet, which occupies three fourths of its territory and makes up 60-70 percent of the human Universe, is exceptional from the other established celestial beings. It has water. However, about 1% of the world's water can be used. Around 97% of the water is salty and 2% of the ice was solid. This accounts for less than 1 percent of available fresh water. A vital asset required for our life is 1% of the world's water supply. The population uses water for industrial development and productivity to produce and maintain, through practices like irrigation, farming, electric generation, production, and travel. Various types of reservoirs are available, such as the dams, streams, marine and groundwater. These tools are invaluable and must be safeguarded.

Scarcity of services will intensify or welcome new conflicts. Citizens only have small amount of fresh water. As the population growing, a person's total volume of clean fresh water is increasing. Power heat and utter depletion are also unavoidable. Climate problems in all areas of the country, including industrial to farm climate use, are widespread. When waterways and coastal areas expand around the planet, freshwater habitats disappear.

Many sectors, from textiles and fabrics to petroleum processing and automobile manufacturing that

absorb vast amounts of water, account for approximate 90% of direct water drainage for agriculture and power generation. Paper production industry is highly susceptible to emission threats.

The paper sector is an significant aspect of the printing business. Today in India in around 10 million tonnes, 715 major paper mills manufacture a range of various pulp, paperboard and newspaper items. The key inputs for paper production involve raw materials, electricity, chemical, labor and water. Raw material and resources constitute about 50-60 percent, and are the major factors influencing manufacturing costs. The pulp and paper industry consume huge amount of water for almost every operation. This creates a substantial amount of effluent.

Owing to the disposal of massive amounts of colorful and toxic waste water (effluent) in the atmosphere, which pollute land, air and water, it has been categorized as one of the most contaminating industries. The river can eventually lead to serious water problems in partly treated waste water or untreated waste water from the paper and pulp industries (Srivastava et al., 2014)

A significant amount of waste water is the biggest challenge facing the pulp and paper industry. Effluent has contaminants like sodium, calcium, chloride, sulphates and large concentrations of organic suspended content. Effluents often include heavy metals such as arsenic, gold, chromium etc. In addition to these elements, In response of strong chemical and biological oxygen demands, the effluents are usually alkaline. Effluent directly in to the water supplies that's why become inadaptable for agriculture and consumption and presents threats to the atmosphere (Kumar et al., 2014).

Wastewater using for agriculture is a developing practice worldwide due to the rising water tension, partly on account of climate change;- and drainage flows; and more industrial households engaged in agriculture. This pattern has the question of either the usage of raw drainage or the indirect use of contaminated waters by rivers. This poses major risks, particularly microbial health risks.

INDUSTRIAL EFFLUENT

Effluent in the counterfeit sense is as a rulethought to be water pollution, for example, the outflow from a sewage treatment office or the wastewater release from industrial offices. An effluent sump pump, for example, pumps waste from toilets introduced below a primary sewage line. Like wastewater created in various foundations, ventures, and offices. These wastewater discharged can likewise gather and contaminate the adjacent networks andwaterways

Businesses are the significant sources of pollution in all conditions. In view of the sort of industry, different levels of toxins can be released into the earth straightforwardly or in a roundabout way through public sewer lines. Wastewater from ventures incorporates representatives' sanitary waste, process wastes from manufacturing, wash waters and moderately uncontaminated water from warming and cooling activities

Stream frameworks are the essential means for disposal of waste, particularly the effluents, from industries that are close them. These effluents from industries impact the pollution of the water body,these effluents can modify the physical, chemical and organic nature of the accepting water body. Expanded industrialexercises have prompted pollution weight on surface waters both from industrial, agricultural and household sources.

CROP PLANTS

A crop is a plant or creature item that can be developed and gathered widely for benefit or subsistence. Crop may allude either to the reaped parts or to the gather in a more refined state. Most crops are developed in agriculture or aquaculture. A crop is normally extended to incorporate plainly visible organism (e.g. mushrooms), or alga (alga culture).

Most crops are collected as food for humans or grain for domesticated animals. A few crops are accumulated from the wild (counting serious social affair, e.g.ginseng).

