EFFECT OF GANGA WATER POLLUTION ON SOCIAL AND RELIGIOUS PRACTICES AT VARANASI

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Abstract:

The water of river Ganga is regarded as the most purifier of human body and soul since time immemorial. However, during past a few decades the unplanned urbanization and fast growing industrialization has imposed a serious threat on the quality of river Ganga water. It has been observed that about 300 MLD city sewage mixed with industrial effluent is directly or indirectly discharged into river Ganga at Varanasi. From the physico-chemical examination of river water, it is revealed that the water quality of river Ganga is continuously deteriorating at Varanasi, the religious centre and cultural capital of India. The BOD values which are suppose to be less than 3.0 mgL^{-1} raised to 18.5 mgL^{-1} on the bathing ghats and DO content of water which must be more than 5.0 mgL^{-1} is reduced to 2.5 mgL^{-1}. The bathing ghats of Varanasi are associated with a number of social, cultural, tourism and religious activities. A number of activities such as marriage, birth, religious ceremonies and cremation of dead bodies etc. which have been conducted since ancient ages on the bank of river Ganga are adversely affected due to knowledge among the people about pollution of river Ganga. Government efforts to clean up the river have failed due to poor planning, technological mismanagement and corruption.

Keyword: River Ganga; Pollution; Physico-chemical examination; Industrialization.

Introduction:

Rivers are important resources and the cradle of most of the human civilizations. Rivers are used for domestic, industrial, recreational, agricultural and other purposes. However, these vital resources are being polluted due to indiscriminate industrialization and unplanned urbanization. The bathing ghats of Varanasi are associated with a number of social, cultural, tourism and religious activities. A number of activities such as marriage, birth, religious ceremonies and cremation of dead bodies etc. which have been conducted since ancient ages on the bank of river Ganga are adversely affected due to knowledge among the people about pollution of river Ganga. Government efforts to clean up the river have failed due to poor planning, technological mismanagement and corruption. Millions of people are dependent on it for their livelihood. Henceforth, the river Ganga has a great socio-economic and cultural significance.

It is believed that the cremation of dead bodies near the river bank would purify the dying man and lead to his salvation. Approximately, 33000 dead bodies are cremated annually at the river bank with the help of ten thousand tons of fire wood per year. The release of ash into the river from the cremation ground also increases nitrogen, potassium and phosphorous contents, which would adversely affect the river water quality. The situation becomes graver due to release of half burnt flesh into the river. Therefore, it was imperative to evaluate the effect of dead body cremation on the quality of river Ganga. Henceforth, the aim of present study was to evaluate the impact of Ganga water pollution on social and religious activities at Varanasi.

2. Materials and Methods

2.1 Study area

The study area was 10 km stretch of the River Ganga between its upstream interface and up to downstream at the city of Varanasi (25°18′ N, 83°1′E), India. Water samples were collected from three stations (Samane Ghat (SG, Site 1), Dashashwmadh Ghat (DG, Site 2), Manikarnika Ghat (MG, Site 3) along a 10 km stretch of the river to evaluate the impact of Ganga water pollution on social and religious activities at Varanasi. Site 1 was taken as reference, while site 2 and 3 are polluted sites.

2.2. Sampling and analytical procedures

Water samples were collected from the 3 sampling stations at monthly interval from January 2014 to December 2014. Grab samples were collected manually at about 6 m distance from river bank in the second week of each month in 2 L plastic containers. The containers were first deepened into the river water, opened inside it and rinsed with the water to be collected. After collecting water, the bottles were closed inside the river water in order to avoid the entry of any air bubble into it. Parameters such as temperature, pH, EC were analysed on the spot using temperature, pH and EC meter (HANNA instruments Inc). The samples were transported to the laboratory in ice boxes. The samples were then analysed for the following parameters using standard methods as prescribed by the APHA et al. (2000): total acidity, total alkalinity, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), nitrate-nitrogen (N), phosphate (PO_4^{3-}-P) and sulphate (SO_4^{2-}).

