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Physico–Chemical Analysis Of Sugar Mill Effluents And Its Effect On Seed Germination Of Paddy (*Oryza sativa*) and Green gram (*Vigna radiata*)

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ABSTRACT

Sugar factories assume a noteworthy part in discharging so as to contaminate the water bodies and land a lot of wastewater as profluent. The sugar plant effluents are having high measure of suspended solids, broke up solids, BOD, COD, chlorides, sulfates and so on. The ceaseless utilization of these effluents destructively influences the yields when utilized for watering system. In the present study, physico-synthetic parameters of sugar factory profluent was resolved and the impact of different fixations (0%, 10%, 25%, half, 75 % and 100%) of the gushing on seed germination, germination pace of Paddy (Oryza sativa) and Green gram (Vigna radiata) was likewise contemplated. The low gushing pH , all out broke down solids, natural oxygen interest and substance oxygen request, show the high inorganic and natural substance with an acidic burden. Germination rates diminish with expanding grouping of emanating in the seeds tried with untreated sugar factory effluents and the germination rate was asusual and typical in the seeds tried with the treated gushing.

Key words: Sugar mill effluent Treated and Untreated effluent , Physico-chemical analysis, Seed germination, Germination percentages , Paddy and Green gram.

INTRODUCTION:

Industrialization is a critical apparatus for the improvement of any country. Thusly, the mechanical movement has extended such a great amount of everywhere throughout the world. Sugar industry is a standout amongst the most imperative agro based commercial ventures in India and is very in charge of making critical effect on provincial economy specifically and nation's economy as a rule. Sugar commercial enterprises rank second among agro based businesses in India. India is the biggest maker of sugar on the planet. Sugar industry is occasional in nature and works just for 120 to 200days in a year for the most part from mid November to a week ago of April.

Today, it has turned into a matter of real worry in the crumbling of nature. With the fast development of businesses (sugar, paper, tannery, material, sago, color commercial enterprises) in the nation, contamination of common water by mechanical waste water has expanded hugely.

Propels in science and innovation and the modern upheaval have empowered people for plot assets. In spite of the fact that industrialization contributes temperate improvement, most imperative regular assets like water and soil are ordinarily contaminated with by-items, waste materials and non-used guardian synthetic mixes. These in-turns eventually influence the agribusiness generation and nourishment security. Dirtied soil and water likewise goes about as optional wellspring of contamination.

India is horticulture based nation and a noteworthy client of water asset for watering system. In any case, there is an extraordinary interest for water for watering system while gallons and gallons of effluents are let out into water sources untreated. Differing nature of sugar modern effluents from different commercial enterprises are arranged off into soil and water bodies, which has been bringing about real contamination issue. The sugar business assumes an imperative part in the monetary improvement of India, yet the effluents discharged produce a high level of natural contamination in both sea-going and physical Ecosystems. (Ayyasamy et al.,2008) To conserve the watering system water mechanical effluents are currently a-days ordinarily utilized for watering system. So it is applicable to comprehend the reaction of modern effluents to yields subject to it.

The most imperative gushing releasing businesses are warm power plants, paper plants, materials, refineries, compost unit, electroplating plants, tannery commercial ventures, sugar factories, sago processing plants, oil refineries, pesticide and herbicide commercial ventures. Mechanical effluents containing overwhelming metals represent a danger to the biological system. Utilization of these modern gushing and sewage slop on horticultural area has turned into a typical practice in India as a consequence of which these lethal metals can be exchanged and get amassed into plant tissues from soil. These metals effectsly affect plants themselves and might turn into a wellbeing issue to man and creatures.

A noteworthy substantial measure of waste is created amid the assembling of sugar and contains a high measure of generation load especially in things of suspended solids, natural matters, press-mud, and bagasses and air contamination. (Bevan, 1971, Hendrickson et.al.1971).

