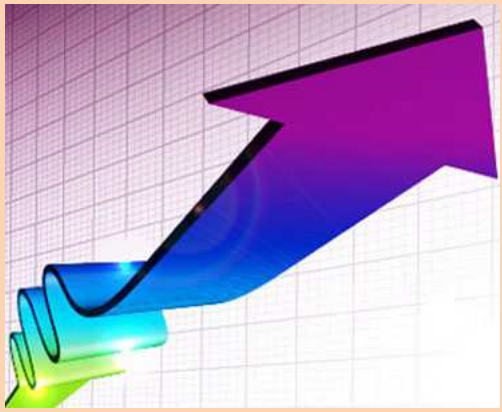
CHAPTER 1



INTRODUCTION

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Advances in science and technology and the industrial revolution have helped humans for plot resources. Industrialization is one of the important tools for the development of any nation. Consequently, the industrial activity has expanded so much all over the world. The Government of India announced a new liberal industrial policy on 24 July 1991. This new policy intends to remove the structure of regulations and help the vibrant growth of industries so that they can enter the ever-competitive world market. The Maharashtra Government's new industrial policy announced in 1993 takes full advantage of this liberalization and makes industrial atmosphere in the state favorable to the setting up of more industries. In fact, Maharashtra always offered the most conductive milieu for nurturing productive entrepreneurship. Owing to its inherent strengths, better physical and financial infrastructure, well-versed techno-managerial class and high growth potential, it continues to exert a pull on new industrial investment. Maharashtra tops the list of states in terms of total investment and the number of ongoing and proposed projects.

Maharashtra is the most industrialized state in India, not only generating capital and addition to the national income, but also providing employment and thus helping a wider spread of the benefits of industrialization. The state accounted for 21 % of the gross value of output and 24 % of the value added in the organized industrial sector in the country. Since India is an agricultural country and one of the major producers of sugar in the World, there are many sugar factories situated in countryside in different states of India and per capita consumption of sugar in the country is 13.4 kilograms per annum, There are about 400 operating sugar mills, located mainly in the states of Uttar Pradesh, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu (Figure 1.1). It is a seasonal industry and operates for about 6 months in a year, normally from October to March. The crushing season may extent upto the April end as per the availability of sugarcane in the predetermined territory of the sugar factory.

In Maharashtra, there are 214 sugar factories installed in seven sugar producing regions, viz, Kolhapur, Pune, Ahmednagar, Aurangabad, Nanded, Amaravti and Nagpur (Figure 1.2). Chopda tahshil in Jalgaon district belongs to Aurangabad sugar producing region. . The District wise % contribution in total sugar production of Maharashtra during crushing season 2011-12 is given in Figure 1.3. Due to low rainfall in Maharashtra during 2012-13, 162 out of 214 sugar factories in Maharashtra State have crushed 72.143 million tons of sugarcane

producing 8.21 million tons of sugar at a recovery rate of 10.35%. Jawahar Shetkari SSK Ltd, a cooperative sugar factory in Kolhapur has crushed the maximum sugarcane 1.51 million tons producing 0.15 million tons of sugar. Another co-operative sugar factory from Kolhapur district Dudhganga Vedganga SSK Ltd. has achieved topmost sugar recovery of 11.25% followed Vishwasrao Naik (11.10%) and Ajara Shetkari (11.08%). Table. 1.1 shows the sugar statistics in Maharashtra during previous two years i.e. 2010-11 and 2011-12.

