

Evaluation of Ganga River Water Quality at Haridwar

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Abstract: The study is aimed at assessing the river water quality parameter of the Ganga river at in Haridwar at Har ki Pauri. The importance of water for good quality/quantity crop growth is well known; it is one of the prime requirements for agricultural practices about which farmers have always been concerned. India is a land of farmers, and agriculture is the backbone of Indian economy. Different samples were taken from different time and date in the Haridwar at Har ki Pauri place. This study revealed that pH value of river Ganga samples in the study area was in the range 6.69 to 7.9 and Conductivity of collected samples varies between 151.6 $\mu\text{S}/\text{cm}$ to 198.9 $\mu\text{S}/\text{cm}$ as well as TDS in the river Ganga of study area varies from 97 mg/l to 127 mg/L. It can be concluded that all the analyzed river water samples were having TDS less than 500 mg/l (acceptable limit). Total Hardness was found to be within 82-100 mg/l as CaCO_3 . Total hardness in 100% samples was found below 200 mg/l (acceptable limit). Total Alkalinity ranged from 8.9mg/l to 90mg/l and Chloride content in the collected samples was in the range of 0.8 to 2.10 mg/l which all exists in the permissible limits. There should be a great need of intercepting the sewage originating from the habitation of Haridwar and nearby area and routing it to a treatment plant before discharging in the river

Keywords: Water Parameters, Ganga river, Haridwar, Chloride, TDS, Alkalinity

I. INTRODUCTION

Water contamination is a noteworthy worldwide issue which requires progressing assessment and update of water asset arrangement at all levels. Waterborne ailments cause around 1.8 million passing every year. Loose bowels happen worldwide and cause 4% of all passing and 5% of wellbeing misfortune to incapacity. It is most normally brought on by gastrointestinal contaminations which lead to the death of around 2.2 million individuals all inclusive every year, generally youngsters in developing nations (WHO 2015). India's growing population is putting a heavy strain on water resources of the country, most of which is contaminated mostly by sewage and agricultural runoff. Only a part of the Indian population has access to safe drinking water (WHO, 2015). Although access to drinking water has improved, the World Bank estimates that about 21% of the communicable diseases in India are related to unsafe water. The waterborne diseases are jaundice, cholera, typhoid and gastro enteritis, etc. This surface water and groundwater is mainly polluted by anthropogenic activities viz. urbanization, industrialization, disposing of garbage, etc.

The immaculateness of such water, the faith in its known recorded and obscure fanciful causes, and the detachment of remote sources, lift its significance considerably further. In India, the water of the River Ganga is treated with such adoration. Legend says that the river has plunged from Heaven on earth as an after effect of the long and laborious supplications of King Bhagirathi for the salvation of his perished precursors. Water quality of River Ganga is deteriorating due to disposal of untreated domestic sewage directly into the river, agricultural runoff, bathing & washing of cattle's in rivers. Rivers being the running water bodies are less prone to pollution than the lakes whose self-purification process are less effective than rivers. Any contamination or pollution of the river affects greatly the flora and fauna and also the human health if the water is used for domestic supply. The environmental health of any river system depends upon the nature of that river and its exposure to various environmental factors such as temperature, depth of water, wind speed, soil types and land uses of the catchment of the river. Thus, there is a great need for regular monitoring & assessment of river water quality. The present study aims at evaluating the water quality of river Ganga at Haridwar at Har ki Pauri & thus, evaluating the level of pollution in the river to understand its suitability for drinking and bathing.

II. MATERIAL AND METHOD

2.1 Study Location: Har ki Pauri, Haridwar

Har Ki Pauri is a famous ghat on the banks of the Ganges in Haridwar in the Indian state of Uttarakhand. This revered place is the major landmark of the holy city of Haridwar. Literally, "Har" means "Lord Shiva" who is the god according to shaivite Rishabh Bhagwan school of Hindu theology, "Ki" means "of" and "Pauri" means "steps". Lord Shiva and Lord Vishnu are believed to have visited the Brahmakund in Har Ki Pauri in the Vedic times. Har Ki Pauri lies between latitude 29°57'23.1" N and Longitude is 78°10'15.3" E.

