

Geographical analysis of instream and along brick kilns and its impact on water quality of river Pravara.

Análisis geográfico de las fábricas de ladrillos a lo largo del río Pravara y su impacto en la calidad del agua

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ABSTRACT

An attempt has been made to identify instream brick units and its impact on water quality in the Pravara River. The main aim of the paper is to analyze physico-chemical analysis of the Pravara River water, for that water samples for 10 sampling stations within tehsil have been collected during 1st week of January 2020. Physico-chemical parameters have been analyzed by standard method. The field observations reveal that enhancement in population has been observed every year and with population growth brick kilns also increased. It is an easy source of money earning specially for rural economy. Many brick kilns are instream for easy availability of soil and water, but it declined water quality. Study reveals that in the study area due to instream brick units turbidity (>39 NTU) and TDS (Total Dissolved Solids) (>700 mg/l) have been increased at Kokanevadi, Kasara Dumala and Umbari. Results also show that at Sangamner, Kokanevadi and Kasara Dumala water is not fit for drinking purpose. To analyze that physico-chemical characteristics of water is the main aim of the research with remedial measures for mitigate the deterioration and related consequences in future.

Keywords: Pravara River, brick kilns, physico-chemical analysis

RESUMEN

Se ha intentado identificar ladrillos en las corrientes y su impacto en la calidad del agua del río Pravara. El principal objetivo de este documento es analizar físico-químicamente el agua del río Pravara. Para esto, se recolectaron muestras de agua para 10 estaciones de muestreo dentro de tehsil (unidad de gobierno indio) durante la primera semana de enero de 2020. Los parámetros físico-químicos se han analizado por el método estándar. Las observaciones de campo revelan que cada año aumenta la población y por lo tanto las fábricas de ladrillo también. Para la economía rural, este trabajo es una fuente fácil de ingresos. Muchas fábricas de ladrillo se encuentran dentro del cauce del río para facilitar la disponibilidad del suelo y agua, aunque disminuya la

calidad del agua. El estudio demuestra que, en la zona investigada, la turbidez del agua (>39 NTU) y el total de sólidos disueltos (>700 mg/l) ha aumentado en Kokanevadi, Kasara Dumala y Umbari, debido a los ladrillos en la corriente. Los resultados también muestran que en Sangamner, Kokanevadi y Kasara Dumala el agua no es potable. El objetivo principal de este estudio es analizar las características fisicoquímicas del agua, aplicando medidas correctoras para mitigar el deterioro y sus consecuencias en el futuro.

Palabras clave: río Pravara, fábricas de ladrillo, análisis fisicoquímico.

INTRODUCTION

River plays an essential role in human life. Rivers nourishes every living organisms on the earth so they are also known as arteries of our planet. Rivers are the most important life supporting systems of the nature. (Sreebha S., 2008). River water is a basic natural resource for human beings because they are important carriers of water and nutrients. (Falkenmark etal 2019) Rivers also provides its valuable deposits like sand and clay to the respected area. Many human activities like brick making, sand excavation, construction of bridges, vegetation destruction, diversion of channel, agricultural activites depend on the river water resource and deposited materials.

Brick industry is material provider industry to the construction sector. It is also one of the important cottage industries which provides employment to rural and unskilled population (Kumbhar A, 2007). Rivers acts a vital role in brick making industries because it is source of essential raw material like sand, clay and water. Brick industries always try to find location at a place where major raw materials like soil and water are available nearest and transportation charges are minimum. Inherently location near river is conducive for brick industries. For least transport cost of water and clay maximum brick units mostly situated in and along the river (Cullen, Beth. 2020) Sangamner tehsil in Ahmednagar District is one of the developed tehsil and well known for co-operatives industries. It is also famous as an educational hub. It also has concentration of sugar mills and allied industries which provide employment for skilled and unskilled labours of nearby villages, which lead to population growth and with population growth construction sector also has increased and to meet the need of construction sector brick kilns have been developed in small villages especially along river. Brick kiln are basis of rural economy but instream and along brick kiln effects on river water quality and river environment. (Das etal 2021)

Taking this view in account Pravara River in Sangamner Tehsil has been selected for further research. Pravara River is an important drainage pattern of Sangamner tehsil. River Pravara hase proved as a boon for tehsil for drinking, irrigation and industrial and tourism purpose. Many human activities along river badly affects on quality of the water as well as Geoenvironmental effects in the area specially brick kilns. (Sikderetal 2016) (Das etal 2021)

To understand inappropriate locality of brick kilns and its impact on water quality of Pravara River is the main objective of the paper, Future research will be helpful to minimize such interventions in future and also enhance water quality.