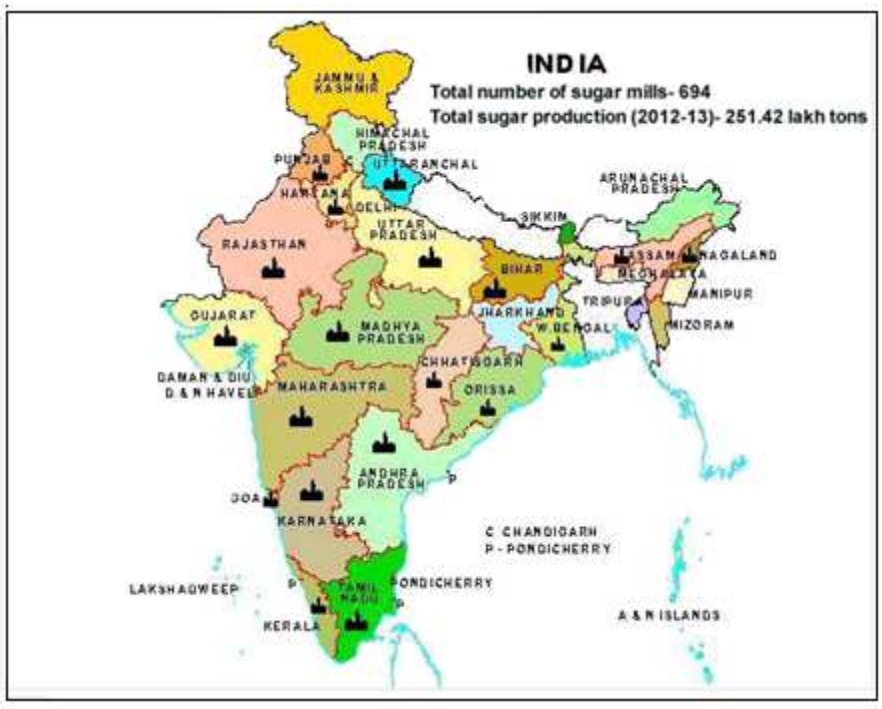

Figure 1.1 Sugar Map of India (Source: www.vsisugar.com)

Figure 1.2 Seven sugar producing regions in Maharashtra
(The above map is inductive purpose only) Source: *www.vsisugar.com*

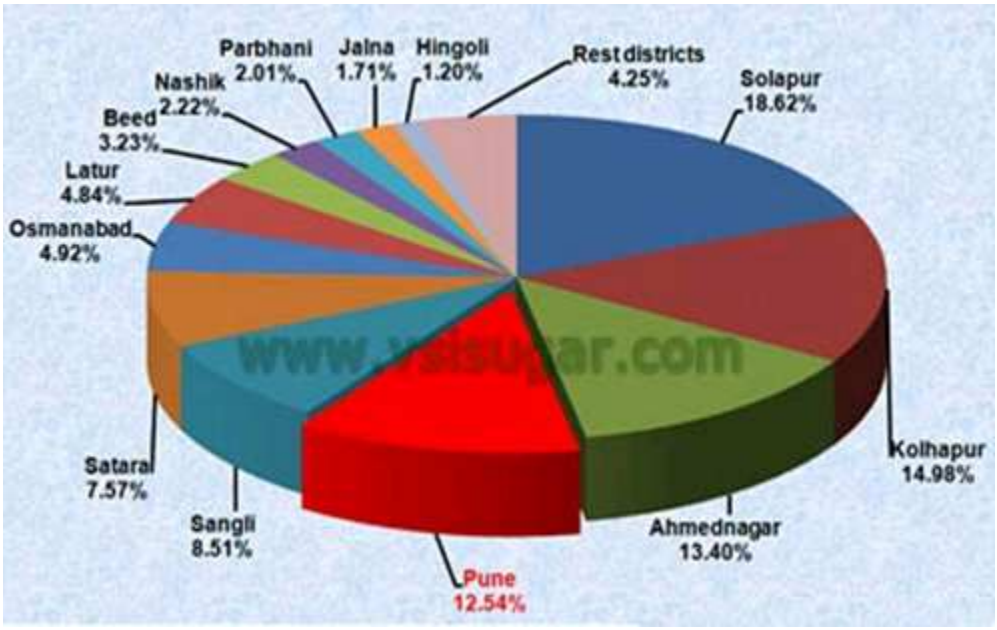

Figure 1.3 District wise % contribution in total sugar production of Maharashtra (Crushing season 2011-12) Source: *www.vsisugar.com*

Table 1.1 Sugar Statistics in Maharashtra State

Sr. No.	Particulars	Crushing Season	
		2010-11	2011-12
1	Number of Sugar Factories		
	a) Installed	209	214
	b) In operation	167	172
2	Crushing Capacity (million TCD)	0.536	0.554
3	Sugarcane Crushed (million tons	80.215	77.125
4	Sugar produced million tons)	9.054	8.982
5	Recovery % Cane	11.31	11.66

Source: : *www.vsisugar.com*

Pollution Problems due to Sugar Factories

India is an agriculture based country and a major user of water resource for irrigation. But there is a great demand for water for irrigation while gallons and gallons of effluents are let out into water sources untreated. The most important effluent discharging industries are thermal power plants, paper mills, textiles, distilleries, fertilizer unit, electroplating plants, tannery industries, sugar mills, sago factories, oil refineries, pesticide and herbicide industries. Industrial effluents containing heavy metals pose a threat to the ecosystem. Use of these industrial effluent and sewage sludge on agricultural land has become a common practice in India as a result of which these toxic metals can be transferred and get

accumulated into plant tissues from soil. These metals have damaging effects on plants themselves and may become a health problem to man and animals

Among the effluent discharging industries, sugar factories play a major role in polluting the water bodies. Diverse sugar industry effluents disposed of in soil and water cause major pollution problems. The sugar industry plays an important role in the economic development of India, but the effluents released produce a high degree of organic pollution in both aquatic and terrestrial ecosystems (Ayyasamy et al, 2008). The effluents also alter the physico-chemical characteristics, and flora and fauna of receiving aquatic bodies. In addition, sugar factory effluent discharged in the environment poses a serious health hazard to the rural and semi-urban populations that use stream and river water for agriculture and domestic purposes. (Baruah,1993). Hence, it is necessary to study the physicochemical properties of sugar factory effluents.

