CHAPTER I
INTRODUCTION

Our environment is composed of atmosphere, earth, water and space. In normal circumstances if it remains clean it is enjoyable. The interaction of the atmosphere, lithosphere, hydrosphere and biosphere continues for years together. Unfortunately, on account of the various activities of man, the composition and complex nature of environment gets changed. Such activities include industrialization, construction, transportation, etc. These activities, although desirable for human development and welfare, lead to germination and release of objectionable materials into the environment thus turning it foul, and makes our life miserable.

The natural environment is clean, but due to multifarious activities of man it gets polluted resulting in what is called as environmental pollution. Our main aim is to keep our environment clean. One way of achieving it is by curbing our activities. However, in order to keep pace with the rapid industrialization world over, a developing country like India cannot afford to arrest its industrial activity.

Environmental pollution is classified into various groups. For instance, pollution of air is termed as the atmospheric pollution, the pollution of hydrosphere or water is termed as industrial effluents pollution. Similarly, indiscriminate dispersal of domestic sewage or
sullage is called domestic effluent pollution. In addition to these major 
sources of pollution we have pollution of lithosphere or land, called soil 
pollution. Pesticide residue contribute towards soil pollution. The rapid 
industrialisation of the developing countries though contributed to 
eradicate the problem of unemployment, affected the living organisms 
through pollution. The most important one is the water pollution.

Industrialization has brought in water pollution, which is one of the 
major hazards facing the environment today. Both surface and 
groundwaters get pollution due to almost all developmental activities. 
Various human and natural activities have direct impacts on water and 
water resources. The characteristics of runoffs have direct relationships 
with precipitation, land use patterns, water flow in streams and rivers and 
natural, geological and physical factors. In 1980, less than 75% of the 
world’s urban population and 15% of the rural population had access to 
clean water, which is much lesser than the goal of supplying water to all 
the urban population and 25% of rural population (Biswas, 1981). 
Considering the world population, every minute 3 people die because of 
their lack of access to safe and reliable supply of drinking water. An 
average of 50,000 people die each day from diseases associated with 
bad water (Mahler, 1980). The number of water taps per thousand 
persons is a better indication of health than the number of hospital beds 
(Gupta, 1989). Groundwater is the source of one-thirds of drinking
Most of the rivers in India are polluted due to industrial activity. Ulhas river in Bombay is polluted due to disposal of effluents from rayon and dyestuff industries. The rivers in India with polluting industries shown in parenthesis, are listed as follows: Ganga (jute, sugar), Sone (paper pulp), Gomti (paper), Yamuna (insecticides), Chaliyar (rayon waste), Kaveri (rayon, sugar), Godavari (paper, small-scale industries), Mahi (dyestuff), Mullamutha (antibiotics), Brahmaputra (black liquor, paper industry), Juhari (fertiliser waste), Patalganga (organic chemicals) and Valdhun (disposal of dye intermediates). It is paradoxical to note that holier the river, the more it is polluted. It is bound to be polluted due to disposal of industrial effluents in the streams that feed the river. The Government of India has fortunately now constituted the Ganga River Authority to keep the Ganges clean. We need such authority for all principal rivers in India. There exist similar organisations in most developed cities of the world, e.g. Thames River Authority in England. Same purpose without treatment. Such water which emerges out after use form industries is called as the industrial effluent. Such effluents have no definite composition, as anything which is not required is carelessly dumped into its stream. Such unwanted disposable material is contributed by chemical firms, foods and beverage industry, textile and apparel industries, electronics and electrical material industries, or
thermal power plants. The quality of such water is characterised by the study of its various physical, chemical and biological properties.

Water after use is disposed off into the sea, or a stream. Such water which was used for domestic or industrial purposes is considered useless from the point of further use and is therefore disposed off. Out of the total water consumed by human being, more than 50% of it is consumed for industrial activity; and only a small proportion is used for drinking purposes.

