Comparison of Utilization of Treated Wastewater from Constructed Wetland for Fighting Fish *(Bettasplendens* Regan) Culture in Rainy and Cold Season.

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The experiment was set by constructing three sets of the wastewater treatment systems; three experimental repeats. Each set included 4 wells. The diameter of each well was 0.7 meters and the depth was 0.25 meters. The 1^{st} and 2^{nd} wells were for *Scirpus mucronatus* Linn. growing ; the $3"^{1}$ well was for lotus *(Nympheae sp)* growing; and the 4^{th} well was for Fighting Fish *(Betta splendens* Regan) culture. Wastewater to be treated was from Sc. 07 building of the faculty of science, Khon Kaen University with the hydraulic loading of 0.03 m^3 / m^2/day. 24 Fighting Fish, 8 fish for each repeat, were cultured in the treated wastewater. 4 weeks after culture, the Fighting Fish was weighed to investigate the increasing weight. The living score of the fish was checked every week along with the testing 5 parameters of the water. These parameters were Temperature, pH, Dissolved Oxygen (DO), Free Carbondioxide(CO,), and Suspended Solid.The resalt was tested by statistical method (3 factorial). The results showed that all fish had increased varied weight. In rainy season the lowest weight increased was 1.93% and the highest was 13.97%; and in winter season the lowest weight increased was 0.17% and the highest was 27.09%. The scoring of living quality of all fish that survived until the end of the experiment showed that those fish has the quality of living in range between normal to good in rainy season while moderately to good in winter season. However, the statistic analysis showed non-significant difference between the living quality of the two seasons. Most of the parameters met the water quality standard for living condition for aquatic organisms. Only some experiments of Dissolved Oxygen (DO) and temperature that was lower than the standard. Some pH and suspended solid were higher than the standard. The temperature between the two season were significantly different at all period of time in a day. The temperature in rainy season (26.0-30.0 degree celcious) was higher than in winter season (18.0-26.0 degree celcious).The pH of the water; in some period of time in a day, were significantly different between the two seasons. The pH in rainy season (5.5-10.9) varied more than winter season (6.5-9.5).Dissolved oxygen of the water; in some period of time in a day, were significantly

different between the two seasons. DO in rainy season (1.5-12.3 mg./L) tended to be lower than in winter season (2.0-15.0mg./L).

Key word : Constructed Wetland,

Degradation of Used Lubricating Oil by Soil Microbial Isolates.

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Study of efficiency of degradation of used lubricating oil by soil microbial isolates was conducted by putting the oil - contaminated soil from a motorcycle - repaired shop, KKU. in the medium containing 2 % (v/v) used lubricating oil as carbon source. Fifteen isolates were found ; 13 species belong to bacteria and 2 species belong to fungi. Three isolates showing the highest growth rates were selected, *Bacillus* sp. U1, *Staphylococcus* sp. U2, and *Arthrobacter* sp. U3, respectively. The efficiency of degradation of used lubricating oil was studied and found that the 3 bacterial isolates degraded the used oil significantly within 20 day. *Bacillus* sp. Ul, had the highest efficiency (33.73 %), followed by *Arthobacter* sp. U3, (22.43 %) and *Staphylococcus* sp. U2, had the lowest efficiency (20.88 %). The rates of degradation were calculated to be 245.8, 189.7 and 161.8 mg oil/L-d by *Bacillus* sp. U1, *Arthrobacter* sp. U3 and *Stapylococcus* sp. U2 , respectively.

Key word : Lubricating Oil, Soil Microbial

Diversity of Ferns along Nature Trail in Phu Khieo Wildlife Sanctuary , Chaiyaphum Province,Thailand.

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Diversity of ferns along the nature trail in Phu Khieo Wildlife Sanctuary , Chaiyaphum province ,Thailand was studied. The observation distance of 3.850 km., (0.0385 km^2) was made since July 2001 to February 2002 (7 months). The number of ferns found were 14 families, 22 genera, 37 species level. Thirty specimens can be identified to species level, 6 specimens can be identified to genus level. Ferns in family Polypodiaceae was the most found (8 species) and at genus level, the *Thelypteris* (Fam. Thelypteridaceae) was found the most (7 species). Some families and some genera, only one species were found and some species were found only one individual, such as *Ctenitis* sp. , *Cibotium barometz* (L.) J.Smith .

