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## Corrosion study of ferrous and non ferrous metals in ground water from Pravara area

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### ABSTRACT

In present investigation an attempt has been made to investigate corrosion rate of ferrous, non ferrous (aluminum) and mild steel in ground water around Pravara area in pre-monsoon (April – May) and post monsoon (October – November) 2007 seasons. The eighteen different sites have been selected for collection of ground water samples. The factor causing corrosion and conditions of the environment has been studied.

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### KEYWORDS

Corrosion;  
Alloys;  
Non ferrous;  
Ferrous (S-S-304);  
Mild steel;  
Ground water.

### INTRODUCTION

Corrosion now a days has gained more importance due to an increased use of metal within all fields of technology. A more corrosive environment is due to increase in pollution of air and water. In case of metallic construction of more slender dimensions which do not tolerate corrosive attack to some extent. Corrosion is the destructive attack on a metal or a metal alloy by chemical or electrochemical reaction with its environment<sup>[1]</sup>. Aluminum and its alloys tend themselves to many engineering application because of their combination and lightness with strength, thermal and electrochemical conductivity, reflectivity and non toxic qualities<sup>[2]</sup>.

Iron is used in the form of stainless steel for making cutlery, hospital and food service equipment. Carbon steel is the most common, cheapest and most versatile metal used in industry. Due to wide range of applications of alloy in day to day life. The corrosion study of

metal is an analytical importance.

Corrosion is disintegration of material into its constituent atom due to chemical reaction with its surroundings. The loss of electrons of metal reacting with water and oxygen. Weakening of iron due to oxidation of the iron atoms is a well known example of electrochemical corrosion. Although in this context, the term degradation is more common. Most structural alloys corrode merely from exposure to moisture in the air, but the process can be strongly affected by exposure to certain substances. Corrosion can be concentrated locally to form a pit or crack, or it can extend across a wide area to produce general deterioration<sup>[1]</sup>. There are different factors influencing corrosion such as acids, oxidizing agents and temperature. The work on monitoring of ground water from some segments of pravara area<sup>[3,4]</sup>. Khadkwasala reservoir<sup>[5,6]</sup>, impact of human activities on quality of water<sup>[7]</sup> and physio-chemical characteristics of effluents<sup>[8-10]</sup> has been carried out in our

## Current Research Paper

laboratory. The attempt has been made to extend this work for corrosion study of various metals.

Proposed work was under taken for the systematic study of corrosion of the metal and alloys in ground water from Pravara area. pravara area is choose because is highly irrigated, large use of the fertilizers and single crop cultivations.

### EXPERIMENTAL

Ground water samples were collected from eighteen different locations from villages in pravara area TABLE 1, Figure 1. The sampling stations are 4 to 5 km away from each other. Samples were collected in sterilized screw-capped polyethylene bottles<sup>[11]</sup> having one liter capacity, labeled properly.

TABLE 1 : Sampling station

Sample No.	Sampling Locations	Sample No.	Sampling Locations
S <sub>1</sub>	Zarekathi	S <sub>10</sub>	Sadatpur
S <sub>2</sub>	Dadh Kd.	S <sub>11</sub>	Hasnapur
S <sub>3</sub>	Durkagapur	S <sub>12</sub>	Mamdapur
S <sub>4</sub>	Dadh Bk.	S <sub>13</sub>	Rajuri
S <sub>5</sub>	Pratappur	S <sub>14</sub>	Fatyabad
S <sub>6</sub>	Chinchpur	S <sub>15</sub>	Songaon
S <sub>7</sub>	Gogalgaon	S <sub>16</sub>	Chanegaon
S <sub>8</sub>	Loni Kd.	S <sub>17</sub>	Satral
S <sub>9</sub>	Chandrapur	S <sub>18</sub>	Dhanore