2.2 Sampling Day

Sampling was being carried out for 4 months at an interval of 5 to 20 days and on the occasion of ardh kumbh snaan days starting from January 2019 to April 2019 (Table 1). Samples were collected from one location. 10 samples of river water were collected from Har ki Pauri. The map of sampling is presented in Fig. 1

Table 1: sampling day in the Har Ki Pauri

Date	Day	Date	Day
8/01/2019	Amavasya	4/03/2019	Chaitra Shukla
12 /01/ 2019	Panchami	14/03/2019	Mesha Sankranti
22/01/ 2019	Magh Purnima	20/03/2019	Panchami
7/02/2019	Purnima	26/03/2019	Chaitra shukla Purnima
22/02/2019	Chaitra Amavasya	01/04/2019	Purnima



Figure 1: View of Har Ki Pauri

III. RESULT

The Bureau of Indian Standards (BIS) has framed the specifications for Drinking Water and published as IS 10500:2012. The standard specifies the acceptable and permissible limits for water used for drinking applications. It is recommended that the water with acceptable limit should be provided for drinking whereas, in the absence of the water satisfying the acceptable limits, water satisfying the permissible limits can be used. If the parameters exceed the permissible limits, the source should be rejected. 10 samples from different days were analyzed for their physicochemical parameters such as pH, Acidity, Alkalinity, Hardness, Total Dissolved Solids and Chloride as shown in Table 2 and 3.

Table 2: Physical results of the samples

S. NO.	DATE	LOCATION SOURCE	LATITUDE	LONGITUDE	pH	EC (μS/cm)	TDS (mg/L)	Turbidity (NTU)
Acceptable Limit					6.5 – 8.5	----	500	1
Permissible Limit					NR	-----	2000	5
1	8 Jan	Har Ki Pauri	N29°57'23"	E 78°10'15"	7.43	190.6	122	0.9
2	12 Jan	Har Ki Pauri	N29°57'23"	E 78°10'15"	6.85	190.5	122	5.6
3	22 Jan	Har Ki Pauri	N29°57'23"	E 78°10'15"	7.23	198.9	127	3.2
4	7 FEB	Har Ki Pauri	N29°57'23.1"	E 78°10'15.3"	6.69	151.6	97	3.12
5	22 FEB	Har Ki Pauri	N29°57'23.1"	E 78°10'15.3"	6.85	190.5	118	1.6
6	4 Mar	Har Ki Pauri	N29°57'23.1"	E 78°10'15.3"	7.23	198.9	126	2.9
7	14 Mar	Har Ki Pauri	N29°57'23.1"	E 78°10'15.3"	7.90	196.2	126	0.3
8	20 Mar	Har Ki Pauri	N29°57'23.1"	E 78°10'15.3"	7.70	181.8	116	3
9	26 Mar	Har Ki Pauri	N29°57'23.1"	E 78°10'15.3"	7.90	183.4	117	6
10	1 Apr	Har Ki Pauri	N29°57'23.1"	E 78°10'15.3"	7.74	181.6	116	8

Table 3: Chemical results of the samples

S NO	DATE	DO (mg/l)	TA (mg/l)	T Hard (mg/l)	Mg (mg/l)	Na (mg/l)	Cl (mg/l)	BOD (mg/l)
Acceptable Limit		5	200	200	30	-----	250	3
Permissible limit		NR	600	600	100	-----	1000	NR
1	8 Jan	9.9	90	86.0	40.83	3.2	0.8	0.4
2	12 Jan	10.3	68	100.0	25.17	3.2	1.9	0.60
3	22 Jan	10.2	76	90	24.34	4.6	1.9	0.2
4	7 FEB	12.5	80	92	7.81	4.7	2.1	0.20
5	22 FEB	8.9	8.9	86	11.22	4.40	1.9	0.1
6	4 Mar	9.6	9.6	84	8.30	4.4	2	0.8
7	14 Mar	9.5	9.5	98	12.20	4.5	2	0.6
8	20 Mar	9.1	9.1	82	7.32	4.8	2.1	1.4
9	26 Mar	9.6	9.6	88	5.86	4.4	0.9	0.4
10	1 Apr	9.6	9.6	88	7.32	3.7	0.9	0.2

III. DISCUSSION

3.1 Alkalinity

Alkalinity in natural water is mainly due to the presence of carbonates, bicarbonates, and hydroxides. It constitutes an important parameter in determining the quality of water. The alkalinity values having lower concentration as compared to BIS standards recommended. The alkalinity values were found to be significant at the Ganges and at different study sites. Total Alkalinity ranged from 8.9mg/l to 90mg/l which was well within the permissible limits of BIS standards (200- 600mg/l). The graphical representations of Alkalinity of all the samples are as shown in Fig. 2.