Diversity of ferns in four communities, the highest number found was in evergreen forest (9 families, 15 genera, 20 species), the second was in hill evergreen forest (9 families, 11 genera, 15 species), deciduous mixed pine forest (8 families, 8 genera, 13 species) and grassland (2 families, 2 genera, 4 species) , respectively.The most ferns found were terrestrial, such as *Adiantum flabellulatum* L. ,following by epiphytes on other plants or rocks *Platycerium holttumii* Jonch.et Henuipm and no aquatic fern was recorded.

Key word : Diversity of Ferns

Ecological Study of Mushroom *(Amanita vaginata)* in Phundorn-pakho Reserved Forest of Udornthani

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Ecological Study of Mushroom (*Amanita vaginata)* in phusaad Forest which is the part of Phundorn-pakho Reserved Forest of Udornthani using species:area curve method optimum plot's area is 5x5 m and *Shorea obtusa* had the highest importance value (166.32).Studied in physical factor and biotic factor were made since October2001 to Frebuary 2002 (4 month) found *Amanitavaginata* in three plot (1)17°08'42.6"N,102°43'56.5"E,(2)17°08'43.8"N,102°43'55.6"E and (3)17°08'45.8" N,102°43'57.3"E. Physical factor studied in 2 level:in atmosphere and in soil.The physical factor in atmosphere temperature were 30-31°Cin air, 30°C right above the mushroom,and 28-28.5 °C in soil,Humidity (66.5-75.6%),slope(0-5%),light intensity(682-854 lux),wind velocity(0.2m/s),wind direction(SW to NE),precipitation(0.5m1/day).Physical factor in soil studied were soil texture (sandy loam),soil profile(0-6cm was A-horizon,6-20cm was B-horizon,>20cm was rock layer),soil moisture(13.76- 16.35%),soil density(0.6-0.9g/100cm^3) ,soil pH (4.73-4.91),electro conductivity(0.0234-0.0260 mmho/cm)and organic matter(2.39-2.61%).The biotic factor studied found 5 tree *Shorea obtusa* Wall. Ex Blume *T, Dipterocarpus obtusifolius* Teijsm. ex Miq. *T, Castanopsis schefferiana* Hance *T, Dialium cochinchinense* Pierre *T* and *Syzygium* sp.:,forest floor plant *Vietnamosasa pusilla* -(Chevalier & A.Camus) Nguyen *B , Microcos tomentosa Sm. T, Scleria* sp. , *Memecylon pauciflorum* Blume *S , Heritiera parvifolia* Merr. *T, Dalbergia cochinchinensis* Pierre *T, Imperata cylindrica* (L.) P.Beauv. *G,* UNKOWN 1, UNKOWN 2, and UNKOWN 3.Animal found 4 species: order Hymenoptera(2 species), order Termitidae and order Araneae.

Key word : Ecological Study, *Amanita vaginata*

Efficiency of *Spirulina* spp. Isolate from Wastewater Treatment Plant for Nitrate Reduction.

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Efficiency of *Spirulina* spp. Isolated from the Khon Kaen University wastewater treatment plant for nitrate-nitrogen reduction was study. It is found that, *Spirulina* spp. was isolated from the third pond of the treatment plant and it best survived in at a concentration of 75% wastewater. The growth was not significantly different at different levels of nitrate-nitrogen concentration (0.7,0.9,1.1,1.3 and1.5 mg/l) within 14 days. *Spirulina* spp. , however, reduced nitrate-nitrogen significantly ($p<0.05$) and at 0.9 mgNO_3-N/l had the highest. In order to compare the efficiency, the reduction per unit biomass were studied. Within 14 days of the study, the wastewater with 0.9 mgNO_3-N/I had the highest removal efficiency, at 72.30%. In contrary, at 1.5 mgN0,-N/1 had the lowest reduction efficiency, only 56.46% per gram of the algae was reported. Majority of the experiments (60%) reached the maximum efficiency of nitrate reduction within the first 4 days.

