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ATMOSPHERIC CORROSION AT DIFFERENT LOCATIONS IN SOUTH INDIA

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To undertake proper corrosion preventive methods, the design engineers require corrosivity data of an area and also the pollutants present in the atmosphere. In this paper, the intensity of corrosion of various metals and the pollution data of different locations in the southern region is reported.

Keyword: **Atmospheric corrosion and corrosion map**

INTRODUCTION

Corrosion is essentially a chemical or electrochemical reaction between a metal and its environment. Since environments, such as, air, water and soil are of complex nature and variable, the reactions cannot be accurately predicted. To engineers and general users of metals, the corrosivity of the atmosphere in a particular area or location is important to help them in the selection of steel materials and suitable protective coatings.

The sites panel committee of the corrosion Advisory Bureau had a detailed study of atmospheric corrosion in different parts of the country and published its findings in the form of a book, 'Corrosion Map of India [1]. In this paper, corrosion rates of different metals at different locations in South India (not covered in the Corrosion Map of India) is reported.

EXPERIMENTAL

Description of experimental sites

Site No. 1: It is situated in the Nellore District of Andhra Pradesh and is 50 M from Bay of Bengal.

Site No. 2: It is situated 1 Km from Bay of Bengal near Kakinada of Andhra Pradesh.

Site No. 3: It is situated at Mandapam in Tamil Nadu and 15 M from the sea shore.

Site No. 4: It is situated at Kayamkulam in the state of Kerala and is 1 Km away from Arabian Sea. But very near to backwater.

Site No. 5: It is situated 2 Kms away from Arabian Sea and is 16 Kms from Mangalore.

Preparation and cleaning of specimens

Specimens of size 150 mm x 100 mm x 1.5 mm were used. The specimens were prepared as described in earlier publication [2]. The specimens were exposed in the exposure stands inclined to 318 K and facing south. Mild steel, zinc, aluminium and stainless steel panels were used. The corrosion rates were determined for various durations by weight loss method.

RESULTS AND DISCUSSION

Table I shows the corrosion rates of mild steel, zinc, aluminium, copper and stainless steel for 3 months, 6 months, 9 months and one year. The corrosion rates at Site 1, 2 and 3 which are on eastern coast of India are higher than the sites 4 and 4, which are on western coast of India. Uniformly corroding metals like mild steel, copper and zinc shows a slight decrease in corrosion rate during prolonged exposure whereas in the case of aluminium and stainless steel the initial corrosion rate is very low and increase rapidly with increase in time with the formation of pits.

Table II shows the monthly corrosion rate of mild steel at the five sites. The average monthly corrosion rate at site No.2 and 3 are 0.108, 0.276 mm/y respectively. It shows that eastern coast is more corrosive than the western coast of India. The highest corrosion rate is observed during March and April at site Nos. 2 and 3 when the temperature and chloride content are high, humidity is above critical limit and

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TABLE I: Corrosion rate of metals at various locations

Period exposure	Corrosion rate in mm/y				
	MS	Zn	Al	Cu	SS
			Site I		
3 months	0.9700	0.0440	0.0007	0.03000	0.00150
6 months	0.8100	0.2800	0.0007	0.02000	0.00500
9 months	—	0.0550	0.0026	0.01800	0.00550
one year	—	0.0460	0.0029	0.01500	0.00500
			Site II		
3 months	0.1340	—	—	—	—
6 months	0.1250	—	—	—	—
9 months	—	—	—	—	—
one year	0.0820	—	—	—	—
			Site III		
3 months	0.7800	0.1050	0.0110	0.25500	0.00060
6 months	0.9666	0.0625	0.0092	0.01460	0.00060
9 months	0.6900	0.0383	0.0017	0.00512	0.00027
one year	0.5300	0.0448	0.0020	0.00870	0.00040
			Site IV		
3 months	0.0630	0.0270	—	—	—
6 months	0.0540	0.0020	0.0001	—	—
9 months	0.0480	0.0015	0.0004	—	—
one year	0.0420	0.0030	0.0005	—	—
			Site V		
3 months	0.0340	0.0090	0.0002	—	—
6 months	0.0550	0.0030	0.0001	—	—
9 months	0.0530	0.0020	0.0004	—	—
one year	0.0430	0.0020	0.0014	—	—

MS - Mild Steel; Zn - Zinc; Al - Aluminium; Cu - Copper; SS - Stainless Steel

there is no rain to wash off the pollutant. The highest corrosion rate at sites 4 and 5 are observed during May to July during southeast monsoon.

Table III shows the chloride pollution in the atmosphere at the five sites.

TABLE II: Monthly corrosion rate of mild steel at different locations

Period of exposure	Corrosion rate in mm/y at			
	Site II	Site III	Site IV	Site V
January	—	0.036	0.055	0.040
February	0.046	0.025	0.055	0.063
March	0.208	0.031	0.066	0.037
April	0.211	0.148	0.045	0.035
May	0.162	0.554	0.095	0.064
June	0.083	0.708	0.084	0.162
July	0.068	0.506	0.070	0.118
August	0.023	0.536	0.058	0.128
September	0.064	0.454	0.041	0.051
October	0.067	0.185	0.029	0.048
November	0.126	0.095	0.053	0.025
December	0.128	0.036	0.045	0.035

TABLE III: Chloride pollution in the atmosphere at different sites

Month	Chloride; mdd				
	Site I	Site II	Site III	Site IV	Site V
January	3.7		0.23	4.48	0.17
February	3.9	0.85	0.25	—	1.70
March	4.7		0.20	4.00	1.00
April	5.5		2.07	5.20	—
May	3.6	0.88	24.02	2.50	0.96
June	4.9		11.60	1.17	0.80
July	4.6		8.08	1.29	0.11
August	4.4	3.1	4.44	—	0.76
September	3.6		1.88	1.13	0.56
October	3.2	0.93	—	—	—
November	3.3		0.54	1.45	0.42
December	3.6		0.29	—	0.17

CONCLUSION

From the field exposure studies, it is observed that eastern coast is more corrosive than western coast in India.

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