SUMMARY AND CONCLUSION
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Next to air, water is most important constituent of life support system. It is an important natural resource. We depend on water for irrigation, industry, domestic needs, shipping, sanitation and disposal of wastes. Most of our water bodies like ponds, lakes, streams, rivers, and oceans have become polluted, due to industrial growth, urbanization and other man made problems.

The increased human interference has lead to increased water pollution problem. Water pollution is defined as the addition of any substance to water or changing of water's physical, chemical and biological properties which interfere its
legitimate use. The assessment of water quality reflects its, physical, chemical and biological properties. In fact the biological and physico-chemical data together provide, converging lines of evidence, that supplement each other.

Of the many rivers of Gujarat, a few rivers have been studied so far. The present investigation was undertaken to study the pollution status of rivers like Sabarmati, Khari, Shedhy and Vatrak, at the Kheda region of Gujarat. Seven sampling stations were fixed to cover the four rivers, and regular physico-chemical and biological characters were monitored for a period of two years.

Physico-chemical properties of different river waters showed great variations even at different sites of the river. The first site of river Sabarmati showed alkaline pH throughout the study, while the second and third site showed acidic range in most of the collections. This occurred because of the confluence of highly acidic Khari river with Sabarmati. The pH of the Sabarmati river was affected to a great extent.

The D.O. also showed a similar trend throughout the study. Comparatively fair D.O. was observed at the first site, while at the second and third site it was very low. A similar trend was observed for most of the parameters. No regular seasonal variation of any parameter was observed in this river as
it received intermittent discharges of industrial and domestic wastes from time to time.

Khari river also showed erratic fluctuations in all the parameters. The dissolved oxygen was absent throughout the study except for a month or so. The pH of this river water was highly acidic, particularly in summer months, when the effluent get concentrated probably because of high evaporation rate. Total solids, phosphate, sulphate, calcium etc. were also very high. The BOD and COD values were too high. The COD value was three to four times higher than BOD values indicating the presence of high oxygen demanding wastes which are not biologically degradable.

River Shedhy and Vatrak showed comparatively less values of most parameters, indicate its less polluted nature. Good D.O. content and suitable pH range was observed throughout the study. However, these rivers also receive lot of sewage and other domestic wastes from various towns through which it flows.

The phycological analysis showed the dominance of Cyanophyceae in river Sabarmati. This group was represented by 28 taxa belonging to 11 genera. The occurrence of Cyanophyceae in polluted habitats is well established and the dominance of this group indicates highly polluted nature of river Sabarmati. Highly pollution tolerant species of Oscillatoria were the main
representatives of this group. Bacillariophyceae was next dominant followed by tolerant forms of Chlorophyceae and Euglenophyceae. Desmids were absent in the river and hence some of the Nygaard's indices were not scored for the river. Palmer's index showed high value. A generic index value of 33 and species index value of 34 were recorded from the river. Dominance of Cyanophyceae, absence of desmids, and high Palmer index scores; indicate the highly polluted nature of river Sabarmati.

River Khari can be considered "Ecologically dead" as this river is devoid of aquatic life. The highly acidic nature, absence of dissolved oxygen and high concentration of organic and inorganic toxic substances were responsible for total destruction of aquatic life.

River Shehdy and Vatrak found to be much healthier showing diverse algal flora. Chlorophyceae was the dominant group indicating its comparatively less polluted nature. It was represented by 32 taxa belonging to 10 genera. Different species of desmids were recorded from the river. Euglenophyceae was represented by only two forms while a better representation was there for Cyanophyceae and Bacillariophyceae. Palmer's species pollution index value showed less value. It scored 17 each for river Shehdy and Vatrak. The presence of Desmids, poor growth of
Euglenophyceae, and less values of Palmer's index values indicate the less polluted nature of these rivers.

The order of pollution level of the four rivers is as follows:

Khari > Sabarmati > Shedhy > Vatrak

Besides physico-chemical and phycological evaluation of river Khari, bio-assays with different test systems also showed its highly toxic nature. The test alga Anacystis nidulans was found to be the most sensitive among the four organisms studied. Alga could not sustain growth in any concentrations of the effluent. However, when its pH was adjusted to 7.2 the alga was able to upto 10 per cent effluent and the LC-50 values found to be 4 percent effluent. Anacystis, which is not considered to be a very sensitive species for such test, could not grow in any of the concentration, further supports the highly toxic nature of the effluent. Daphnia and fish, the other two test systems were also severely affected by the effluent. The effluent found to be very toxic even at low concentrations to both Daphnia and fish. The LC-50 values for Daphnia was 13 and for test fish 12 percent effluent in acute toxicity test. Death occurred within few minutes of exposure at higher concentrations. However, when the pH and DO were adjusted, the toxic effect was reduced a little, and the LC-50 value increased to 20 per cent effluent.
concentration for fish. The effluent found toxic at lower concentrations when exposed for longer time. The chronic effect on biochemical parameters revealed its toxicity even at very low concentrations. An alarming drop was observed in all the biochemical constituents of the muscles of the test fish. At 5 per cent effluent concentration the decrease was 32.13, 6.32 and 59.4 per cent respectively for glycogen, protein and lipids in the raw effluent. While it was 44.1, zero and 69.94 percent for the adjusted effluent. At 10 percent effluent concentration of adjusted effluent, the decrease was 81.8, 26.91 and 76.68 percent respectively for glycogen, protein and lipids. The decrease in biochemical constituents may be due to the utilization of energy reserves to counteract the stress conditions.

Higher plants showed better tolerance to this effluent. Their seeds were able to germinate upto 75 percent concentrations. However early seedling survival was affected. The LC-50 values found were between 40 to 50 percent effluent concentration. Root growth, shoot growth and phytomass formation found affected severely. Roots did not elongate; they remain, short and robust at higher concentrations, and the seedlings died off as the exposure time increased. The Mustard found to be the most sensitive, among the three plants. It did not show growth at concentrations above 25 percent of the sample.
The bioassay studies with all the test systems indicate toxicity of this effluent. The effluent requires to be diluted by 95 percent before being discharged into the river or land. A proper treatment plant should be constructed to remove all the toxicants from the effluent. The bioassays are important tools for characterizing industrial wastes. Since all the organisms of an ecosystem are equally important, any organism particularly most sensitive species should be used as the test system. If the most sensitive species is safe all the organisms are safe in the ecosystem. Further, as the tolerance vary with organisms of different trophic levels representation should be given to each level and organisms should be tested accordingly. Biotest systems should be set up with each industry, for characterizing their wastes and appropriate biotests should be made before the discharge of the waste into either aquatic or terrestrial ecosystem.