Key word : Efficiency of *Spirulina* spp., Treatment Plant**,** Nitrate Reduction.

Efficiency of Constructed Wetlands in improving pH , Dissolved Oxygen (DO) and Biochemical Oxygen Demand (DOD) of Wastewater from Sc.07 Building , Khone Kaen University.

Student : Miss Siriwan Whasuwan

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Department of Environmental Science, Faculty of Science , Khon Kaen University. Thailand.

Constructing three sets of the wastewater treatment system set the experiment; three experimental repeats. Each set included4 well. The diameter of each well was 0.70 meters, and the depth was 0.25 meters. The first and second wells was for grow *Scirpus mucronatus* the third well was for grow *Nymphaea* sp.and the forth was for accept the water that has been treatment . Wastewater to be treated was from Sc.07 building of the faculty of Science, Khon Kaen University with the hydraulic loading of 0.03 m^3/m^2/day .The result of the experiment showed that pH of wastewater varied in wide range. From the statistical analysis, it was found that the pH varied with time in a day. It showed highest value 10.00, at 02.00 p.m. It was lowest at 02.00 a.m. and 08.00a.m. in range between 5.77 — 7.60 .The pH also with the duration of experiment (7 week). From the experiment, once the result did not meet the standard for wastewater from type a. building. The amount of Dissolved Oxygen (DO) was getting higher while it had been treating through each well. From the statistical analysis it varied with times in a day significantly. It was highest at 02.00 p.m., which was 10.70 mg/l. It was lowest at 02.00 a.m., which was 1.6mg/i. There is no standard for this. The efficiency of Biochemical Oxygen Demand (DO) reducing was highest at 80. 83 % and lowest at 68.29 %.It decreased as the water got through the wastewater treatment system. From the statistical analysis, it was found that the duration of the experiment did not effect the BOD value. It also met the standard for wastewater from type a. building.

Key word : Efficiency of Constructed Wetlands, improving pH , Dissolved Oxygen (DO) and Biochemical Oxygen Demand (DOD)

Efficiency of Constructed Wetlands in reducing COD, PO_4^3 , SS and TDS of Wastewater from Sc.07 Building, Faculty of Science, Khon Kaen University in rainy season.

Student : Mr. Thanawat Antachai

Project advisor : Associate Professor. Kitti Akamphon

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Efficiency of constructed wetlands with hydraulic loading of 0.03 m^3/m^2.day, in reducing Chemical Oxygen Demand (COD), Phosphate ($P0_4^3$), Suspended Solids (SS) and Total Dissolved Solids (TDS) of wastewater from the Sc.07 building, Faculty of Science, Khon Kaen University in rainy season (July — October, 2001) were studied. The results indicated that constructed wetlands could reduce Chemical Oxygen Demand ranged from 71.30 to 90.16 %, Phosphate's reduction ranged from 61.65 to 88.26 % and Suspended Solids's reduction ranged from 51.28 to 72.11 %. In addition Total Dissolved Solids's was reduced in the range from 47.00 to 65.53 %. When comparing with the quality of treated wastewater from building effluents standards type A., it was found that SS and TDS of the treated wastewater met the water quality standards. There is no water quality standards for COD and $P0_4^3$ to be compared.

Key word : Efficiency of Constructed Wetlands, reducing COD, PO_4^3 , SS and TDS

Heavy metal in rain fall in Khon Kaen university.

Student : Mr. Bancha Kophajon

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The analysis of heavy metal in rianfall ,rainwater,conductant and pH value of the rianfall in Khon Kaen university The exampling of rianfall in Khon Kaen university for 3 station : Student domitory No. 17 ,West Sethan pond and Meteorogical supstation for Agricuture,Faculty of Agricuture

The results from experiments show that the rian water were averaged 414.62 , 414.23 , and 404.42 mm. respectively The conductant were averaged 0.039 , 0.030 , and 0.024 mmhos /cm respectively and the heavy metal which had analysed by Atomic Apsorption Spectroscopy Amout of Lead were in the range 0.0156-0.0181 mg/L Amout of Cromium . were in the range 0 .0010-0.0013 mg/L Amout of Copper were in the range 0.0003-0.0008 mg/L.