Every one of the commercial enterprises expend colossal amount of water and toss back nearly and equivalent amount of gushing which contains profoundly poisonous materials in broke up or suspended structure. In the event that this water is appropriately utilized or it is sanitized to reuse, an a portion of water lack will most likely be comprehended.

The effluents additionally change the physico-compound attributes, and widely varied vegetation of getting sea-going bodies. Furthermore, sugar processing plant profluent released in the earth represents a genuine wellbeing danger to the country and semi-urban populaces that utilization stream and waterway water for farming and residential purposes. Fish mortality and harm to paddy crops because of sugar industry waste-waters entering rural area have been accounted for .

Sugar industrial facility emanating that has not been dealt with appropriately has an unsavory smell when discharged into nature. Ranchers utilizing these effluents for watering system to decrease water request have found that plant development and product yield were lessened and soil wellbeing was bargained. Since sugar industry effluents are generally utilized for watering system, it is vital to decide how trims react when presented to mechanical effluents.

In such manner, endeavors have been made to decide the impact of treated and untreated mechanical effluents on seed germination of different harvests, for example, rice and green gram.Seed germination is a basic stage that guarantees multiplication and controls the flow of plant populaces, so it is a basic test of plausible yield profitability

The present research center analysis was intended to decide the impact of various fixations (0-100%) of sugar industry profluent treated and untreated on seed germination in Paddy (Oryza sativa) and Green gram (Vigna radiata)

PHYSICO–CHEMICAL ANALYSIS OF SUGAR MILL EFFLUENTS

MATERIALS AND METHODS:

For the present study the effluent was collected in 5 filter can from “THE JEYPORE SUGAR MILLS Co. Ltd ,V.V.S.Sugars” ,Chagallu, West Godavari district, Andhra Pradesh.It was preserved for long period by adding chemicals to analyse in the laboratory, physico-chemical parameters were analysed by standard procedures given by Trivedi et.al.1984 The physico-chemical analysis data of the sugar industry effluent is given in Table.1

RESULTS & DISCUSSION:

1. Colour—In the present investigation the colour of the untreated effluent was dark brownish to brown and treated effluent appeared whitish to yellow.Colour is very important factor for the aquatic life for making food from sun-rays. Photosynthesis activity gets reduced due to dark colouration and affect other parameters like temperature D.O. and B.O.D.etc.

2. Odour—Odour can be defined as the “perception of smell” or in scientific terms as “a sensation resulting from the reception of stimulus by the olfactory sensory system”. Whether pleasant or unpleasant, odour is induced by inhaling air-borne volatile organics or inorganics.

Odour affects human beings in a number of ways. Strong, unpleasant or offensive smells
can interfere with a person’s enjoyment of life especially if they are frequent and / or persistent. Major factors relevant to perceived odour nuisance are:

- Offensiveness
- Duration of exposure to odour
- Frequency of odour occurrence
- Tolerance and expectation of the receptor

Though foul odour may not cause direct damage to health, toxic stimulants of odour may
cause ill health or respiratory symptoms. Secondary effects, in some, may be nausea, insomnia and discomfort. Very strong odour can result in nasal irritation, trigger symptoms in individuals with breathing problems or

asthma. On the economic front, loss of property value near odour causing operations/ industries and odorous environment is partly a consequence of offensive odour.

Odorous substances that are emitted from industrial sources include both inorganic and organic gases and particulate. Many odorous compounds result from biological activity or are present in emissions from chemical processes. Most of the odorous substances derived from anaerobic decomposition of organic matter contain sulfur and nitrogen. In the present study the smell of untreated effluent is decaying molasses smell and that of the treated effluent is normal. Manal etal also recorded unpleasant odour in Faren Nalla and River Rapti, Allahabad.