Total coliform was analysed using most probable number (MPN) method.

For heavy metal analysis (Cu, Cr, Cd, Fe, Pb and Zn), the collected water samples were filtered using pre-conditioned vacuum filtering devices and passed through a pre-washed Whatman filter membrane (diameter 0.45 μm). The filter and filtering devices were pre- conditioned in 1M HNO_3 and rinsed with deionized water. Metal analysis was carried out using atomic absorption pectrophotometer

(AAS Perkins Elmer model 2380, USA). The accuracy of results was evaluated using certified reference material (CRM) following 3111 C method. The detection limits were 0.01 µg L^{-1} for Cu, Zn, Pb and Cd , 0.02 µg L^{-1} for Cr and 0.03 µg L^{-1} for Fe. The 18 parameters with their abbreviations and analytical methods applied were listed in Table 1.

Table 1

List of physicochemical and biological parameters measured for river water, their units, abbreviations and analytical method applied

Parameters	**Units**	**Abbreviation**	**Analytical method**
Temperature	°C	T	Thermometer
pH	pH unit	pH	pH meter
Total alkalinity	$CaCO_3$ mg L^{-1}	T.Alk	Titration
Total acidity	$CaCO_3$ mg L^{-1}	T.Aci	Titration
Electrical conductivity	µS cm^{-1}	EC	Electrometer
Dissolved oxygen	mg L^{-1}	DO	Winkler titration
Biochemical oxygen demand	mg L^{-1}	BOD	Winkler titration
Chemical oxygen demand	mg L^{-1}	COD	Dichromate reflex method
Nitrate nitrogen	mg L^{-1}	N	Spectrometric
Phosphate-P	mg L^{-1}	PO_4^{3-}-P	Spectrometric
Sulphate	mg L^{-1}	SO_4^{2-}	Spectrometric
Copper	µg L^{-1}	Cu	AAS
Cadmium	µg L^{-1}	Cd	AAS
Chromium	µg L^{-1}	Cr	AAS
Iron	µg L^{-1}	Fe	AAS
Lead	µg L^{-1}	Pb	AAS
Zinc	µg L^{-1}	Zn	AAS
Total Coliform	MPN/100 mL	TC	MPN method

AAS= Atomic absorption spectrophotometer, MPN= Most probable number

About 400 people of different age, sex, caste, education etc. have been interviewed to evaluate the impact of Ganga water pollution on social and religious activities. Questionnaire method was used for the collection of data and significance of the data was tested with the help of relevant statistical methods.

3. Results and Discussion:

In order to evaluate the effect of dead body cremation on the quality of river Ganga, the physico-chemical and biological parameters were examined.

3.1 Physico-chemical properties of Ganga water

The highest values of temperature, pH, total alkalinity, acidity, BOD, NO_3N, PO_4^{3-} and SO_4^{2-}, were observed at MG followed by DG and least at the reference site (Fig.1). Similar results were reported by Tripathi et al. in 1991 for the effect of city sewage on the quality of river Ganga. The possible reason for higher values of these pollutants at MG and DG might be due to release of elevated amounts of these pollutants. The lowest value at reference site might be due to least release of pollutants. The DO content was highest at reference site followed by DG and least at MG. The possible reason for relatively low DO value at DG and MG might be that DO is consumed in the degradation of pollutants

Fig.1(a)

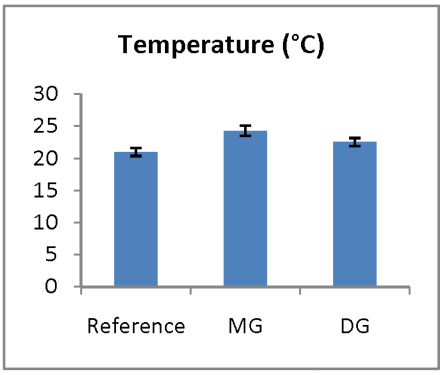


Fig.1(b)