Key word : Heavy metal, rain fall

Phytoplankton in Oxidation Ponds at Surface and Provide Information Through Information Technology System.

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Project advisor : Asst.prof.Turenjai Dooljindachabaporn

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Studies of Phytoplankton in Oxidation ponds, Srinakarin Hospital Wastewater Treatment Plant . Khon Kaen. University and Provide of information through Internet,were inverstigated.The plankton samples were collected during January — July 2001 . The total number of phytoplankton at up wind were 4 division 28 genera 43 species. There are 18 genera 25 species of the Chlorophyta, 3 genera I I species of Euglenophyta, 3 genera 3 species of Cyanophyta, 2 genera 2 species of Chrysophyta and 2 species were unidentified. The most of genera was *Scenedesmus* and *Phacus* (4 species) followed by *Tretraedron* (3 species) .The total number of phytoplankton at down wind were 4 division 28 genera 41 species. There are 17 genera 24 species of the Chlorophyta, 4 genera 10 species of Euglenophyta, 3 genera 3 species of Cyanophyta, 2 genera 2 species of Chrysophyta and 2 species were unidentified. The most of genera was *Scenedesmus* and *Phacus* (4 species) followed by *Tretraedron* (3 species) . Three species were not found in Kachain(2000) which were Unknown 1-3 . When the statistic comparition with RCBD of SAS program inface dissolved oxygen (DO) and spicier of phytoplankton are different while direction of wind , temperature , pH and salinity are not different . Provide information through website www.champa.kkmac.th/turenjai/plankton2001/index.asp.th/

Key word : Phytoplankton, Oxidation Ponds

Quantitative Analysis of Methylparathion in water from rice paddy.

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Analysis of methyl parathion in water from rice paddy by gas chromatography technique found methyl parathion in only one rice paddy out of three, and the quantities were 0.13 and 0.14 ppb in August and October respectively. When compared to water quality standard for methyl parathion in water(0.02 ppm) found that the quantities were less so that the organisms could survive. There was no significant difference between 4 physical factors, which were pH, Dissolved Oxygen (DO), Electric conductance (EC), and water temperature, in each rice paddy. Therefore, this cannot be concluded about the relationship between quantity of methyl parathion and those physical factors. Gas Chromatography technique used in this study showed that it could detect the amount of methyl parathion in water. However, condition used was not suitable, as a result, it needed to be adjusted to find the best result for such analysis.

Key word : Quantitative Analysis, Methylparathion

Quantitative Reduction of DDT Residue from Water using Adsorption Method with Activated Carbon, Cation Exchange Resin, Charcoal and Coconut.

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Project advisor : Asst. prof. Dr. Pisit Chareonsudjai

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This study aims to quantitatively reduce of DDT residue from Water using adsorption method. Four adsorbents are selected to use in this experiment. The first two adsorbents are Activated carbon and Cation Exchange Resin, which are commonly use in present times household water purifier. Charcoal and Coconut husk are easily found resource. Four adsorbents are experimented to find the optimum time and effectiveness.

The result shows that the optimum adsorption time is 30 minutes. The highest efficiency adsorbent to reduce a DDT pesticide from water is Activatedcarbon (91.71 ± 0.79). The next ones are - Charcoal (91.41 ± 0.65) and Coconut husk (89.07 ± 1.15). The least efficiency is Cation Exchange Resin (65 ± 3.91 %)

Key word : Quantitative Reduction of DDT

Study of the decomposition rate of plant residues in salt affected soil.

Student : Miss Tussapom Thanajaturon

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To study decomposition rates of 3 plant residues (rice husks, rice straws and dry cassava leaves) in saline soil of 4 levels (non-salt, slightly salt, moderately salt and heavily salt). The decomposition rates were checked every two weeks during July-September (rainy season) 2001. The experiment was conducted at Tumbon Ban Ped, Amphor Muang, Khon Kaen province.