STUDY AREA

Pravara River is an important drainage pattern of Ahmednagar district. The northern part of district is drained by Pravara. For further study Pravara River in Sangamner Tehsil has been selected. The total length of River is about 230 Km River Pravara rises at an elevation of 1080 meters near Ratanvadi village in Akole Tehsil. Sangamner Tehsil is the one of the developed Tehsil in the district which located about 58 km. downstream from the origin of Pravara River. Sangamner city in tehsil is situated on the confluence (sangam) of river Pravara, Mahlunji and river Nataki that's why city got its name Sangamner. Sangamner Tehsil is located at 19°57' north and 72° 22' east. Sangamner Tehsil has an average elevation of 549 meters from mean sea level. After 1967 establishment of co-operative sugar mill at Sangamner, the agriculture in the area has witnessed rapid changes. Sugarcane has become dominant commercial crop in the area. River Pravara is a major irrigation source for the agriculture.

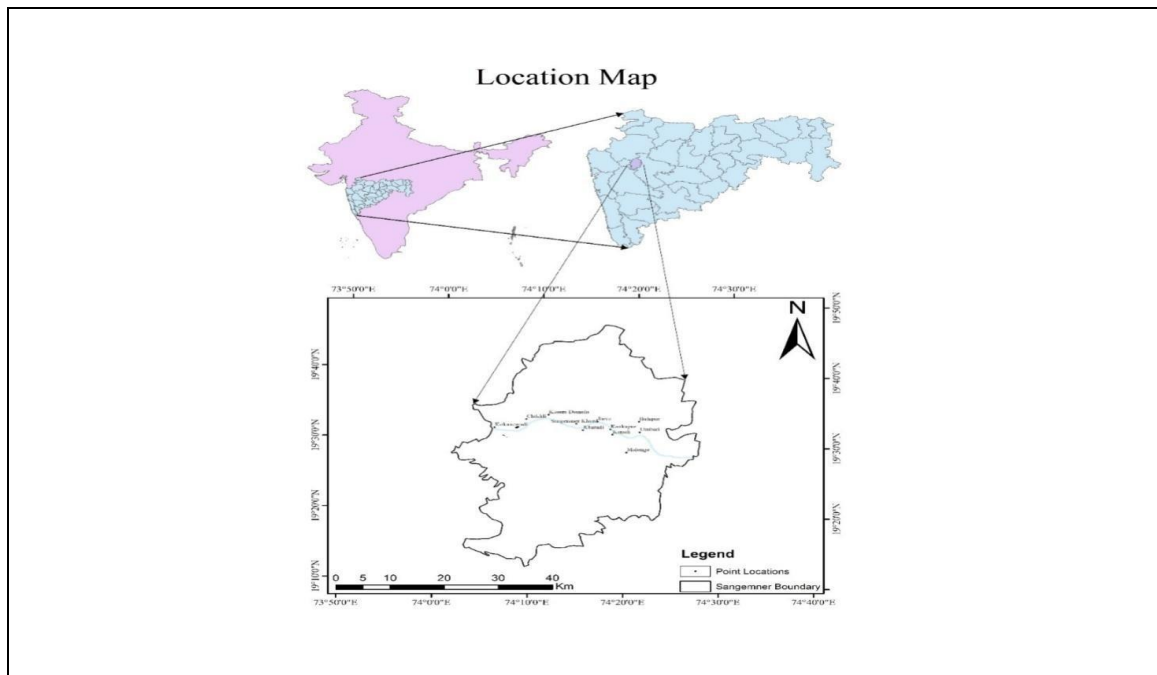


Figure 1 Location map of the study area

MATERIAL AND METHODS

Study includes systematic observation of entire channel through SOI Topographical maps (47/I/1,2,3,6,7,10,11,14,15 and 47/E/10,11,12,13,14,15, on 1:50000 scale). It can help to understand the morphology, physiography and general observation of the study area. Field observation also has been done for

understanding instream brick kilns sites. For future study 10 sampling stations within Sangamner Tehsil have been selected. Selection of sampling stations is based on instream brick kiln, so sites along Pravara River namely Kokanewadi, Chikhali, Kasara Dumala, Sangamner Khurd, Khardi, Jorve, Kanoli, Kankapur, Umbari Balapur and Malunje have been selected. All these sites have instream brick kilns. Various Physio-chemical parameters like Total solids (TS), Total dissolved solids (TDS), Dissolved oxygen (DO), calcium hardness and turbidity were analyzed for the evaluate the impact of instream brick kilns on water quality. For water quality analysis water samples have been collected from the surface water along river during January 2020. Temperature and pH of samples have been measured at in the field during collection. The water samples were analyzed at Water Quality Laboratory level- II, Nashik under Hydrology Project, Water resources department, Government of Maharashtra. The analysis was carried out in the laboratory as per BIS standard methods.

