The material for the present study was collected from the effluent steam of eleven different industries situated at Rohtak. Data on the physico-chemical characteristic of these industries and their effects on seed germination, seedling growth, fresh weight, dry weight, total biomass, nutrient uptake by the plants and soil characteristics have been presented.

Physico-Chemical Characteristics of the Effluent

The effluents of all the factories were acidic except Milk factory and Om Surgical. The effluent of these industries were alkaline. The effluent have objectionable amount of BOD, COD and chloride in most of the industries. The effluents contained variable amounts of plant nutrients such as Ca, Mg, phosphate & sulphate. They also contained other toxic metals and total suspended solids in varying concentrations. None of the industries contain cadmium, lead and chromium except LPS & J.C. Fastner where chromium was present more than the permissible limit. Calcium was recorded higher than the permissible limits only in Sugar & Om Surgical factory while Magnesium was higher only in Milk Plant. Sulphate was more than the permissible limit only in Manu Steel & Manish Seel. The amount of alkalinity was more than permissible limit in Milk, Sugar & Om Surgical industry. All the industries contained...
higher values of Iron i.e. more than the permissible limits except Milk Plant, Sugar Factory and Om Surgical.

Effects of Industrial Effluent on Seed Germination

The effects collected from eleven industries (Milk Plant, Sugar Factory, Om Surgical, L.P.S., J.C. Fastner, R.R. Metal, Amba Electroplating, R.B. Steel, Manish Steel, Hanumant Wire and Manu Steel) of Rohtak have been carried out on seed germination of Wheat, Raddish, Jawar and Ladyfinger crops. There was 100% germination in control for all the crops except Ladyfinger where in control the germination percentage was less than 100% in some industrial effluent. The milk plant effluent at 25% concentration give rise to 100% germination like the control in all the studied crops. Except Ladyfinger i.e. 93.3%. At 100% effluent concentration of milk plant, the germination ws slightly diminished. It was upto 70% germination. Sugar plant effluents at 25% concentration showed the germination percentage nearly 90% for all the crops. The seed germination in Sugar plant effluents at 100% concentration was 83.3% in Raddish 86.6% in Wheat and Jawar, 60% in Ladyfinger.

The effluent collected from other industries showed the germination percentage at 25% concentration in the range 70% to 80% for Wheat, 66.6% to 73.3% for Raddish and 70% to 83.3% for Jawar, 50 to 70% for Ladyfinger. As the effluents concentration increased the percentage for seed germination for all the crops also decreased. Due
to the toxicity of industrial effluent there was lowest seed germination (33.3%) in case of Ladyfinger at 100% effluent taken from L.P.S. industry. Likewise the lowest seed germination in Ladyfinger (36.6%), Raddish & Jawar (43.3%) were reported at 100% effluents concentration taken from R.B. Steel.

Effects Of Industrial Effluents On Seedling Growth & Biomass

The seedling growth was measured by taking the root length and shoot length from 10 days old seedlings while the fresh and dry weight of the root have been taken for biomass. The data for the root length and shoot length indicate that the growth of plants were maximum in the 25% of effluents taken from Milk Plant and Sugar factor over control. The slight increase over control was observed in Om Surgical. Among the four crops Wheat is showing maximum root length, shoot length in Milk Plant and Om Surgical industries while in Sugar Mill, Raddish is showing maximum root and shoot length. The growth was gradually decreased with the increased concentration. The effects of effluents taken from other industries (L.P.S., R.B. Steel etc.) indicate that there were continuously decreased in growth over the control. The Wheat plant is least effected while Bhindi is most effected crop in the different effluent concentration.

Fresh and dry weight of the root and shoot reported that the growth of plant i.e. root and shoot weight increasing from control to the 25% effluent water of Milk Plant, Sugar Factory and slightly increase in
Om Surgical. The total biomass was found increased at 25% effluent of Sugar, Milk & Om Surgical industries. The biomass was found to decreased over control in the effluents taken from other industries.