The result of the experiment indicated that the dry cassava leaves have highest decomposing rate then the rice straws and rice husks, respectively. The highest decomposable fraction of the cassava leaves was in moderately salted soil at 47.46% and increasing salinity cause the decomposable fraction to reduce to 35.88%. The highest decomposable fraction of the rice straws was in moderately salted soil at 56.27% and increasing salinity causes the decomposition fraction to reduce to 30.67%. For the rice husks, the highest decomposable fraction was in moderately salted soil at 25.69%, but the lower decomposable fraction was in non-salted soil at 17.78%. The tendency of decomposition rates of 3 plants residues were decreased along with the time. However rates of decomposing were varies. The dry cassava leaves took shortest time to decompost and the second was rice straws and the rice husks was the last one to decompost.

Key word : decomposition rate, affected soil

Study on Species and Density of Mosquito Larvae in Constructed Wetlands.

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The study on mosquito larvae species and density in constructed wetland in rainy and cold season. The 3 parameters; pH, temperature and BOD were studied along. The study was set by constructing 3 sets of-wastewater treatment system, for 3 experimental repeats. Each systems included 3 wells which the I' and 2nd wells were for *Script's inucronatus* Linn. growing, and the 3rd well was for lotus (*Nymphaea* sp.) growing. The wastewater flow from the to 2d and to the 3rd well respectively. The hydraulic loading was 0.03 $m^3/(m^2/day)$ for all 3 systems. The wastewater to be treated was from Sc.07 building, the faculty of Science, Khon Kaen University. The result showed that only one species of mosquito larvae was found which was culex mosquito *(Culex* spp.). The highest density of the mosquito larvae was in the first well for both in rainy and cold season and there was lower in the 2nd and 3 rd well. From the statistic test(T-test), the density in 2nd and 3rd wells were non-significantly different(P-value>0.05). The comparison of the number of mosquito larvae between rainy and cold season, it was found that the 2nd and 3rd wells were non-significantly different(P-value>0.05), however it was significantly different in the 1st wells(Pvalue<0.05). The mosquito larvae number in the cold season was higher than in rainy season. The BOD of *the* water tended to decrease from the l st to 2nd and 3rd well respectively. The BOD of the wastewater in cold season was lower than in rainy season in all wells. The temperature in rainy season was in range between 24.83-30.83 C° and in cold season it was in the range of 19.17-25.27 C°. The pH value of the wastewater in rainy season was 5.1-8.97, and in cold season was 6.077.97. From the statistic test, correlation analysis, showed that all parameters weren't related to the mosquito larvae number in rainy season. In cold season only pH value in the 1St well was related to the mosquito larvae number in reverse direction. The BOD and temperature weren't related to the mosquito larvae number(R>0.05).

Key word : Species and Density, Mosquito Larvae

Study Water Use of *Eucalyptus camaldulensis* on Severe Saline Soiland Non Saline Soil Areas at Ban Dong Bung and Ban Phonsim in Yang Talad District, Kalasin Province.

Student : Miss Prawatwit Srichangsa

Project advisor : Asst. prof. Dr. Pisit Chareonsudjai

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The objective of this study is to compare the water use of *Eucalyptus camaldulensis* **on** severe saline soil area at Ban Dung Bung, classified as discharge area with soil salinity of higher than 4 dS/m and the *Eucalyptus camaldulensis* plantation at Ban Phonsim, classified as non saline soil area. Both plantation are location at Yang Talad district, Kalasin Province. The Heat Pulse Velocity (HPV) technique was used to verify the water use of *Eucalyptus camaldulensis* At severe saline soil area, tree with sapwood areas ranging from 18.70 — 50.30 sq.cm used water from 2.95 — 18.72 liter/day. Where as, in the non saline plantation trees have more sapwood areas ranging from 23 — 89.70 sq.cm used water from 7.94 — 28.04 liter/day. In conclusion, their water uses were higher on non saline soil area than severe saline soil area.

Key word : Saline Soiland

The study of ethanol quantity from corn *(Zea mays)* fermentation.