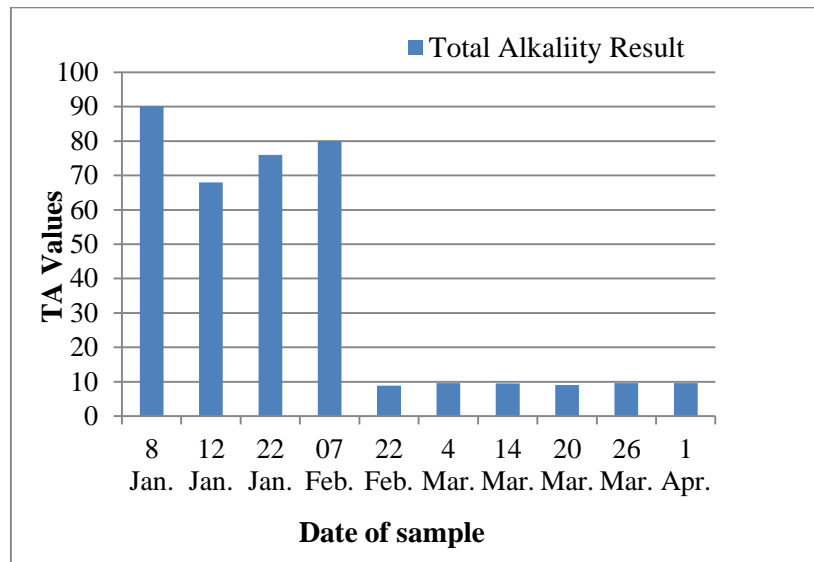


Figure 2: Graphical representation of alkalinity of the samples

3.2 Total Hardness

Total hardness in 100% samples was found below 200 mg/l (acceptable limit) and all the samples were well within the permissible limits prescribed by BIS (2012). The World Health Organization says that "there does not appear to be any convincing evidence that water hardness causes adverse health effects in humans". In fact, the United States National Research Council has found that hard water actually serves as a dietary supplement for calcium and magnesium. Some studies have shown a weak inverse relationship between water hardness and cardiovascular disease in men, up to a level of 170 mg calcium carbonate per litre of water. The graphical representations of Alkalinity of all the samples are as shown in Fig. 3.

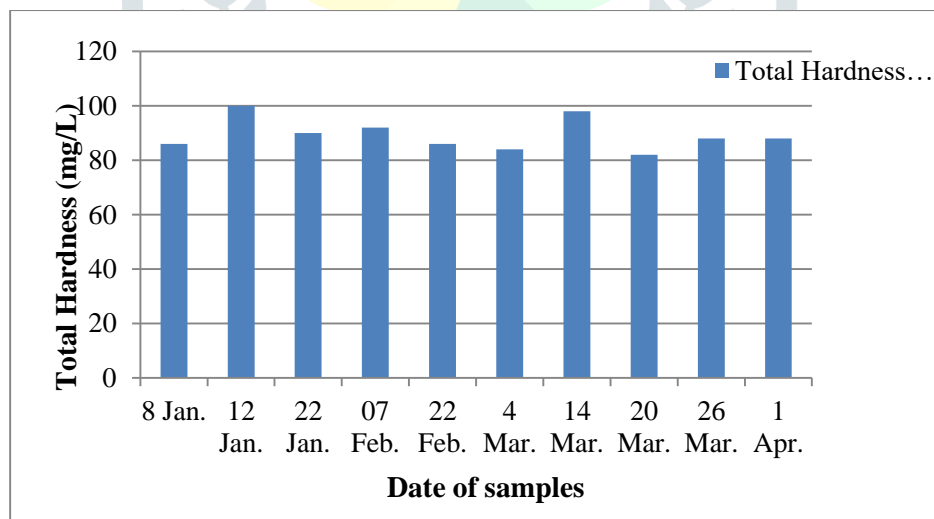


Figure 3: Graphical representation of the total hardness of the samples

3.3 Magnesium

Magnesium is present in seawater in amounts of about 1300 ppm. After sodium, it is the most commonly found cation in oceans. Rivers contains approximately 4 ppm of magnesium, marine algae 6000-20000 ppm, and oysters 1200 ppm. The value of magnesium in river samples of the study area ranges from 5.86 to 40.83 mg/l. The magnesium content in all samples was well within the acceptable limit (30 mg/l) and the permissible limit (100 mg/l) prescribed by BIS (2012). The graphical representations of Alkalinity of all the samples are as shown in Fig. 4.