The Effects of Industrial Effluent On Nutrient Uptake On Crop & Vegetable Plants

The effect of different industrial effluents uptake by Wheat, Jawar, Raddish & Bhindi have been studied. In the effluent of Milk Plant & Sugar industries the Calcium, Magnesium and Sodium uptake was higher than the control at 25% concentration. The uptake of Ca and Mg was higher in Om Surgical. At higher effluent concentration i.e. more than 25% the uptake of Ca, Mg and Na was less than the control. Phosphate uptake was in increasing order in Milk Plant and Sugar Industry while it was in decreasing order in Om Surgical in the different effluent concentration. Micronutrients (Fe, Zn, Cu) uptake showed slight increased in values at different effluent concentrations. In rest of the industries the macronutrients uptake was less than the control and was found decreasing in order as the effluent concentration increased for all the crops except Na level increased at higher effluent concentration in L.P.S. and J.C. Fastner industry. The level of Micronutrients uptake was recorded higher in all the crops for rest of the industries according to the presence of these nutrients in the effluent.
Effects Of Industrial Effluents On Soil Physio-Chemical Characteristics

The characteristics of the soil were examined after the plant harvesting. Soil irrigated with milk plant effluent showed no significant changes in the pH, while organic carbon, available P, Ca, Mg percentage increased with the increase in the amount of the effluent. Maximum increased in these parameters was observed at 100% effluent. Effluent of Sugar Mill, L.P.S., R.B. and all rest of the industries decreased the pH of soil but increase available P, Ca & Mg was observed. Increase in the organic carbon was maximum in soil treated with Milk Plant, Sugar Mill and Om Surgical effluent while soil treated with effluents of other industries showed no significant changes in the organic carbon contents. Water holding capacity of the soil decreased in soil treated with the different concentration of effluents. These observation are similar in all the industries. However, the water holding capacity does not decreased much in the soil treated with the effluents of Milk Plant & Sugar Industry. The presence of micronutrients (Fe, Zn, Cu & Cr) in treated soil increased depending on the concentration of effluents and presence of these in the raw effluent.

The Effect Of Industrial Effluent On Yield Of Crop And Vegetable Plants

The yield has been taken after harvesting the mature crop and it was found that the yield of Wheat, Raddish, Jawar were considerably high at 25% effluent concentration of Sugar, Milk & Om Surgical
Industries in comparison to control. The yield of crop grown in other factories effluents were found to be in decreasing order in comparison with control. The yield at 100% effluent was found lowest in all the crops. In small scale steel industries treated effluent yield was much lower at all the effluent concentration for all the crops and vegetable plants. However, lowest yield was reported in crops treated with L.P.S. effluent.

The following will be the detailed chapter-wise distribution in the thesis.

CONCLUSION

Industrial effluents let out from the industries are either discharged into the canal or in the fields around the industrial areas. The industrial effluent influence considerable the major and micronutrients status of the soils. A critical study of the industries effluent on the crop and vegetable plants suggest that the fresh dairy effluent, Sugar Mill effluent and Om Surgical effluent discharged as waste may be utilized as an additional potential source of liquid fertilizer upto 25% concentration and need to diluted above these concentration. The concentration should be reduced to beneficial levels of nutrients such as nitrogen, potassium and magnesium etc. by diluting with ordinary water. The other industries effluents used in the present study have adverse effect on both the soil property and growth of crop plants. In addition the present study has also shown hat there is accumulation
of minerals in the soil after continuous irrigation which causes decrease
the water holding capacity of the soil. They may probably have lethal
effects on plants after a few years of cultivation using effluents. The
present study revealed that *Triticum avestivum* is more tolerant to the
industrial effluents and *Ablmoschus esculantus* is most sensitive to he
industrial effluent. However, *Raphanus sativus* is found to more tolerant
to the toxic substances released by L.P.S. & Hanumant Wire Industry.
In case of Manish Steel *Sorghum vulgare* is found to be highly tolerant
to the effluent. The overall germination percentage and plant growth for
different studied crop plants found in order: *Triticum avestivum>*
*Raphanus sativus>*Sorghum vulgare>*Ablmoschus esculantus*. It is
suggested that effluents should be subjected to primary treatment
which brings down the concentration of toxic substances and hence
treated effluents could be used after suitable dilution. This is of prime
concern as far as the industries located in the areas like Rohtak. Such
factories can either recycle the waste water after treatment or after
dilution the same effluents could be used for irrigation. This would pave
the way not only for the safe disposal of the water but also boosts our
agricultural production.