Table No. 1- Physico-chemical Analysis of selected sited of Pravara River in Sangamner Tehsil

Sr No	Sampling station	Total solids (mg/l)	Dissolved Oxygen (mg/l)	Calcium Hardnesss (mg/l)	Total Hardness (mg/l)	Turbidity (NTU)
1	Kokanewadi	1200	5.9	252	320	45.32
2	Chikhali	465	8.5	102	124	14.02
3	Kasara Dumala	1100	6	248	318	38.7
4	Sangamner Khurd	1000	6.3	238	308	37.9
5	Khardi	720	7.8	198	235	32.4
6	Jorve	956	6.2	231	298	36.5
7	Kanoli	852	6.1	227	201	36.8
8	Kankapur	921	6.15	254	250	38.1
9	Umbari Balapur	657	7.91	125	201	39.1
10	Malunje	981	6.2	230	315	38.3

(Required desirable limits- As per standards prescribed For Drinking Water by Bureau of Indian Standards, 2002 (BIS) limits, 2012)

RESULTS AND DISCUSSION

The effect of brick kilns on water quality of Pravara River is studied in this paper for this purpose total solids, dissolved oxygen, calcium hardness, and total hardness and turbidity of river water was estimated. All information was analyzed as per standards prescribed by Bureau of Indian Standards, 2002 (BIS) limits, 2012 (Table No.1)

Total Solids- Total dissolved solids (TDS) are the inorganic salts and small amounts of organic matter present in solution in water, i.e. it is combination of total dissolved solids and total suspended solids in a liquid. It includes any dissolved salts such as sodium chloride, calcium chloride and solid particles such as silt and plankton. Water coming out of fields and water coming out of residential complexes, clay-waters, leaching of soil contamination, and water coming out of sewage treatment plants are major sources of TDS [13]. The above table shows that there is highest value of TDS at Kokanewadi this can be attributed to the fact it has largest number of brick kilns along river

Dissolved oxygen- Dissolved oxygen (DO) is a measure of how much oxygen is dissolved in the water. Rapidly moving water, such as in a mountain stream or large river, tends to contain a lot of dissolved oxygen, whereas stagnant water contains less. Bacteria in water consume oxygen as organic matter decays. Thus, excess organic material in lakes and rivers can cause eutrophic conditions, which is an oxygen-deficient situation that can cause a water body to "die". The amount of dissolved oxygen in a stream or lake can tell us a lot about its water quality. Low levels of dissolved oxygen in water are a sign of possible pollution. It means if a water body has high value of dissolved oxygen in it then the water quality is considered good with respect to its dissolved oxygen value [14]

The concentration of dissolved Oxygen in the river Pravara ranged between 5.9 to 8.5 mg /l at selected sampling sites. Within all selected sites Kokanewadi indicates lower value of DO. It may be due to organic matters dissolved in water through instream brick kilns and its wastage material.

Calcium hardness: one of the main reasons for the abundance of calcium in water is its natural occurrence in the earth's crust. Calcium is also a constituent of coral. Rivers generally contain 1-2 ppm calcium, but in lime areas rivers may contain calcium concentrations as high as 100 ppm. Calcium hardness is ranged between 102 to 205 mg/l. calcium hardness is maximum at kokanewadi it may be due to dissolved alluvium soil.

Total hardness: total hardness is a measure of the mineral content in a water sample. Total hardness is equivalent to the total calcium and magnesium hardness. Total hardness is determined by the multivalent cations' concentrations present in water. Total hardness in river Pravara is ranged between 124 to 320 mg /l. Higher values of TH have been observed at kokanewadi it may be due to mixing of clay and sand of brick units. Kasara Dumala and Malunje also found high TH because contamination.

Turbidity: it is an optical characteristic of water and is a measurement of the amount of light that is scattered by material in the water when a light is passed through the water sample. The higher the intensity of scattered light, the higher the turbidity. Turbidity is measured in Nephelometric Turbidity Units (NTU). The values of turbidity are also affected by effluents from brick industries. The turbidity values are highest at Kokanewadi, Kasara Dumala and Umbri as these locations have large number of bricks kilns more effluents enter in the water and make it turbid.

CONCLUSION

From above analysis can be concluded that increased number instream brick kilns deteriorate the water quality. Among all sampling stations, Kokanewadi, Kasara Dumala, Sangamner Khurd and Malunje are more affected by brick kilns and due to which water has become unfit for drinking. Brick making activities add the clay and sand in the water which increased hardness of water. Raw material used in bricks kilns affect the water quality. In addition to this more studies are needed to know the different type of pollutants. Brick industries also increase air pollution, which may be due to open burning of bricks therefore, Vertical Shaft Brick Kiln (VSBK) process is an alternative method, which is energy efficient method of firing. It produces better bricks and reduces pollution. Efforts should be made to convince brick industry owners to adopt process so that environmental pollution is reduced and step is taken towards sustainable development. Also, calcium carbonate and calcium hydroxide can also be used in coal briquettes which could also be an efficient and economical way to control the pollution.

Photo I: instream sand excavation for brick making at Sangamner

Photo II: deposited instream waste material at Kokanewadi



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