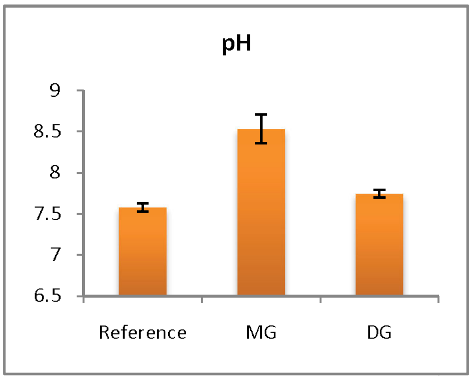
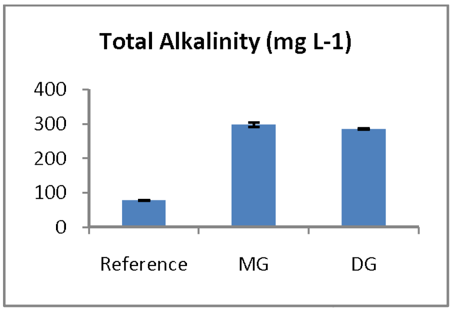


Fig.1(c)



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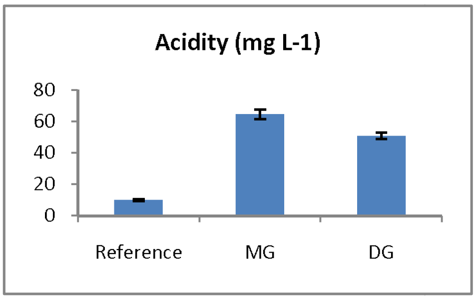

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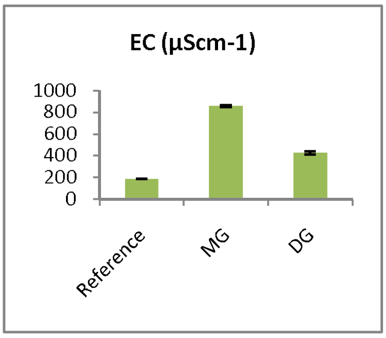
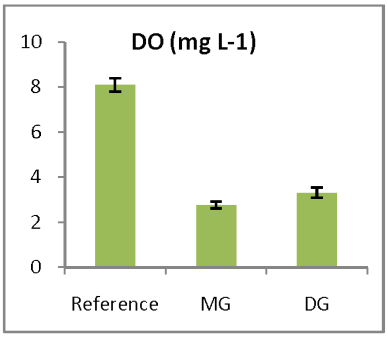


Fig.1(f)



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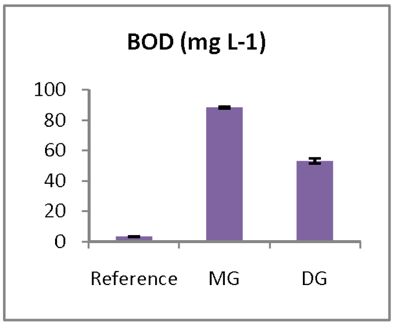

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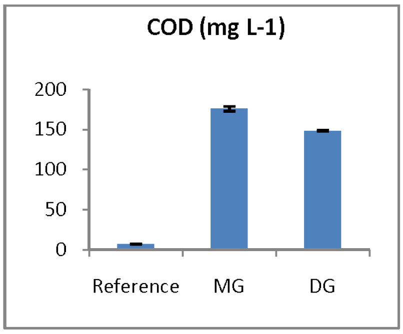


Fig.1(i)

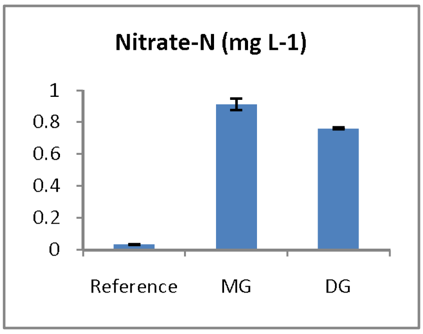


Fig.1(j)