3.Temperature — Temperature is essentially imperative for its impact on certain compound and natural radiations occurring in water for life form and occupying oceanic media. It relies on season, time testing etc.The watertemperature assumes an essential part in impacting wealth of phytoplankton.T he water released from commercial enterprises, which has by and large higher temperature, influences the area antagonistically ,which might even influence the economy of the item delivered by the business. In the present study temperature of the untreated profluent was recorded in November 420C and in December 400C separately, and temperature of the regarded emanating was recorded as 310C and 300C in November and December individually. The temperature of the release ought not surpass 350C since high temperature might deliver softening of bituminous joints and might be deteropans to the channel material itself. The ascent in temperature quickened the synthetic response in oxygen. Beruch et.al., (1993),. Kannan and Rajasekaran, (1991), recorded the estimation of temperature of printing emanating 28.0C

4. pH— pH is one of the imperative biotic component that serves as a list for contamination. The elements like photosynthetic introduction to air, transfer of mechanical water and local sewage influence pH.pH is the quality communicated as the negative logarithm of the hydrogen particle focus. Its reach is between 0 to 14 and 7 being unbiased, under 7 being acidic or more 7 being fundamental or soluble. The wide portrayal in the pH estimation of emanating can influence the rate of natural response and survival of different microorganisms. The vicinity or nonattendance of different particles can have direct connection with pH of the gushing. Consequently such emanating can impact the nature of soil. The response between profluent spilling out of open seepage framework with the dirt has direct importance to the pH gushing. It is in this way important to assess emanating as for the pH esteem. In the present examination the pH estimation of the untreated effluents was 2.5 and 3.0 in November and December separately and treated gushing was7.5 and 7.5 in November and December respectively. Senthil et.al.(2001), watched the pH of sugar plant emanating is in the middle of 6.0 to 7.6, Avasn (2001),observed the pH of the sugar plant profluent releases from Tummapala sugar production line, Anakapalli (AndhraPradesh) was 6.5 to 8.8 territory. Matkar.S. (2002),observed the pH of sugar plant gushing is 4.5. Thoratt.al.,(1999), watched the pH of the ooze test was 8.4 Khan et.al.,(1999), recorded the pH of pharmaceutical industry untreated emanating in January as 6.68 and treated gushing recorded in January was 7.38. Rao et.al., (1993), watched the pH of material industry profluent shifted from 11.0 to 8.0.

5. Dissolved oxygen — It is a standout amongst the most essential parameter in water quality evaluation.

D.O. is a file of physical and organic procedure going in water. The D.O. levels in normal and also squander water relies on upon physical, substance and natural exercises of the water body. The examination of D.O. is critical in water contamination control and in addition waste water control. Amphibian biological community thoroughly relies on upon broke up oxygen different biochemical changes and its impacts on metabolic exercises of microorganism were extremely very much archived. All the writing aggregately showed the significance of the broke up oxygen fixation. DO is fundamental to keep up assortment of shaping of natural life in water and the impact of water release in water body are generally controlled by oxygen parity of the framework, non-contaminated surface water remaining typically soaked with broke down oxygen. It can be quickly expelled from the water by release of oxygen requesting waste. Inorganic lessening specialists, for example, hydrogen sulfates, smelling salts nitrites and ferrous particles and certain accessible oxidizable substances likewise tend to diminish the oxygen in water. Mitra (1982), reported the prescribed estimation of broke down oxygen in ordinary drinking water was 8 mg/lit .Devi (1980), additionally reported high DO amid rainstorm and low amid summer in Asmaansagar.Mahan (1980), recorded disintegrated oxygen range as 4.61 mg/lit to 6.68 mg/lit in the