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The study of ethanol quantity from corn fermentation, hydrochloric acid and heat for 16 hours were used for saccharification. Comparative test between the fermentation by added ammonium sulfate for yeast *(Saccharomyces serevisiae)* and the fermentation of corn only. The result showed that the highest amount of ethanol from corn with ammonium sulfate was 2.12 g/l. When compare with quantity of ethanol without ammonium sulfate, they were significantly different. The corn fermentation which non ammonium sulfate gave the highest amount with 2.09 g/l.

Key word : ethanol quantity,

Utilization of Treated Wastewater from Constructed Wetland for Fighting Fish *(Betta splendens* Regan) Culture.

Student : Mr. Nitikul Chantawira

Project advisor : Associate Professor Kitti Akamphon

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The experiment was set by constructing three sets of the wastewater treatment systems; three experimental repeats. Each set included 4 wells. The diameter of each well was 0.7 meters and the depth was 25 centimeters. The 1 st and 2nd wells were for *Scirpus mucunatus* Linn. growing ; the 3rd well was for lotus growing *(Nympheae sp);* and the 4th well was for Fighting Fish *(Betta splendens* Regan) culture. Wastewater to be treated was from Sc. 07 building of the faculty of science, Khon Kaen University with the hydraulic loading of 0.03 m^3 / m^2/day. 24 Fighting Fish, 8 fish for each repeat, were cultured in the treated wastewater. 4 weeks after culture, the Fighting Fish was weighed to see the increasing weight. The living score of the fish was checked every week along with the testing 5 parameters of the water. These parameters were Temperature, pH, Dissolved Oxygen (DO), Free Carbondioxide(CO_2), and Suspended Solid.

The results showed that all 24 fish had increased varied weight. The lowest weight increased was 1.93% and the highest was 13.97%. The scoring showed that all fish has the quality of living in range between normal to very good. Two fish died in the third week of the experiment.

All the parameters met the standard of the water quality standard for living aquatic organisms. Only some experiments of Dissolved Oxygen (DO) that was lower than the standard, and they were between 1.5-12.3 mg/L. Some pH were higher than the standard, between 5.5-11.2. Temperature, pH, Dissolved Oxygen (DO), Free Carbondioxide (CO_2) varied with times in one day. Temperature, pH, and Dissolved Oxygen (DO) were highest at 02.00pm. and lower at 02.00am and 08.00am. Free Carbondioxide (CO_2) was in the opposite direction, it was lowest at 02.00pm, and highest at 02.00am,between 0.0-19.0 mg/L. Suspended Solid was not varied by time in a day, and all valued were in range of the water quality standard for living aquatic organisms which in the range of 3.0-12.0 mg/L.

Key word : Treated Wastewater, Constructed Wetland

Utilization of Treated Wastewater from Constructed Wetlands for Ornamental-fish (Zebra Danio Fish , *Brachydanio rerio)* during Rainy Season and Winter Season

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Project advisor : Associate Professor Kitty Akamphon

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Treated waste water from Sc.07 building, Khon Kaen University by means of Constructed wetlands system with hydraulic retention time of 0.03 m^3/m^2 /day was used in culturing *Brachydanio rerio* during rainy season (September to Octorber 2001) and winter season November-December 2001). Water quality parameters, i.e. temperature, SS, DO, CO_2 and pH were studied. In rainy season, the average temperature, SS. DO, CO_2 and pH were in the range of 27.4-28.2 $^{\circ}$c , 5.0-8.0 mg/l, 4.6-6.9 mg/l, 7.6-11.3 mg/l and 6.5-10.0; respestively. In cold season, the average temperature, SS, DO, CO, and pH were in the range of 20.1-24.1 $^{\circ}$c. , 8.0-26.8 mg/l, 5.98.4 mg/l, 4.2-9.4 mg/l and 6.9-7.5; respestively. It was found that temperature and SS in cold season a litter bit beyond the standard for aquatic lives sustainability. But the living condition of *Brachydanio rerio* was in good level. Every fish survived in the water and the average weight had increased due to the ability to adjust of *Brachydanio rerio.* From the statistical test it was found that the average temperature and SS in both seasons were significantly different (P-value < 0.05). While the average DO, CO_2, pH, increasing of fish weight, and the mark for the fish living condition were not significantly different (P-value > 0.05).

Key word : Treated Wastewater, Constructed Wetlands