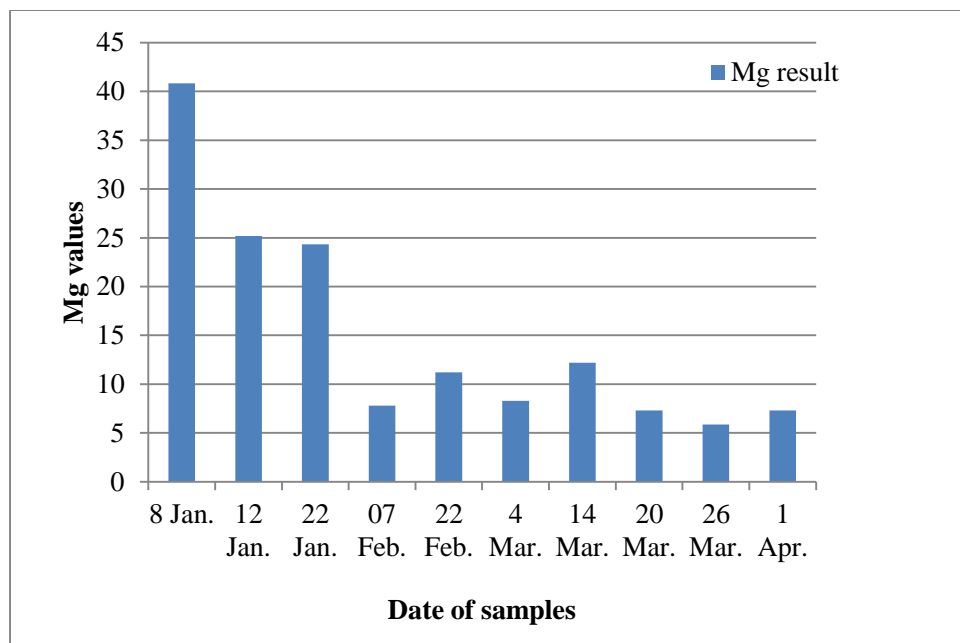


Figure 4: Graphical representation of magnesium of the samples

3.4 Chloride

The concentrations of chloride in the collected samples were in the range of 0.8 to 2.1 mg/l. Chloride level in samples was well within the acceptable limit. Chlorides in River Ganges waters can be credited to release of neighborhood effluents or local sewage transfer at various focuses which may bring about moderate increment in levels of chlorides. The graphical representations of Alkalinity of all the samples are as shown in Fig. 5.

