International Journal of Academic Research and Development
ISSN: 2455-4197
Impact Factor: RJIF 5.22
www.academicsjournal.com
Volume 2; Issue 6; November 2017; Page No. 223-224

A case study on change in irrigation practices due to industrialization around Jodhpur

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Abstract
This paper is based on impact of industrialization on changes in agricultural practices and dependence of farmers on polluted water for irrigation purpose. Main focus area was Jodhpur and its surroundings. More than 27000 industrial units are working in this area. Among these many units dispose waste material directly into water resources through sewage line or on land. In Jodhpur, Jojari river is most important river for agricultural land. Presently it is polluted with effluent mixed sewage water. Many animals and plants suffer from this unhygienic and hazardous conditions and even some die. Farmers are also using this polluted riverine water for their agricultural irrigation because it is easy and chiefly available. This type of changing pattern of farmer's irrigation practices may cause major health risk issues in near future for whole population.

Keywords: pollution, industrial effluents, irrigation, Jodhpur, jojari river

Introduction
Jodhpur is the main study area of this research. It is second largest district of the state Rajasthan. It is situated at its latitude is 72-55'N and longitude is 73-52'E and spread over 22580 Sq. Km. Presently, industrial sector is growing rapidly which is defined as a key factor of development of any country. In India, 17 categories of heavily polluting industries have also been listed by CPCB. In Jodhpur many more industries have also been established over time [1, 2] as shown in table and graph. Increasing rate of industrialization also increases problem of its effluent discharge. Thousands of ton waste material is discharged annually [3, 4]. The treated and untreated both types of effluents are discharged from industrial units. Untreated effluents contain many chemicals, minerals, acids, bases etc. Different investigations showed that values of biological oxygen demand (BOD), chemical oxygen demand (COD), sodium absorption ratio (SAR), residual sodium carbonate (RSC), soluble sodium percentage (SSP) and EC found higher than standard values [5] which may be hazardous to our environment. Many times these pollutants are discharged into the sewage system, water bodies or directly on the land that causes serious soil pollution and water pollution. Jojari river is life-line of Jodhpur agricultural farms but it has been polluted due to disposal of industrial effluents. This effluent and sewage mixed water is also used by farmer for sawn many important crops like Pearl millet, Moth-bean [6] and Sorghum [7] etc. Heavy metals and other pollutants accumulate in crops and cause many diseases [8, 9]. Hence it was decided to survey the possibility of pollution due to industrial disposal.

Problem definition
No doubt growing industrialization is important for development but its waste material is directly discharged into water resources like river is problematic because it causes pollution and risk for health of living beings. Farmers are dependent on riverine water for irrigation. So they haven't any option to depend on other sources that's why they are helpless to use this contaminated water.

Materials and methods
Jodhpur was the study area for survey. Many field visits have been done in and around Jodhpur city of Rajasthan that are under influence of industrial effluents. Photographs of various sites were taken. Several agricultural farms were observed along the Jojari River. Interaction with many farmers were done who were using effluent affected water for their irrigation. Possibility of land pollution were explored.

Observations
During survey at many sites we found that there were almost all farmers who were using untreated water of Jojari River. Some farmers were using little bit filtration techniques but it did not seem to be effective. They use latticed iron box on the tip of pipe from where water comes towards farm. Somewhere dump sites were also found. These dump sites were used for riverine water just near farm-land and from where they use it in fields. Though dumping sites are somehow capable of precipitating large particles, sand and other materials but it is not sufficient for chemical impurities.
Table: No. of industrial units in Jodhpur with year intervals. Data taken from two governmental reports viz., Brief Industrial Profile of Jodhpur District: Micro, Small and Medium Enterprises Reports 2012 and 2016 [1, 2]

Table 1

Year	No. of Industrial Units
2000-2001	14417
2005-2006	18436
2010-2011	23319
2015-2016	27701

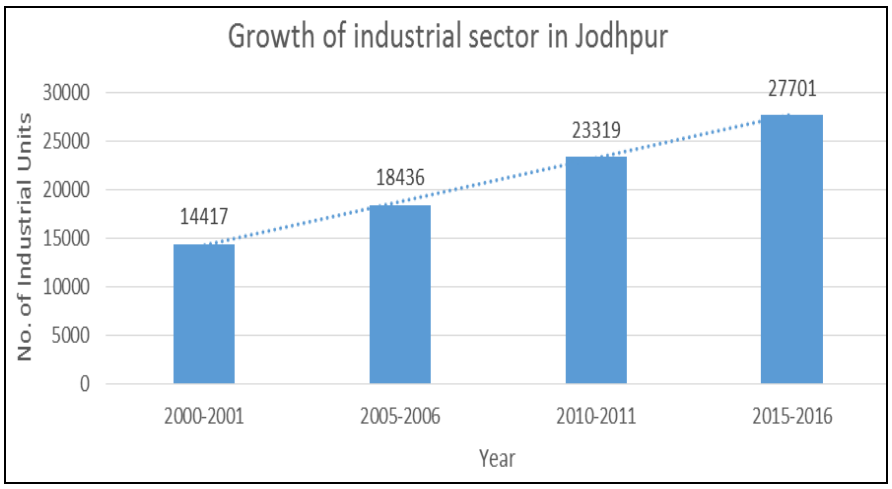

Fig 1: Continuously increasing growth of industrial units in Jodhpur over time.

Results and Discussion

On above mentioned observational table and interpretations graph clearly understood that industrial growth is in continuously increasing manner during last 15 years. As a result, industrial effluent is poured in water bodies is also increasing persistently. It is not good for health of soil and flora and fauna inhabiting in this ecosystem. Simply filtered or direct use of this contaminated water is causing loss of soil fertility leading to infertile soil. Not only soil but also crops which are sawn in this condition are also unfit for human consumption it. Many diseases and life threating conditions are introduced to the ecosystem. A lot of time newspapers are publishing this threat in form of less-yielded crops, death of animals and pollution in riverine water etc. This matter needs further extensive investigation at scientific level.

Conclusions

It is major problem of farmers lives around Jodhpur to use contaminated water for irrigation purpose but is a one type of their coercive due to easy availability and chief sources. Rejuvenation and cleaning of river, strict governmental policy for industrial effluent discharge and awareness programmes for farmers about health risk concerned are solutions to mitigate this problem.

Future scope

Limitation of this research is should be kept in mind. It will be milestone to analyse chemical constituents and other pollutants which are magnifies in crops due to changing patterns of irrigation practices which will helpful for forecast health concerns.

Acknowledgement

I am thankful to my Research supervisor and Head of Department Prof. G. Tripathi for providing research facilities and proofreading and Dr. B.R. Jaipal for their contribution in ideology. I am also grateful for University Grant Commission for financial assistance in terms of Junior Research Fellowship.

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