Microbiological Quality

Worldwide guidelines for the microbiological quality of irrigation water utilized on a specific crop don't exist. The reason is the absence of direct epidemiological information to demonstrate any connection between the quality of water really connected at the field and sickness transmission or contamination.

Microbiological Guidelines forWastewater Reuse

Wastewater contains high groupings of discharged pathogens, for example, viruses, bacteria, helminthes eggs, and fecal coliforms. These discharged pathogens can possibly cause infection if showing a human host in adequate amounts. Intestinal nematodes represent the most elevated level of danger of contamination while microbes represent a lower chance. Infections display the least hazard. To limit the potential danger of contamination, the World Bank, World Health Organization and International Reference Center for Waste Disposal at Engel erg, Switzerland, met a gathering of specialists including disease

transmission experts, social researchers and clean specialists in 1985, to audit ongoing epidemiological proof, and make proposals.

As per EPA, 2003 the microbial model for recycled water in light of the comparing scope of reuse is grouped into four classes (A-D) where class A speaks to the tertiary treatment for unlimited crops with high caliber and class D speaks to the optional treatment (least treatment level) for nonfood crops as in table.

Table 1: Recycled water classes for biological and pathogen reduction and the scope ofreuse

Class	Water quality	Treatment level	Range of class uses
A	10 E-coli mg/LBOD/SS	Tertiary & reduction pathogen	Unrestricted, Urban (Non Potable)Industrial
B	100 E-coli org. /100ml. 20/30 mg/L BOD/SS	Secondary & reduction	Agriculture, Industrial
		pathogen	
C	1000 E-coli org /100ml. 20/30 mg/L BOD/SS	Secondary & reduction pathogen	Agriculture: human food crops/cocked
D	10000E-coliorg./100ml , 0/30 mg/L BOD/SS	Secondary	Fodder crops, crops, flowers

REVIEW OF LITERATURE

LVEMP/COWI, 2002 Uganda has been described by a high economic and Industrial growth in the most parts of the nation. This has prompted enormous changes in the supplement science of the water resources, especially of the Lake Victoria. These gigantic changes in the supplement fixations may prompt unsafe impacts to humans and aquatic life. For instance most heavy metals in streams of water are usually connected with industrial releases and every single heavy metal basic in industrial effluents are aggregate poisons to aquatic life.

Muwanga and Barifaijo (2006) built up the principle pollution sources of Kinawata stream and the Nakivubo channel were because of industrial effluents and localwaste keep running off. The real reasons for pollution in the Nakivubo channel have been in this manner distinguished as crude sewage from public sewage frameworks, especially untreated sewage from sewage works, abattoir effluent and garbage collection.

Kamizoulis, 2007 Wastewater is utilized widely for irrigation in specific nations e.g. 67% of aggregate effluent of Israel, 25% in India and 24% in South Africa is reused for irrigation through direct Arranging. Plainly, agricultural and scene irrigation speaks to the most imperative zone in which this important asset is utilized Treated waste-water speaks to steady and dependable sources of irrigation water and frequently gives noteworthy levels of required plant nutrients, for example, potassium and nitrogen. It has been fruitful for irrigation of a wide exhibit of crops, and increments in crop yields from 10-30% have been accounted for (Asano, 2008). What's more, the utilization of wastewater in agriculture is a type of supplement and water reusing, and this regularly diminishes downstream environmental effects on water resources notwithstanding assist networks with growing more food and preserve valuable water and supplement resources.

Al-Lahham et al.,2003; Salgot et al., 2006; Toze, 2006; Palese et al., 2009 These might then collect in the soils, with negative consequences for crop quality and profitability, and on the ecological soil conditions (Siebe and Cifuentes, 1995; Chen et al., 2008). One of the significant worries with wastewater reutilize is the danger of the transfer of pathogenic microorganisms that speak to a potential riskto human health on the off chance that they enter the food chain. For sure, numerous investigations have demonstrated that microbiological contamination canbe a noteworthy issue for the re-utilization of treated agricultural wastewater (Rubino and Lonigro, 2008; Lopez et al., 2010; Patterson et al., 2011; Vivaldi et al., 2013). To augment the advantages and at the at some point, to limit the dangers identified with the utilization of treated wastewater, universal approaches and uniform authoritativesystems ought to be embraced.