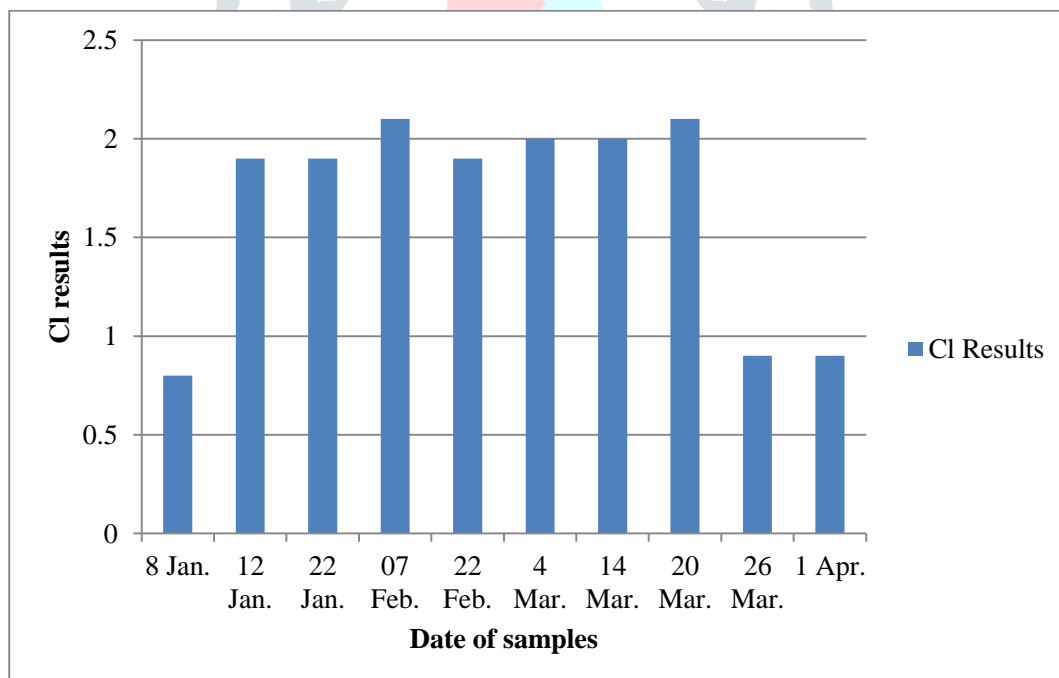


Figure 5: Graphical representation of chloride of the samples

3.5 BOD

Biochemical Oxygen Demand (BOD, also called Biological Oxygen Demand) is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. The BOD content in the analyzed river Ganga water samples of the study area varies from were 0.1

to 1.4 mg/l which were well within the BIS guidelines of acceptable limit. The graphical representations of Alkalinity of all the samples are as shown in Fig. 6.

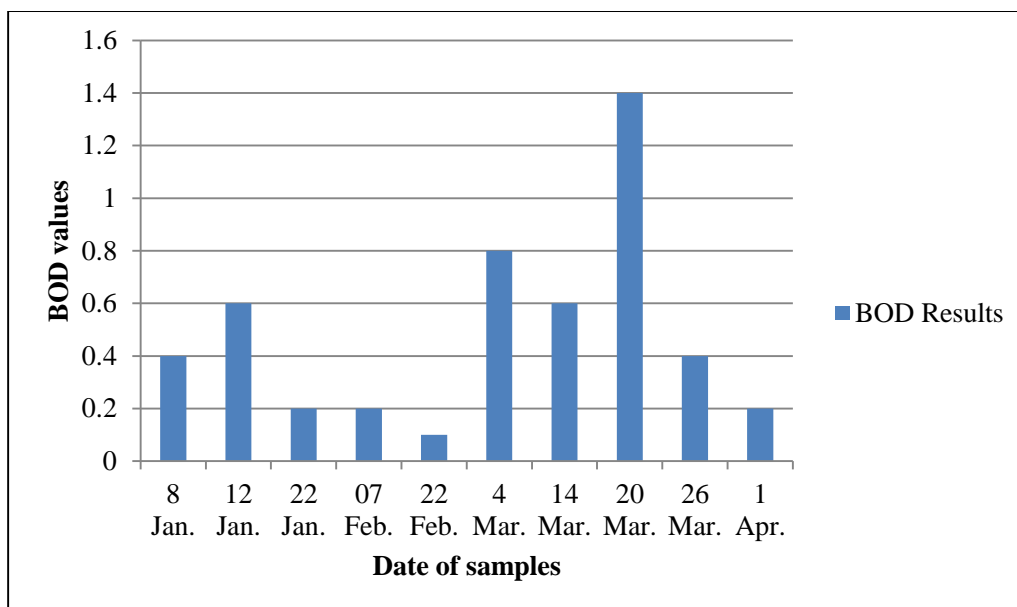


Figure 6: Graphical representation of BOD of the samples

IV. CONCLUSION

Based on this study, the following conclusions can be drawn for river water of Ganga At Haridwar:

- The pH value of river Ganga samples in the study area was in the range of 6.69 to 7.9. Most of the time, the samples were confirming the limits prescribed by BIS (2012) for drinking water.
- The conductivity of collected samples varies between 151.6 $\mu\text{S}/\text{cm}$ to 198.9 $\mu\text{S}/\text{cm}$ and TDS in the river Ganga of study area varies from 97 mg/l to 127 mg/L. Turbidity in the analyzed river Ganga samples of study area varies from 0.3 NTU to 8 NTU.
- Total Hardness was found to be within 82-100 mg/l as CaCO_3 . Total hardness in 100% samples was found below 200 mg/l (acceptable limit) and all the samples were well within the permissible limits prescribed by BIS (2012). The chloride content in the collected samples was in the range of 0.8 to 2.10 mg/l
- The value of magnesium in groundwater samples of the study area ranges between 0.3 to 8 mg/l, Magnesium content in all samples was well within the acceptable limit (30 mg/l) and the permissible limit (100 mg/l) prescribed by BIS (2012). Total Alkalinity ranged from 8.9mg/l to 90mg/l as CaCO_3 which was well within the permissible limits of BIS standards (200-600mg/l).
- There's a great need of intercepting the sewage originating from the habitation of Haridwar and nearby area and routing it to a treatment plant before discharging in the river.

REFERENCES

- [1]. Bhutiani, D. R. Khanna, Dipali Bhaskar Kulkarni, Mukesh Ruhela; Assessment of Ganga river ecosystem at Haridwar, Uttarakhand, India with reference to water quality indices; Appl Water Sci DOI 10.1007/s13201-014-0206-6
- [2]. Assessment of Water Quality of River Ganga along Ghats in Varanasi City, U. P., India; tarence thomas, meenu mishra, h. thomas, arun a. david, ram bharose and d.venkat reddy; international journal of earth sciences and engineering ISSN 0974-5904, Vol. 04, No. 04, August 2011, pp. 698-711
- [3]. ARCHANA MISHRA and B.D. TRIPATHI, Seasonal and Temporal variations in physicochemical and bacteriological characteristics of river Ganga in Varanasi;
- [4]. Current World Enviroment Vol. 2(2), 149-154 (2007)
- [5]. Sarita Verma; Seasonal Variation of Water Quality in Betwa River at Bundelkhand Region, India; Global Journal of Environmental Research 3 (3): 164-168, 2009
- [6]. <http://www.researchgate.net/publication/233413301>
- [7]. Spatial and Temporal Variations of water quality in Cao-E River of Eastern China; CHEN Ding-jiang, LU Jun, YUAN Shao-feng, JIN Shu-quan, SHEN Ye-na;
- [8]. Journal of Environmental Sciences Vol 18, No. 4, pp. 680-688, 2006
- [9]. www.wikipedia.com
- [10]. <http://www.unitedlifejournals.com/ijals/view-article.php?id=35>
- [11]. Naveen kumar arora, sakshi tewari and sachin singh; ANALYSIS OF WATER QUALITY PARAMETERS OF RIVER GANGA DURING MAHA KUMBH, HARIDWAR, INDIA

- [12]. Vijay Sharma, Sushil Bhadula and B. D. Joshi; Nature and Science, 2012;10(6); Impact of Mass Bathing on water quality of Ganga River during Maha Kumbh-2010
- [13]. Sarita Verma; Global Journal of Environmental Research 3 (3): 164-168, 2009; Seasonal Variation of Water Quality in Betwa River at Bundelkhand Region, India
- [14]. A.A. Kazmi, Akansha Bhatia, Azfar Shaيدا, Meena Sharma, Markus Stark and R. C. Trivedi; Journal of Indian Water Society, vol 33, No. 3, July 2013; A SHORT SCREENING STUDY ON WATER QUALITY OF INDIAN RIVERS AND LAKES
- [15]. N. Semwal and P. Akolkar; Water quality assessment of sacred Himalayan rivers of Uttaranchal
- [16]. TARENCE THOMAS, MEENU MISHRA, H. THOMAS, ARUN A. DAVID, RAMBHAROSE and D. VENKAT REDDY; International Journal of Earth Sciences and Engineering; ISSN 0974-5904, Vol. 04, No. 04, August 2011, pp. 698-711; Assessment of Water Quality of River Ganga along Ghats in Varanasi City, U. P., India
- [17]. Ashok Kumar, B.S. Bisht, V.D. Joshi, A.K. Singh and Amitabh Talwar; J Hum Ecol, 32(3): 169-173 (2010); Physical, Chemical and Bacteriological Study of Water from Rivers of Uttarakhand