Table 1: PHYSICO–CHEMICAL ANALYSIS OF SUGAR MILL EFFLUENTS

Sr.No	Parameter	Untreated Effluent Noveber	Untreated Effluent December	Treated Effluent November	Treated Effluent December	ISI Standards
1	Colour	Dark Brownish	Dark Brownish	Whitish Yellow	Whitish Yellow	-
2	Odour	Decaying molasses smell	Decaying molasses smell	Normal	Normal	-
3	Temperature	42^0 C	40^o C	31^o C	30^o C	Shall not exceed 5^0 C above the reading water temperaure
4	pH	2.5	3	7.5	7.5	5.5 to 9.0
5	D.O	1.29 mg/lit	1.5 mg/lit	3.2 mg/lit	3.5 mg/lit	6.0 mg/lit
6	B.O.D	1850 mg/lit	1660 mg/lit	30 mg/lit & 100 (irrigation)	30 mg/lit & 100 (irrigation)	30 mg/lit & 100 (irrigation)
7	C.O.D	3990 mg/lit	3780 mg/lit	250 mg/lit	250 mg/lit	250 mg/lit
8	T.D.S	2980 mg/lit	2960 mg/lit	1920 mg/lit	1910 mg/lit	2100 mg/lit
9	T.S	3010 mg/lit	3075 mg/lit	2020 mg/lit	2015 mg/lit	2700 mg/lit
10	T.S.S	110 mg/lit	105 mg/lit	100 mg/lit	95 mg/lit	600 mg/lit
11	Total Hardness	473mg/lit	480 mg/lit	-	-	-
12	Chlorides	200 mg/lit	205 mg/lit	185 mg/lit	190 mg/lit	600 mg/lit
13	Sulphates	660 mg/lit	650 mg/lit	320 mg/lit	305 mg/lit	1000 mg/lit
14	Oil and Grease	18 mg/lit	12 mg/lit	8 mg/lit	8 mg/lit	10 mg/lit

winter season. In the present investigation the DO of the untreated effluent is 1.29 mg/lit and 1.50 mg/lit in November and December respectively and the treated effluent was 3.2 mg/lit and 3.5 mg/lit in November and December respectively. Throat et.al., (1999), observed the DO in untreated tamasi effluent 0.5 mg/lit and treated effluent 0.8 mg/lit. Avasan et.al., (2001), observed the DO of sugar mill is ranging between 0-2.0. He observed that if DO is low then it cause anoxic conditions. This causes respiratory distress of fish and fish shows erratic movements.

6. Biochemical Oxygen Demand (B.O.D.)— B.O.D. is characterized as measure of oxygen required by microorganism while settling natural decomposable natural matter in a water vigorous conditions. The natural oxidation is moderate procedure .During oxidation the natural toxins are oxidized by certain microorganism into carbondioxide and water utilizing broke down oxygen. Henceforth bringing down in broke up oxygen worth is the measure of BOD connection. The concoction active component like temperature, weight palette can positively influence the BOD response. Beruch et.al.,(1993), recommended that oxidation of the natural waste by common microorganisms make abnormal state

of BOD (1920 mg/lit of 2100 mg/lit). Natural oxygen interest is an essential parameter that shows the size of water contamination, by the oxidizable natural matter and the oxygen used to oxidize inorganic material, for example, sulfides and ferrous particles. In normal source the oxidizable matter on oxidation goes into biogeochemical cycle.BOD does not work autonomously henceforth it performs well contingent upon such a variety of called factors.The estimation of BOD is low nearly in more extensive months which might be because of lesser amount of aggregate solids, broke up solids, suspended solids in water and in addition to the quantitative number microbial contamination. (Avasan and Rao, 2001). In the present study the untreated effluents BOD was 1850 mg/lit and 1660 mg/lit in November and December individually and treated profluent BOD demonstrated 30 mg/lit and 30mg/lit in November and December separately and it is 100mg/lit when permitted to the rural area for watering system purpose.Senthil et.al., (2001), watched the BOD of sugar factory emanating in a scope of 635 mg/lit to 950 mg/lit . He saw in summer season the estimation of BOD for the sugar factory profluent and it fluctuated from 950 to 635 mg/lit with streaming separation. Trivedi et.al., (1986), watched the emanating of a material industry from various unit BOD estimation of blended profluent extended between 320 mg/lit to 720 mg/lit and last gushing 80 mg/lit to 640 mg/lit.