OBJECTIVES

1. To study the industrial effluent andcrops.
2. To study the impact of industrialeffluent on crops.
3. To describe the various reviews given by various authors regarding the industrial effluent on crops and agriculture.
4. To analyze the microbial quality ofcrops.

MATERIAL AND METHODS

Wastewater from the treatment plant of the India was utilized. This wastewater treatment plant works based on primary and secondary treatments, with a past anaerobic area for organic disposal of phosphorus supplemented with chemical precipitation of phosphorus and resulting dissemination natural initiation with synchronous de nitrification and partial aerobic stabilization of the sludge. Wastewater entering the plant comprises of ca 38% sewage and 62% industrial wastewaters. In 2016, secondary-treated wastewater and in 2017 and 2018 just primary-treated wastewater were utilizedas a part of the tests. In each investigation a control treatment was completed utilizing the irrigation with well water from a nearby well in 2016 and with water from the public water supply in 2017 and 2018

Variables

Materials such as carrot, potato, tomato, rice, coriander, wheat, Brinjal, Cabbage, cauliflower, Ginger, papaya, Radish etc.used for the data analysis as crops.

Techniques used

Statistical techniques have been used for crop yields using Industrial wastewater at the 0.05 significance level (α)

Period of the study

Year 2016-2018 has been chosen for the study

Data Collection

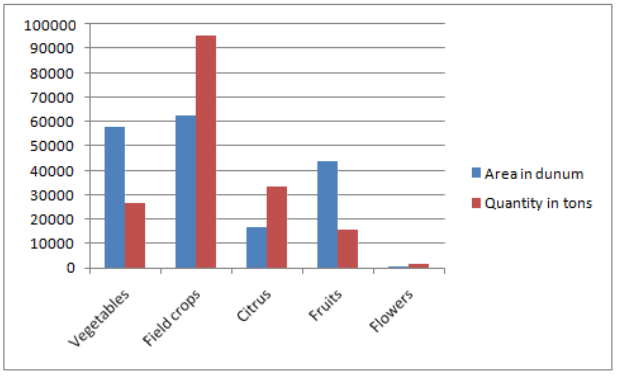
Information collection is a process of gathering data from all the applicable sources to discover answers to the examination issue, test the theory and assess the results. Information collection strategies can be partitioned into two classifications: secondary techniques for information collection and primary techniques for information collection. Inthis research paper Primary data has been used for collecting information through survey done in Indian villages and town effect of microbiologically treated industrial effluent on crop plants.

DATA ANALYSIS AND RESULT

Agriculture is the prevalent sector contributes to 32% of its economic production. In addition, it is a politically sensitive sector as all of its inputs such as, seeds, fertilizers and pesticides are imported from Israel. Therefore, any political crisis influences it directly while the agricultural sector is considered to be a main part of Palestinian life, over the last five years it's contribution to the national Gross Domestic Production (GDP) has reduced from 9.1% to about 7.0%, the irrigated area in GS is estimated to be about 176,000 dunum and the total supply is estimated to be about 86 MCM.

Table 2: Agricultural production

Crop	Area in dunum	Quantity in tons
Vegetables	57412	26325
Field crops	62450	95124
Citrus	16585	33121
Fruits	43589	15302
Flowers	735	1341



The above table and figure shows the agriculture production and the regions of each crop for the year as per MOA, 2017. The aggregate of Agricultural Production of vegetables in area are 57412, field crops are 62450, citrus are 16585, fruits are 43589 and flowers are 735. The highest production is done of field in comparison with other crops.

Crop Yield

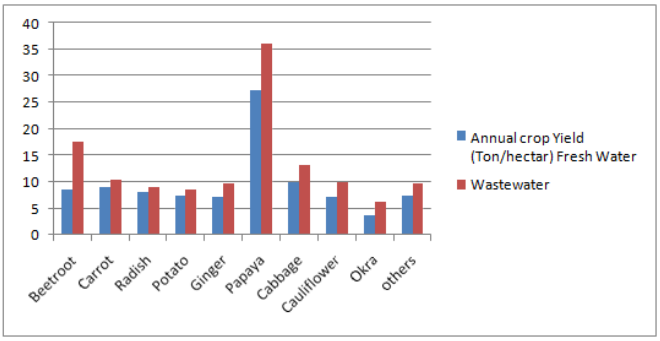
The economic effects of wastewater on crops may contrast generally contingent on the level of treatment, sorts and nature of crops developed, and

the water administration rehearses. For the most part, as wastewater is a rich wellspring of nutrients, higher than normal crop yields might be higher with wastewaterirrigation.