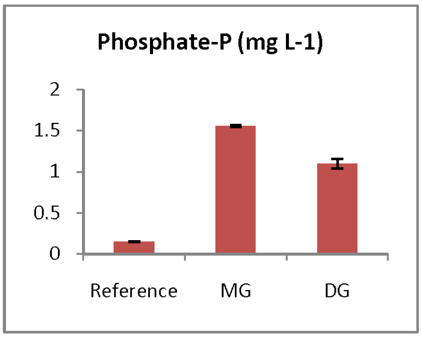


Fig.1(k)

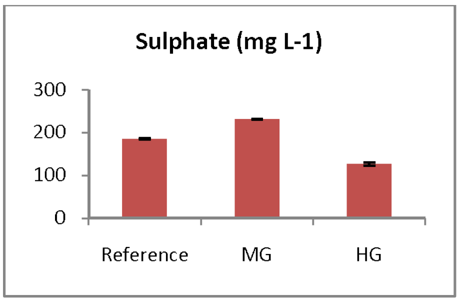
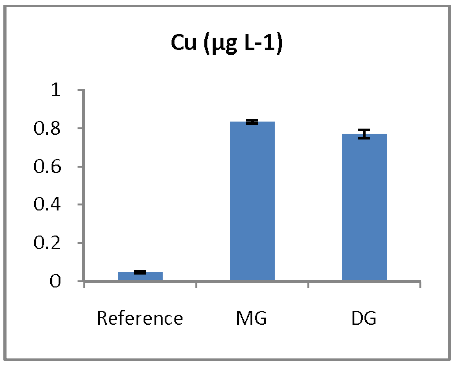


Fig.1 Physicochemical properties of river Ganga water (a) Temperature; (b) pH; (c) Total alkalinity; (d) Acidity; (e) EC (f) DO; (g) BOD; (h) COD; (i) Nitrate-N; (j) Phosphate-P and (k) Sulphate

3.2 Heavy metal content in the Ganga water

Cu, Cd, Cr, Fe, Pb and Zn were noted relatively high at MG followed by DG and least at the reference site (Fig.2). Similar findings were observed by Ganpati and Alikunhi in 1950 for discharge of industrial effluents into river water. The possible reason for higher values of these pollutants at MG and DG might be due to release of elevated amounts of these pollutants. The lowest value at reference site might be due to least release of pollutants.

Fig.2(a)



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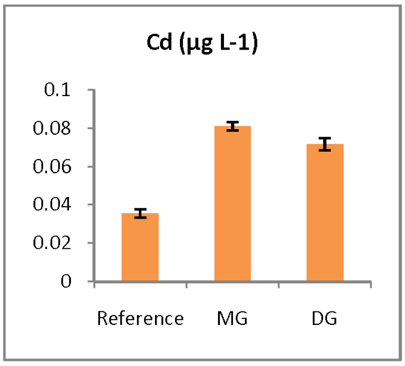

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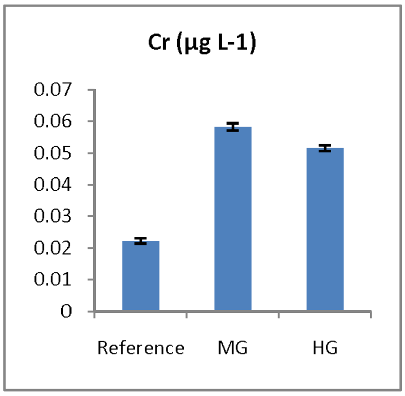

Fig.2(d)

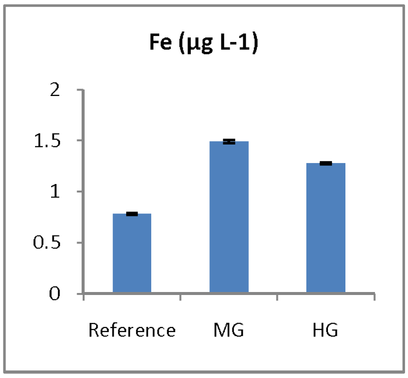

Fig.2(e)