7. Chemical Oxygen Demand (C.O.D.)— The COD test decides the oxygen required for concoction oxidation of natural matter with the assistance of solid synthetic oxidant. The COD is a test, which is utilized to quantify contamination of local and modern waste. The waste is measured as far as nature of oxygen required for oxidation of natural matter to create carbon dioxide and water. All natural mixes with couple of special cases can be oxidized by the activity of solid oxidizing operators under acidic conditions.COD is a helpful device in pinpointing poisonous condition and vicinity of organic resistance substances. The conjugation of BOD test, with COD test is useful in sign of poisonous conditions and the vicinity of organic resistance. In the present study the COD of untreated effluents was 3990 mg/lit and 3780 mg/lit in November and December individually and treated emanating COD is 250 mg/lit and 250 mg/lit in November and December separately and COD is totally truant in the water supplied to the fields. Devi et.al., (2001), watched COD 500 mg/lit to 550 mg/lit on excited commercial ventures. Significance of natural matter in the environment of blossom firming cyanobacteria has been accounted for by numerous specialists. Trivedi et.al.,(1986), watched COD esteem range from 300 mg/lit to 2400 mg/lit of material industry profluent.

8. Total Dissolved Solids— The greatest convergence of aggregate solids was in summer, which

expanded, in blustery season while the base worth was found in winter most likely in view of stagnation. In summer the vast majority of the vegetation was rotting as an ascent in measure of broke down solids was nonpartisan, as the results of the rotting matter were settled in water. The aggregate solids fixations in waste gushing speak to the colloidal frame and broke up ghosts. The likely purpose behind the variance or estimations of aggregate solids and resulting the estimation of broke up strong because of religious circle impact of the impacting particles. The rate of impact of totaled procedure is likewise affected by pH of these effluents. In the stormy season less centralization of aggregate broke down solids are acquired because of weakening of waste gushing with downpour water. Hosetti et.al.,(1994), have reported aggregate broken up solids in extent 488 mg/lit in waste water for Jayanthinala. Most businesses situated close to the region of in charge of higher qualities. In the present study the disintegrated solids of untreated effluents was 2980mg/lit and 2960 mg/lit in November and December individually and treated examples are 1920 mg/lit and 1910 mg/lit in November December separately. Avasan (2001), watched the sugar plant gushing and the watched that the aggregate broke up solids running between 400 to 1650 mg/lit. Thorat et.al., (1999), examined tannery squander and watched all out broke down solids in emanating 2850 mg/lit. Rao et.al., (1993), examined material mechanical emanating and recorded aggregate broke down strong worth which goes from 8500 mg/lit to 10000 mg/lit

9.Total solids (T.S.)— The term strong alludes to the matter either filterable or in filterable that stay as deposit after worshiping and resulting drying at a characterized temperature utilized for drying and ignition. Diverse types of solids are characterized on the premise of technique connected for their determination.High centralization of aggregate solids amid summer was most likely because of low level of water, the immediate relationship in the middle of precipitation and aggregate solids was ascribed to an expanded heap of solvent salts from the catchment region as a consequences of surface spillover. In gushing aggregate solids all out broke up solids absolute suspended solids are made for the most part out of carbonates bicarbonates, chlorides, sulphates,nitrates, Ca, Mg, Na, K, Mn and natural matter

residues and different particles contaminating water expand the focus f downright solids. In the present study the amount of aggregate solids in untreated emanating was 3010 mg/lit and 3075 mg/lit in November and December individually and that of treated gushing is 2020 mg/lit and 2015mg/lit. in November and December separately. Senthil (2001), watched that the emanating released from sugar plant is running between 4485.0 to 1520 mg/lit with expanding separation (0 to 5 km). Avasan (2001), watched the aggregate solids from the Tummanals sugar industrial facility gushing it extended between 870 to 1950 mg/lit. Ammathusalam. A. (2002), watched the aggregate solids from the sugar business emanating it going between 1979 to 1820 mg/lit.