Various examinations have exhibited the positive effects of wastewater on crop profitability because of these nutrients and natural issue. The usage of treated Industrial wastewater has caused an expansion in the yield of tomato when contrasted with irrigation with the well water.

Table 3: Yield of crops irrigated with Industrial effluent and fresh water in India

Crop	Annual crop Yield (Ton/hectar) FreshWater	Wastewater
Beetroot	8.52	17.41
Carrot	8.96	10.32
Radish	8.1	9.02
Potato	7.45	8.45
Ginger	7.12	9.65
Papaya	27.25	36.12
Cabbage	9.96	13.10
Cauliflower	7.25	9.98
Okra	3.78	6.1
others	7.47	9.6



The above table and figure shows that a correlation contemplates on the distinction in crop yield when wastewater and fresh water utilized as a part of India showed in table 3. It is seen that at most time and for every single tried crop the utilization of wastewater expands the crop yields with various proportions from crop to another. It can be seen from the table that high crops are yielded with wastewater effluent of industries.

Table 4: the effect of wastewater on vegetable nutrients and heavy metal contents

Nutrients and Heavy Metal	Vegetables/Crops	Concentration in Vegetables Irrigated by Wastewater (mg/kg)
N	Lettuce	43,125
	Rice	455
	Coriander	501
	Wheat	178
	Rice	146
P	Lettuce	5612
	Rice	40
	Alfalfa	0.31
	Rice	40
	Rice	871
K	Rice	302
	Coriander	520
	Alfalfa	2.9
	Rice	227
	Tomato	8.9

	Panicum	0.10
	Brinjal	15.23
	Radish	3.4
Pb	Cypress	3.7
	Onion	2.8
	Garlic	5.74
	Tomato	5.36
	Tomato	0.52
	Maize	0.07
Cd	Cypress	0.09
	Radish	5.3
	Garlic	31
Ni	Tomato	8.75
	Cabbage	0.75
	Tomato	5.66
	Brinjal	7.43
	Maize	1.17
As	Lettuce	1.40
	vegetables, cereal crops	8.96
	Maize	0.07
	Carrot	0.18
	Radish	0.6
	Radish	6
Cr	Onion	1.13
	Garlic	2
	Tomato	7.3
	Brinjal	8.7
	vegetables, cereal crops	8.63
Fe	tomato	7.12
	onion Brinjal	2.36
	sunflower	6.4
	lettuce	5.7

The utilization of wastewater for crop irrigation in the agricultural part has the potential for both negative and constructive outcomes on the soil quality/productivity, crop generation, and human health. Wastewater may contain undesirable pathogens and chemical constituents that stance health and environmental dangers. The negative impacts of crop irrigation with wastewater are essentially because of the nearness of high aggregate suspended and broke down solids, high supplement substance, and PTEs. Wastewater may contain high convergences of salts which can influence the soil quality and productivity by amassing in the root zone. The drawn out utilization of saline and sodium-rich wastewater can break down the soil structure and influence the soil productivity. Soil salinization because of wastewater irrigation has been broadly revealed amid the ongoing years. The significant impact of wastewater on crop productivity is because of the nearness of heavy metals, which are well-known to contrarily influence crop productivity.

Secondary-treated Industrial wastewater utilized for the experiments in 2005 was poor in nutrients – the normal substance of aggregate nitrogen was ca 5 mg/l, add up to phosphorus 5.7 mg/l, potassium 19 mg/l and magnesium 15 mg/l. Low substance of nutrients, in any case, especially nitrogen and phosphorus, in the secondary-treated wastewater can be normal on account of all cutting edge, legitimately planned and worked wastewater treatment plants in light of the fact that the evacuation of nitrogen and phosphorus mixes from wastewater is one of their primary objectives. The secondary-treated wastewater had low substance of components and mixes with potential.

