

POLLUTION OF SOME RECREATION BEACHES OF MUMBAI, MAHARASHTRA

SHAMRAO A.INGOLE¹ AND ARUN N KADAM²

ABSTRACT : Pollution in terms of water and sediment qualities of Madh, Juhu, Dadar and Girgaon recreation beaches was studied. Water quality in respect of low pH (7.8-8.3), low salinity (15.1-34.5 ppt), high microbial population (coliform count up to 18000 /100 mL) and high phosphate and ammonium contents reveal the influence of a land run-off. High DO (3.8-7.8 mg/L) and low BOD (<0.1-7.5 mg/L) however indicate well oxygenated conditions possibly through the surfing action of tidal seawater. Variations over a tidal cycle in respect of low DO; high levels of phosphate, ammonium and coliforms during ebbing and enhancement in DO and salinity associated with decrease in corresponding nutrients during flooding suggest deterioration in the water quality by polluted land based discharges. The deterioration was marked at Dadar where influence of highly polluted discharges through Mahim Creek could be responsible. The beach quality shows marked deviations as compared to the quality of seawater sampled 5 km off the coast. Though most of the parameters are within the norms, coliform counts were abnormally high in the beach waters as compared to the CPCB criteria.

KEYWORDS : Pollution, Heavy metals, Coliform count, Beach waters.

INTRODUCTION

It has been reported that releases of large volumes of untreated/partially treated industrial and domestic effluents have polluted¹⁻⁴ the nearshore marine environment of Mumbai (Figure 1). It was therefore feared that they might have polluted the recreation beaches causing deleterious effects to the human health. Some such effects are known to be skin irritations, gastrointestinal diseases, transmission of typhoid fever, viral diseases, ear and throat and respiratory infections⁵⁻⁹. Moreover the discharges also can spoil aesthetics due to presence of black patches and nauseating smell. Hence the present study on rapid oceanographic survey for water and sediment qualities of some recreation beaches of Mumbai was undertaken.

MATERIALS AND METHODS

Seawater samples were collected at four sandy beaches namely Madh, Juhu, Dadar and Girgaon (Figure 1) during May-June 1999 at 0.5 m depth over a tidal cycle (12 h) with 1 h frequency. They were analysed for temperature, pH, salinity, phosphate, nitrate, nitrite and ammonium (NH_3+NH_4) as per Grasshoff *et al*¹⁰. Samples also collected for suspended solids (SS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and microbiology at full high tide (flood) and full low tide (ebb) were analysed by recommended procedures^{10,11}. The spectroscopic measurements were taken on Bausch and Lomb - spectronic 20 spectrophotometer. Surface sediment samples were collected once at each beach during ebb from mid-littoral zone by scooping. Their

preservation, processing and analysis for microbiology (coliform count) and some heavy metals were performed following procedures by APHA and Loring and Rantala^{11,12}. The results are presented in Tables 1 and 2.

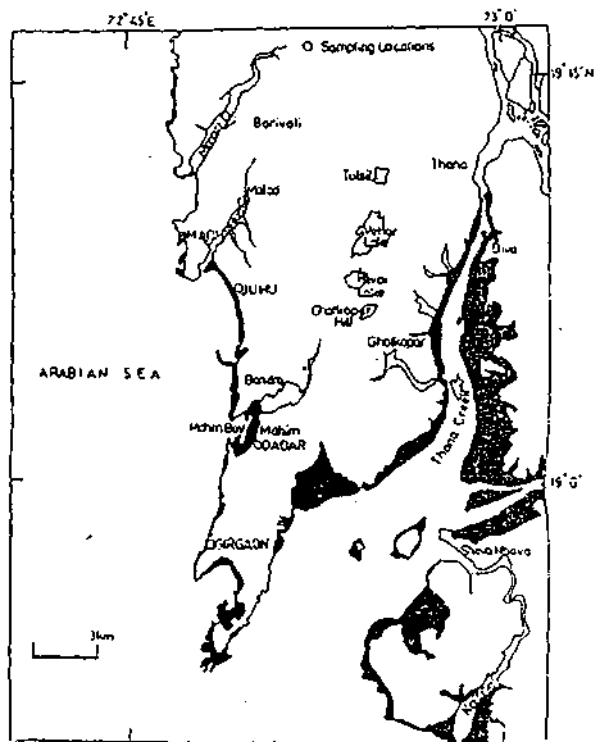


Fig.1: Map showing stretches of Mumbai city and sampling stations.

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TABLE 1: WATER QUALITY OF SOME BEACHES ALONG MUMBAI COAST DURING MAY-JUNE 1999

Parameter	Beach				Coastal Water	CPCB criteria
	Madh	Juhu	Dadar	Girgaon		
Temperature (°C)	31.0-34.9 (33.0)	32.0-34.5 (33.4)	28.0-33.0 (31.0)	31.0-34.0 (32.5)	30.5	
pH	7.9-8.2 (8.0)	7.9-8.0 (7.9)	7.8-8.2 (8.0)	8.2-8.3 (8.3)	8.0-8.1 (8.1)	6.5-8.5
SS (mg/L)	160-190 (175)	255-340 (298)	340-1095 (718)	210-605 (408)	24	No visible suspended solids of sewage or industrial waster origin
Salinity (ppt)	29.6-34.5 (33.6)	32.0-32.9 (32.6)	15.1-32.4 (27.9)	29.5-32.6 (31.3)	35.8	
DO (mg/L)	5.9-6.6 (6.3)	6.3-7.5 (6.9)	3.6-5.4 (4.5)	6.8-7.8 (7.3)	4.1-4.3 (4.2)	3.0
BOD (mg/L)	1.7-4.6 (3.1)	<0.2	<0.2	<0.2-7.5 (3.8)	-	5.0
Phosphate (Mg/L)	14-49 (31)	2-19 (12)	8-58 (27)	2-35 (7)	40-43 (40)	
Nitrate (Mg/L)	34-103 (71)	ND-162 (67)	137-329 (254)	ND-16 (4)	15-29 (22)	
Nitrite (Mg/L)	14-25 (20)	1-22 (10)	28-59 (47)	ND-9 (5)	8-11 (10)	
Ammonium (Mg/L)	3-8 (5)	ND-17 (6)	56-208 (139)	19-95 (47)	17-24 (21)	1200
Coliforms (no/100 mL)	140-16000 (8070)	2250-18000 (> 18000)	450-3000 (1975)	1300-18000 (>18000)	-	1000