10. Total suspended solids (T.S.S.)—The T.S.S. affect the light intensity of water, suspended solids are the cause of suspended particles in side the water body influencing turbidity and transparency. Devi (1980), recorded total plankton, which showed a sterling parallelism with suspended solid. Effluent from different industries many have different amount of solid particulate matter either as suspended solids or total dissolved solids. In the present study, suspended solids of untreated effluent were 110 mg/lit and 105mg/lit in November and December respectively and treated effluent 100 mg/lit and 95 mg/lit in November and December respectively. Avasan et.al., (2001), observed the T.S.S. of sugar mill effluent is 220 to 790 mg/lit.

11. Total hardness: — Water hardness is a measure of the (cations = particles which bear positive electron charges) broke down in the water and is in this manner, identified with disintegrated solids. The more cations broke up in the water the "harder" the water. The most widely recognized cations of this sort are calcium and magnesium. Iron, strontium,and manganese might likewise contribute, however they are rarely present in calculable sums. Hardness is generally reported as a proportionate measure of calcium carbonate (CaCO3). Water hardness is the conventional measure of the limit of water to respond with cleanser. It is not created by a solitary substance but rather an assortment of broke down polyvalent metallic particles, transcendently calcium and magnesium cations. Albeit different cations of barium, zinc likewise contribute. All out hardness (TH) is attributes by substance of calcium and magnesium salts.

WHO suggested (100-500 mg/L) as protected passable cutoff for hardness. In ground water, hardness is fundamentally because of carbonates, bicarbonates, sulfates and chlorides of Ca and Mg.In the present study the aggregate hardness of water in untreated profluent is 473 mg/lit with calcium 293mg/lit and magnesium 180mg/lit where as in treated gushing it is totally truant in both the months of November and December. (Table-2)

Table-2: Total Hardness of water

Parameter	Untreated Effluent
Calcium	293mg/lit
Magnesium	180mg/lit
Total Hardness	473mg/lit

Tiwari etal.recorded the Hardness of tap water ranged from a minimum 150 mg/lit. and maximum of 250 mg/lit. Similarly the variation in hardness of bore well water ranged from a minimum 130 mg/lit. and maximum of 280 mg/lit. The hardness of well water ranged from a minimum 100 mg/lit. and maximum of 300 mg/lit. and the hardness range of pond water from a minimum 100 mg/lit. and maximum 150 mg/lit.

12. Chlorides—Chlorides are generally present in natural water. The presence of chloride in natural water attributed to dissolution of salt deposits discharge of effluents from chemical industries oil well operations, sewage discharges initiation drainage, contamination from refuse leachates, and sea water intrusion in coastal area. The chloride content in the river water has beeninvestigated by Singh (1999) & Hanock (1973),stated that its principle source was animal matter, sewage and drainage from refuse and animal matter. Ragagopalan (1980), reported sharp increase in the chloride concentration at the sewage pollution station of the rivers. In the present study chlorides of untreated effluents was 200 mg/lit and 205 mg/lit in November and December respectively and treated effluent showed 185 mg/lit and 190 mg/ lit in November and December respectively. Matkar (2002), observed that the effluent from sugar industry is having 450 mg/lit and 455 mg/lit untreated effluent and the treated effluent was 156mg/lit and 162 mg/lit in November and December respectively.

13. Sulphate— It is one of the significant dynamic happening in common water. Sulfate might enter characteristic water through weathering of stores. It might be drained from sedimentary rocks. Especially from sulfate stores, for example, gypsum and anhydrate. Emanating from specific commercial ventures likewise might be significant wellsprings of sulfate to be accepting

water. Suphur itself has never been restricting variable in sea-going system,the typical levels of sulfates are increasingly that sufficient to address plants issues, scents conditions are effectively more prominent when water is over stacked with natural waste to the point that oxygen is uprooted, that SO4 as electron acceptor is frequently utilized for the breakdown of natural matter and delivered H2S and spoiled egg smell. (Welch 1980). In the present study sulfate of untreated effluents was 660 mg/lit and 650 mg/lit in November and December individually and treated gushing ought to 320 mg/lit and 305 mg/lit in November and December separately. Manal (2002), watched sulfate in sugar industry gushing that was 550 mg/lit and 555 mg/lit in November and December individually which in untreated and treated profluent demonstrated 256 mg/lit and 262 mg/lit in November and December separately. Senthil et.al.,(2001), watched sulfate range between 200 mg/lit to 93 mg/lit by separation from gushing releasing unit to 5 km long.