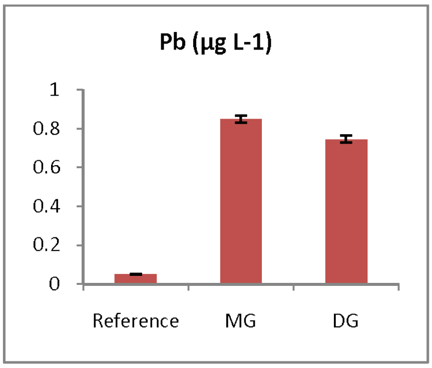

Fig.2(f)

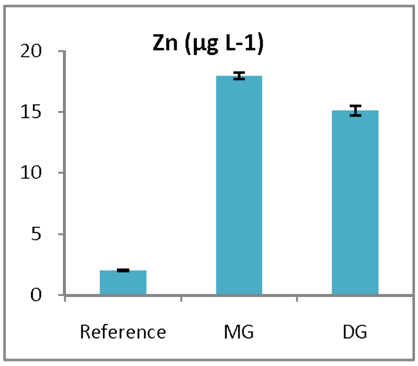

Fig.2 Heavy metal contents of river Ganga water (a) Cu; (b) Cd; (c) Cr; (d) Fe; (e) Pb and (f) Zn.

3.3 Bacterial properties of Ganga water

Total coliform was highest at MG followed by DG and least at the reference site. The possible reason for higher values of these pollutants at MG and DG might be due to release of elevated amounts of these pollutants. The lowest value at reference site might be due to least release of pollutants (Fig.3). Similar results were reported by Shukla et al. in 1989 for physico-chemical and biological characteristics of River Ganga.

Fig.3

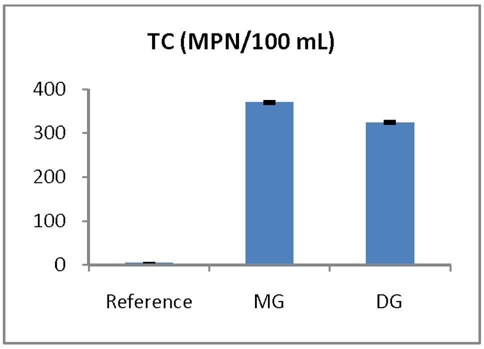

Fig.3 Total coliform of river Ganga water.

3.4 Effects of polluted Ganga water on social and religious activities

About 400 people of different age, sex, caste, education etc have been interviewed to evaluate the impact of Ganga water pollution on our cultural behaviour. From the observations it is revealed that more than 85% people were of the opinion that our rituals related to birth, marriage and death etc. are adversely affected. However, 15% people were of the opinion that there is no adverse effect of the pollution of river Ganga on our cultural activities. Majority of people having opinion that there is adverse effect of Ganga water pollution on our cultural and religious activities belong to the educated group whereas 15% people having opinion that there is no effect belong to illiterate group. Opinion of the 15% people that there is no effect of Ganga water pollution on our cultural and religious activities indicates their strong belief and faith towards mother Ganga.

Conclusions:

Physico-chemical characterization of river Ganga water revealed that the water quality of river Ganga is continuously deteriorating at Varanasi. The BOD values which are suppose to be less than 3.0 mgL^{-1} raised to 18.5 mgL^{-1} on the bathing ghats and DO content of water which must be more than 5.0 mgL^{-1} is reduced to 2.5 mgL^{-1}. The bathing ghats of Varanasi are associated with a number of social, cultural, tourism and religious activities. A number of activities such as marriage, birth, religious ceremonies and cremation of dead bodies etc. which have been conducted since ancient ages on the bank of river Ganga are adversely affected due to knowledge among the people about pollution of river Ganga. Government efforts to clean up the river have failed due to poor planning, technological mismanagement and corruption. A questionnaire based survey revealed that more than 85% people were of the opinion that our rituals related to birth, marriage and death etc. are adversely affected due to the knowledge of polluted Ganga water.

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