The consequence of heavy metal contamination is more serious in comparison to organic or microbial contamination because heavy metals are cycled between aqueous and particulate phases over a long period (Salomons and Forstner 1984). Not all elements in the environment are toxic; they may be classified as (Wood 1974; Forstner and Wittmann 1981): (1) non-critical elements (e.g. Na, K, Mg, Ca, Fe, Rb, Sr, Br, Al, Si, Li, P, N, O, etc.) (2) toxic but very insoluble or very rare (REEs, Ti, Zr, W, Ta, Re, Ba, Ru, Ir, Rh, Os, Ga, etc.) and (3) very toxic and relatively accessible (Cu, Se, Hg, Ni, Pd, Ag, Pb, Zn, Cd, Sb, Sn, etc). These metals form stable bonds and are active sites in many proteins. The elements of categories (2) and (3) serve as catalysts involving electron transfer in several biochemical reactions. As they are eventually incorporated in the proteins of living beings, they represent severe health hazards (Forstner and Wittmann 1981).
The practice of irrigation of crops by polluted water locally had prompted studies of the effect of heavy metal pollutants on growth and certain biochemical processes of plant. In field experiments, it was shown that such irrigation has twin effect, i.e. promotion of growth accompanies by the deleterious process of heavy metal accumulation in edible plant parts (Kumar, 1987).

Metal contamination of soils has become a world-wide concern since rice paddy fields irrigated with waste-waters from a zinc mine caused excessive cadmium (Cd) intake and adverse health effects in farmers who had consumed rice grown on this contaminated soil (Kobayashi, 1978).

Soil metal contamination has occurred since prehistoric times, but the extent and pace of contamination has increased during this century as a result of rapid industrialization.

Metals are non-degradable in nature, forming stable complexes and cause undesirable effects. When present in low concentrations trace metals can retard or induce abnormal growth. But when their concentrations exceed the critical limits, these elements become highly toxic and can endanger even human life. Hence, their presence should be constantly monitored and controlled. The investigation rivers provides an excellent case study of the complex relationships between economic activities and their environmental impacts.
Improperly treated effluents disturb the natural equilibrium of aquatic ecosystem and poses threat to aquatic flora and fauna.

To avoid the water pollution problems complete collection, treatment and disposal of all waste water is very important. However, not all industries can afford this. In this situation, it becomes imperative that we think in terms of cheap and economic methods of waste water treatment. The land application and irrigation utilization of waste water is such an option which has many advantages over the conventional methods.

Pollution by Man in the twentieth century is believed to be a reflection of population growth, development of technology and the resulting increase in living standards and consumption habits associated with economic growth. The most serious effects of these include the increasing spread of waste and the destruction of nature (Sundari & Kanakarani, 2001). Disposal into water courses demands strict treatments, because of presence of many dissolved organic and inorganic materials.

Certain industrial effluents, containing a mixture of nutrients which enhance the crop growth and toxic materials which inhibit the crop growth, are being used for irrigating crop fields. Therefore, it is essential that the impact of these effluents on seed germination and seedling growth should be assessed before they are recommended for irrigation purposes.
The tremendous amount of industrial effluents being produced by exponentially increasing industrialization - is a serious pollution threat. To lessen the deleterious effect of industrial effluents on environment, a suitable treatment prior to its disposal is generally recommended. Land application of waste water while making it possible to recycle and reuse the valuable constituents of waste water for productive purpose in agriculture, provides an effective natural method. This approach is thus capable of not only providing a low cost and environmentally compatible solution to pollution problems but also augments the manurial and irrigational resources for the development of sustainable agriculture.

Industrial wastes are complex, comprising of innumerable chemical compounds. Even the most sophisticated chemical analysis are just inadequate to identify all the biologically active compounds present in the waste (Rane 1995). Small scale industries and even the villages adjoining to the cities/urban areas are adding to the problem of environment, may it be or air, water or soil contamination. The direct discharge of effluent changed the physio-chemical and biological characteristics of the soil.