14. Oil and Grease— It is available in the water and can be removed in petroleum ether, which is immiscible in water and can be isolated by a separatory pipe. Oil, oil, fats and waxes are broken down in suitable dissolvable and isolated from the watery stage. The dissolvable layer is then vanished and the buildup is weighed as oil and oil. In the present study oil and oil present in untreated effluents was 18 mg/lit and 12mg/lit in November and December separately and the treated emanating demonstrated 8 mg/lit and 8 mg/lit in November and December individually. Manal (2002), reported oil and extraordinary in sugar industry gushing extent in the middle of 14 mg/lit to 11 mg/lit (untreated). Thorat et.al., (1999), reported oil and extraordinary was 12 mg/lit and 7 mg/lit separately. Trivedi et.al., (1986), reported oil and oil in material industry emanating from 230 mg/lit to 1798 mg/lit.

EFFECT OF SUGAR MILL EFFLUENT ON SEED GERMINATION OF PADDY *(Oryza sativa)* and GREEN GRAM (*Vigna radiata)*

Collection of Effluent and Seed Materials:

Sugar mill effluent samples were collected from the point of discharge of sugar factory,Chagallu,W.G.District,Andhra Pradesh. Treated and Untreated Sugar mill Effluents were collected in pre-cleaned, acid washed, plastic bottles and containers which was later stored in a refrigerator below 5°C until used.Seeds of Paddy and Green gram were sterilized with 0.1% w/v mercuric chloride solution for 5 minutes to remove microbes and then washed three times with sterile distilled water. The surface sterilized green gram seeds and paddy seeds were equispacially arranged in earthen pots containing three kg of garden soil separately.Seed Germination was assumed to be completed when the radicle pierced through the seed coat

For bioassays, the effluent was diluted to 0%, 10%, 25%, 50%, 75% and 100% with distilled water. These various concentrations (10, 25, 50, 75 and 100%) of sugar mill effluent solution were used for both laboratory and pot culture studies. The pots were irrigated with equal volumes of various concentrations of sugar mill effluent. Control set was irrigated with equal volume of bore-well water. Observations were recorded at 48 hours intervals, the germinated seeds were counted and the number of germinated seeds was expressed as a percentage. The germination percentage was calculated by using the following formula

$$\text{Germination Percentage} = \frac{\text{No. of seeds germinate}}{\text{Total No. of seeds sown}} \times 100$$

RESULTS AND DISCUSSION :

Percentage germination of crop plant seeds varied with respect to different concentrations of effluent (Table-3). The percentage of seeds germinating decreases as the effluent concentration increases. The percentage germination and germination value was maximum at the lower effluent concentrations of 10% and 25%.

Table-3: Germination percentage of Green gram and Paddy on different concentrations of Effluent

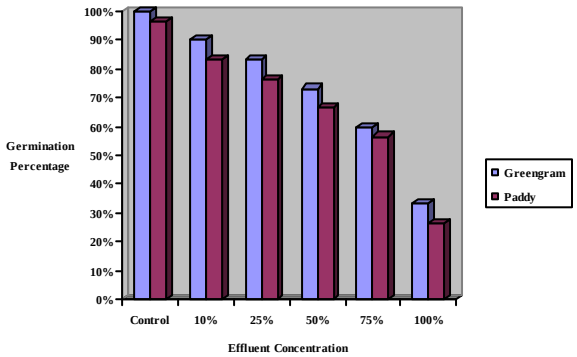
Effluent Concentration	Greengram	Paddy
Control(0%)	100%	96.60%
10%	90%	83.30%
25%	83.30%	76.60%
50%	73.30%	66.60%
75%	60%	56.60%
100%	33%	26.60%