SS - Suspended solids. ND-Not detected. Average in parenthesis

TABLE 2 : SEDIMENT QUALITY OF SOME BEACHES ALONG MUMBAI COAST DURING MAY-JUNE 1999

Transect	Al (%)	Cr (Mg/g)	Mn (Mg/g)	Fe (%)	Co (Mg/g)	Ni (Mg/g)	Cu (Mg/g)	Zn (Mg/g)	Hg (Mg/g)
Madh	3.8	151	1031	5.4	44	43	60	330	0.5
Juhu	2.4	172	1147	3.7	35	34	58	109	0.4
Dadar	2.4	86	917	3.5	32	31	34	29	0.6
Girgaon	1.9	203	957	4.3	30	31	38	24	2.4

Dry wt basis

RESULTS AND DISCUSSION

The beach water temperature (28.0-34.9°C) varied in accordance with the prevailing air temperature (29.0-33.2°C). pH of 7.8 to 8.3 and salinity ranging between 15.1 to 34.5 ppt reveal marked influence of some land run-off on the beach water quality while high DO (3.6-7.8 mg/L) and low BOD (<0.1-7.5 mg/L) indicate efficient maintenance of DO possibly through surfing action of tidal seawater and adequate assimilation of brought-in organic load in beach water respectively. Selective nutrients namely phosphate, nitrate, nitrite and ammonium were 2-58, ND-329, ND-59, ND-208 Mg/L respectively. Though phosphate and ammonium are in higher ranges and varied widely particularly at Dadar beach, high nitrite content at Dadar shows that the aquatic environment is under pollution stress. Coliform count (140-18000 /100 mL) were generally high during ebb and abnormally high at Juhu and Girgaon. Though variations in water quality of the beaches over a tidal cycle were mostly random, increase in salinity and DO during high tide and enhancement in nutrient levels associated with low DO values during low tide are evident particularly at Dadar (Figure 2). Hence, they reveal deterioration due to intrusion of some land run-off and improvement in water quality by ingress of tidal seawater. Topography and water circulation pattern along Mumbai coast suggest that effluents brought in through Manori, Malad and Mahim Creeks (Figure 1) can influence the beach environments of Madh, Juhu and Dadar respectively^{13,14}. Incidentally Malad and Mahim Creeks are reported to be highly polluted in respect of DO undetectable most of the time and high nutrient levels during low tide^{2,15}. Hence it appears that polluted discharges through Mahim Creek are responsible for the deterioration in water quality of Dadar beach.

Generally seawater quality of beaches is expected to be comparable to the quality of the nearshore seawater with few variations. In present study it was assessed by matching the results with the quality data² of seawater sampled 5km off the coast (Table 1). It reveals deterioration in beach water quality in respect of significantly lower values of pH and salinity, and higher contents of SS, nitrate and ammonium particularly at Dadar. Comparison between present data and quality criteria set by Central Pollution Control Board (CPCB) for bathing and recreation in marine coastal areas after receiving sewage and other waste⁶ indicates marginally

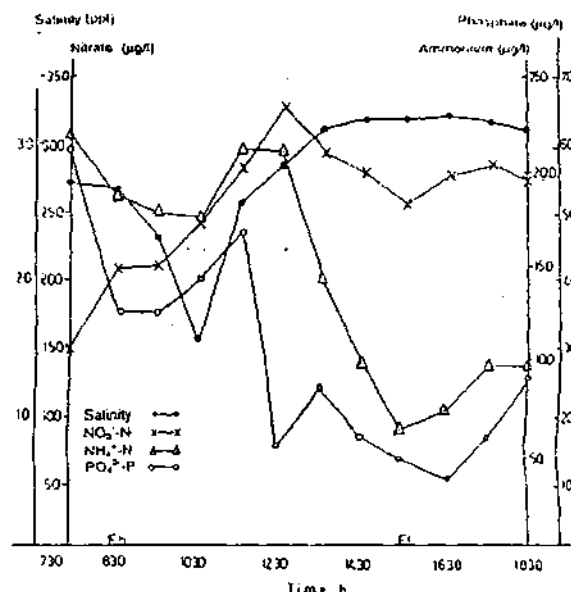


Fig.2: Temporal Variations in some chemical Parameters at Dadar Beach

higher BOD above 5 mg/L at Girgaon and abnormally high coliform count above 1000 /100 mL at all (the beaches (Table 1). Other parameters were however within the limits. UNEP reported that very few beaches worldwide can pass the norm of 1000 coliforms /100 mL¹⁷

Accumulation of metals in surface sediment (Table 2) reveals highest levels of metals namely Al, Fe, Co, Ni, Cu, Zn, at Madh beach and Cr, Hg at Girgaon. Source of the former could be the polluted discharges through Manori Creek. It is necessary to ascertain the source of polluting metals at Girgaon since mostly urban effluents which generally do not contain high levels of these metals are discharged there. The quality criteria for beach sediment is not available.

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