The effluents of sugar factory percolate in the soil and reach the ground water table. These effluents affect the ground water quality by changing its chemical composition. (Pondhe et al, 1992). The different physicochemical aspects of effluents as well as ground water near the factories should be observed. The effect of effluents on oxygen content of water, pH value of water, presence of chemical pollutants like carbonates, bicarbonates, phosphates has to be checked. Such ground water may cause the ill effect on the soil if it is used for the irrigation. It may also cause the health problems if it is used for the drinking.

Regarding water consumption and effluent generation in a sugar factory, specified standards are 1,000 liters and about 500 liters respectively for per tonne of cane crushed. Sugar mill effluent is mainly floor washing wastewater and condensate water. Leakage in valves and glands of the pipeline add sugarcane juice, syrup and molasses in the effluent, The sugar mill effluent has a BOD of 1,000-1,500 mg/Litre, but appears relatively clean initially, However after stagnating for some time, it turns black and start emitting foul odour. If untreated effluent is discharged in watercourses, it depletes dissolved oxygen in water and makes the environment unfit for aquatic life. If untreated effluent is discharged on land, decaying organic solids, oil, and grease clog the soil pores. The pollution standards stipulate that BOD of effluent should be less than 30 mg/L for disposal into inland surface waters and less than 100 mg / litre for disposal on land. BOD can be 500 mg /L, in case land application effluent is envisaged as a secondary treatment system for further removal of BOD.

Most of the Sugar mills use bagasse as a fuel in boilers, which produces particulate matter, oxides of nitrogen, carbon, sulphur and water The vapours, The particulate matter, usually referred to as fly ash, consists of ash, unburnt bagasse and carbon practicles. Fly ash is very light therefore, if pollution control equipments are not installed, it escapes in the atmosphere through chimney and travels long distances. In such conditions, nearby population suffer from dizziness and irritation in eyes, nose, throat and lungs. The heavier particles, if settle on vegetation then it damages them. Among the solid waste generated by sugar mills, lime sludge and press mud are important. For purifying the sugarcane juice from organic matter, dirt and other impurities, milk of lime is used that generates lime sludge. The impurities from the sugarcane juice are either vacuum filtered or pressed and removed as press mud. In addition to these, solid wastes are also generated from the pollution control facilities, like ETP sludge and fly ash collected from the dusting devices.

Today, pollution due to industries has become a matter of major concern so far the deterioration of the environment is concerned. With the rapid growth of industries including sugar factories in the country, pollution of natural water by industrial waste water has increased tremendously. Though industrialization contributes economical development, most important natural resources like water and soil are commonly polluted with byproducts, waste materials and non- utilized parent chemical compounds. These in turns ultimately affect the agriculture production and food security. Polluted soil and water also acts as secondary source of pollution.

The sugar factory effluent affects the quality of soil on which they are released. The physico-chemical study of the soil will show the effect of the effluents on the pH of water, amount of the chlorides, sulphates and heavy metals as well as the soil enzyme , especially cellulase. Cellulase is enzymatic protein, which hydrolyzes the cellulose polymers to oligosaccharides, cellobiose and glucose. Current knowledge of soil biochemistry suggests that this conversion of high molecular weight organic pollutants to low molecular weight nutrients is achieved by metabolism of microorganisms and activity of enzymes in soil (Kang et al 1998). This activity of enzymes is sensitive to change in soil conditions such as pH and soil water potential.

Soil nematode communities also provide useful indicators of soil condition. Nematodes vary in sensitivity to pollutants and environmental disturbance. Application of nematode faunal composition analysis provides information on succession and changes in decomposition pathways in the soil food web, nutrient status and soil acidity and effect of soil contaminants including spentwash released from sugar factory (Bongers and Ferris, 1999). Nematodes may be useful indicators of soil quality because of their tremendous diversity and their participation in many functions at different levels of the soil food web. Several researchers have proposed approaches to assess the status of soil quality by counting the number of nematodes in different families or trophic groups (Blair, et al. 1996). In addition to their diversity, nematodes may be useful indicators because their populations are relatively stable in response to changes in moisture and temperature (in contrast to bacteria), yet nematode populations respond to land management changes in predictable ways. Because they are quite small and live in water films, changes in nematode populations reflect changes in soil microenvironments.

Farmers using these effluents for irrigation to reduce water demand have found that plant growth and crop yield were reduced and soil health was compromised. In this regard, efforts have been made to assess the physico-chemical properties of sugar factory effluent, to determine the effect of industrial effluents on ground water quality and soil properties including soil cellulase activity and nematodes in the soil adjoining to sugar factory.

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