Table 5: Statistical evaluation of crop yields in the experiments using Industrialwastewater at the 0.05 significance level (α)

Wastewater treatment	Crop	Average yield (t/ha)[1] Control water irrigation	wastewater irrigation	Evaluation α calculated	of differences
Secondary (2016)	lettuce salad	48.7	47.6	0.4402	NS
	radishes'	31.8	28.4	0.6174	NS
	carrots	86.2	84.6	0.5856	NS
	early potatoes	75.1	71.2	0.6452	NS
Primary (2017)	lettuce salad	28.3	33.4	0.0125	*
	radishes	13.1	23.2	0.0009	***
	carrots	78.3	132.41	1.50E-08	***
	sugar beet	97.4	104.7	0.2820	NS
Primary (2018)	lettuce salad	44.3	56.3	3.31E-05	***
	radishes	18.7	23.7	0.1314	NS
	carrots	61.5	124.84	2.10E-06	***
	early potatoes	46.8	61.9	0.013	*

[1]from three replicates, yield per 1 ha recalculated from the yield per area of the growth container (0.0314 m^2) or lysimeter (1.29 m^2), NS – non-significant at P = 0.05, *significant at P = 0.05, **significant at P = 0.01, ***significant at P = 0.001

Contrasted and the control treatment, i.e. irrigation with control water, the wastewater did not have any measurably critical impacts on the yields of vegetables and early potatoes. To some degree higher yields of vegetables and early potatoes in the control treatment as contrasted and the wastewater-irrigated treatment can be clarified by the essentially higher nitrogen content in the control water from the nearby well and in this way its higher measurements Primary treated wastewater contained on finished age ca 14fold measure of aggregate nitrogen (70.6 mg/l,89% in smelling salts frame), 3fold that of aggregate phosphorus and generally an indistinguishable measures of potassium and magnesium from the secondary- treated wastewater. The fundamental plant supplement in this wastewater was along these lines nitrogen, when in doubt. Its substance shifted between the qualities given in the writing. The irrigation with primary – treated wastewater prompted high measures of nitrogen connected to carrots, sugar beet, and potatoes, i.e. plants with long vegetation periods and accordingly high irrigation measures of wastewater. The preparing impact of this wastewater was shown with all vegetablesand crops utilized for the experiments. The expanded yield of the promoted parts of the crops as contrasted and the control treatment might have been, aside from theexperiments with radishes in 2018 and sugar beet in 2017, measurably significant at the 0.05 significance level.

CONCLUSION

The utilization of untreated Industrial wastewater, similar to the training in numerous nations, represents an entire arrangement of various problems. In any case, the high grouping of plant food nutrients turns into a motivator for the agriculturists to utilize untreated wastewater as it lessens compost costs, notwithstanding when the higher supplement fixations may not really enhance crop yields. Most crops, incorporating those developed in peri- urban agriculture; require particular measures of NPK for greatest yield. The structure of Industrial wastewater additionally must be considered. Prevalence of industrial waste gets chemical poisons, which might be lethal to plants at higher focuses. A few components may enter the food chain, however most investigations demonstrate that such contaminations are found in fixations allowed for human consumption. Then again, power of residential wastewater may bring about high saltiness levels that may influence the yield of salt delicate crops.

From an economic perspective, wastewater irrigation of crops under appropriate agronomic and water Administration practices may give the following advantages: (1) higher yields, (2) Extra water for irrigation, and (3) estimation of manure spared. On the other hand, if plant food nutrients conveyed through wastewater irrigation result in supplement over supply, yields may adversely be influenced.

RECOMMENDATIONS

1. Whenever wastewater intended to be used for crop, a control unit should be initiated alongside with the reuse project for scientific purposes and comparisons.

2. Rehabilitation and construction of environmental labs should be carried out immediately providing all necessary apparatuses especially thoseused for testing heavy metals and main nutrients

3. Planned areas of wastewater irrigations suggested by DORCH, 2005 study should be reviewed and extended according to soil and crops types. Crops with high water

requirements may be preferred.

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