Land application of industrial wastes is a common practice in India as a majority of the establishments either do not treat the waste or treat it only partially. Even after full treatment, the waste (if suitable) is usually disposed of on land. However, all this is done without adequate
consideration of waste water characteristics, soil types, application rate and choice of crops.

Industrial effluents are being used for irrigation in dry areas. These effluents not only contain nutrients that enhance the growth of crop plants but also have other toxic materials. These effluents are usually discharged to nearby river courses. The application of these industrial effluents to land has also been started during recent years as an alternative means of treatment and disposal. Therefore, it is essential that the implications of the use of industrial effluents in the crop field and their effect on soil characteristics should be assessed before they are recommended for use in irrigation.

The consequences of massive water pollution in relation to the health are of great concern because of two-third of illness is reported to have been related to the water borne diseases through metal intoxication.

Industrialization and industrial effluents have an inevitable effect on the morphology and physiology of plants growing in industrial areas.

These effluents often contain high amounts of various organic and inorganic materials as well as toxic trace elements. These may accumulate in soils in excessive quantities in long-term use. Subsequently, these toxic elements may cause physical problems to human beings and animals by entering the food chains. However, industrial waste water could be used safely and effectively with proper
precautions to increase the soil productivity. The utilization of industrial wastes for agricultural purposes could also provide a solution to the disposal problems.

Soil health is a state defined by the delicate balance of various physical, chemical and biological properties of soil and its relationship with overall environment of which it is a part. From the crop production point of view, a healthy soil may be defined as one that produces good crops suitable for human and animal consumption and has the ability to recuperate to sustain production.

Indian climate being predominantly semi-tropical, and sub-tropical with seasonal rain-faill and low humidity, a considerable demand for irrigation water exists in India. The scarcity of water is a major problem in the arid and semiarid region of India. The use of industrial effluent for irrigation has emerged in the recent past as an alternative source of water in these areas.

Sewage and industrial waste waters contain large amounts of salts which may sometimes serve as nutrients for plants. Soils receiving industrial and domestic wastes have a great capacity to obsolese nutrients and act as efficient purifying media (Dev Vires, 1972 and Young et. Al., 1975). Suspended matter is filtered out by soil particles and organic matter is decomposed by soil microflora. Nutrients are further utilised by plants or precipitated out by the soil constituents. On account of this, industrial waste waters at many
instances are recommended for irrigating crop plants (Steel and Beg. 1954).

The treatment of waste water developed in advanced countries is highly mechanised and energy consuming and is neither appropriate nor financially justifiable for developing countries. The development of simple low cost processes, coupled with re-use of effluents in agriculture, offers the most suitable solution in countries like India. In addition to providing large quantities of water, some effluents contain considerable amount of essential nutrients which may prove beneficial for plants. Although some work has been done on the performance of various crops irrigated with the effluent discharged from various sources.

Industrial effluents are now-a-days commonly used for agricultural purpose. These effluents based on the type of industry, may be beneficial or harmful to crop plants (Somasekhar et. al 1984). Germination levels have significant influence on vigour, field performance and yield in several crops. The decrease in germination level leads to a sub-optimal population of plants per unit area and reduction in vigour may result in poor performance by the surviving plants (Roberts, 1972).

Many studies were conducted to evaluate the effects of industrial effluents and polluted water on seed germination of crops which revealed that the germination percentage and dry matter yields of crops
tested were lower than control. The effluents and waste waters were unsuitable for irrigation and there is a need to treat and dispose of them scientifically. Keeping in view of the very limited study from the effects of industrial effluent on crop plants from Rohtak and the positive and negative effect of industrial effluent regarding environment quality, a study is therefore, conducted with the following objectives:-

1. Characterisation of industrial effluents.

2. To study the effects of industrial effluents on soil physico-chemical property.

3. To study the effect of industrial effluent on the germination behaviour of crops and vegetable plants.

4. To study the effect of industrial effluent on the growth and nutrient uptake by crops and vegetable plant.

5. To study the effect of industrial effluent on yield of crop and vegetable plants.