At lower concentrations (10% – 25%) of sugar factory effluent; 75%-85% of the seeds of Paddy and 80%-90% of seeds of green gram had germinated whereas in undiluted effluent the percentage of

Effluent Type	Greengram	Paddy
Control	100%	96.60%
Treated Effluent	100%	98.40%
Untreated Effluent	67.90%	61.90%

germinations were 25% to 60% in both Paddy and Green gram.(Fig-1)

Fig-1: Germination percentage of Green gram and Paddy on different concentrations of Effluent

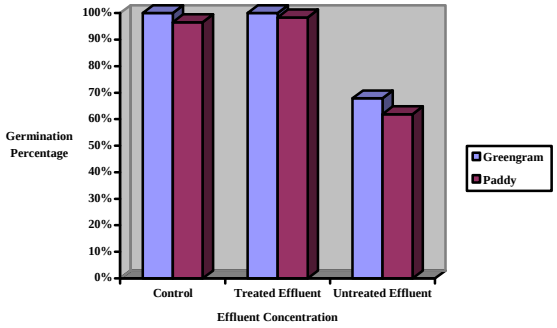


The germination percentage of seeds in control replicas was 100% in Green gram and 96.6% in Paddy where as when the average of seed germination percentages were taken it was recorded as 67.9% in Green gram and 61.9% in Paddy in replicas tested with untreated effluent.(Table-4)

Table-4: Germination percentage of Greengram and Paddy with Control,Treated and Untreated Effluents

Interestingly the seed germination percentages in the pots tested with treated effluents is 100% in Green gram and 98.4% in Paddy which is more than the value of germination percentage of the seeds germinated with normal river water.(Fig-2)

Fig-2:Germination percentage of Greengram and Paddy with Control,Treated and Untreated Effluents



The germination rate and the higher germination rate was seen at 10% sugar plant emanating focus. At higher focuses, the germination rate was bit by bit diminished from 25 to 100% crude profluent. It might likewise be because of the aggravation of the osmotic relations of the seed and water, in this way decreasing the measure of retained water and hindering seed germination by improved saltiness and conductivity of the solutes.Further more, the sprouted seeds won't get any oxygen because of natural and inorganic chemicals present in the gushing. Comparable discoveries were likewise noted by Goel and Kulkarni , Chandrasekar et al. , Priya Kaushik et al. what's more, Bishoni and Goutam .

The expansion in germination rate may be because of the lessening in level of harmful metabolites by weakening and better usage of supplements present in the effluent.The decrease in germination rate at higher fixations might likewise be because of the abundance measure of minerals and supplements present in the effluent.Reduction in seed germination rate at higher convergence of gushing might be because of the higher measure of solids present in the profluent, which causes changes in the osmotic relationship of the seed and water.The diminishment in the measure of water ingestion happen with results into lessening of seed germination because of improved emanating saltiness.

CONCLUSION

* The sugar industry effluent which is untreated highly contains COD, BOD, TSS, TDS, TS and low contents of DO which is toxic, to plants. So it is not permissible for irrigation.
* The treated effluent of sugar industry which is well balanced of chemicals will be suitable for irrigation purpose.

* Treated Effluent released from sugar industry may be utilized for industrial processing again and it is economically profitable for sugar industry.
* Untreated effluent of sugar industry shows higher values of BOD,COD and low value of DO and not suitable for irrigation purpose.
* The germination percentages was found to be gradually decreased when treated with 10% to 100% concentration of Effluent and the more germination percentages were seen when tested with the treated effluents.So the treated effluent is with in the permissible limits
* The treated effluents of industry are not polluted and they satisfy the ISI standard values and therefore can be used for irrigation purpose.

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