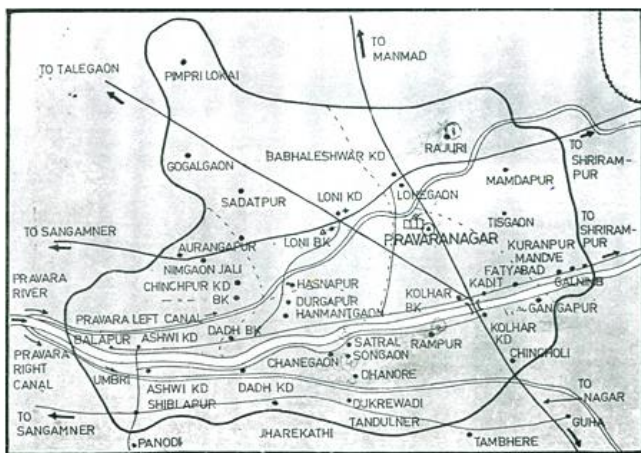


Figure 1 : Map of Pravara area showing position of sampling stations

### MATERIALS AND METHODS

Metal strips ferrous (S-S-304), non ferrous (alu-

minum) and mild steel were used for corrosion study.

Weight loss method is used for corrosion study. Standard metal strips are weighted and deeped in water for a known time i.e. for 3, 6, 15 and 18 hours. The metal strips are taken out, cleaned to remove the corrosion product and reweighed. The rate of corrosion of the metal is calculated by the formula.

$$\text{Corrosion rate} = \frac{W_f - W_i}{A \times t} \text{ (mg m}^{-1} \text{ hr)}$$

W<sub>i</sub> = Weight of metal strip before corrosion.

W<sub>f</sub> = Weight of metal strip after corrosion.

A = Geometric area of metal strip.

t = Time of exposure of metal strip.

### RESULT AND DISCUSSION

Corrosion rate in ground water samples collected from area under investigation in pre and post monsoon season has been carried out. (TABLE 2, 3). These samples frist analyzed for physico-chemical parameters<sup>[12]</sup>.

The corrosion rate of various time interval was monitored. Corrosion rate in post monsoon season is high

TABLE 2 : Corrosion rate in water samples collected in (Pre monsoons season)

Sample No.	Aluminum (Non Ferrous)				S-S 304 (Ferrous)				Mild Steel (Ferrous)			
	3hr	6hr	15hr	18hr	3hr	6hr	15hr	18hr	3hr	6hr	15hr	18hr
1	0.72	0.12	0.08	0.08	0.52	0.13	0.04	--	1.14	0.48	0.24	0.12
2	1.69	0.12	0.09	--	0.26	0.13	0.04	--	0.72	0.36	0.24	0.14
3	1.69	0.12	0.09	0.08	0.52	--	--	--	1.20	0.24	0.20	0.19
4	1.21	0.08	--	--	0.26	0.13	--	--	1.20	0.36	0.24	0.24
5	0.72	0.12	0.12	--	0.52	--	--	--	0.97	0.36	--	--
6	1.21	0.12	--	--	0.13	0.13	--	--	0.72	0.48	0.20	0.19
7	0.24	0.09	0.05	0.04	0.13	0.13	0.04	--	0.48	0.20	0.09	--
8	16.3	0.48	0.09	0.04	0.66	0.52	0.17	--	0.48	0.43	0.36	0.24
9	1.21	0.36	0.19	0.08	0.26	0.08	--	--	0.96	0.24	0.24	0.14
10	0.48	0.24	0.12	0.04	0.52	--	--	--	0.96	0.36	0.14	0.16
11	1.69	0.24	0.16	--	0.79	0.04	--	--	0.96	0.40	0.33	0.12
12	0.97	0.12	0.04	0.02	0.26	--	--	--	1.93	0.48	0.24	0.14
13	--	0.24	0.04	0.04	0.21	0.13	0.04	--	0.72	0.34	0.24	0.24
14	0.24	0.24	0.04	--	0.26	0.16	--	--	0.48	0.36	0.24	0.24
15	0.24	0.14	0.12	0.08	0.52	0.26	0.11	--	0.60	0.48	0.28	0.24
16	0.72	0.12	0.09	0.08	0.26	0.13	0.05	--	0.36	0.19	0.12	0.02
17	0.24	0.14	--	--	0.79	0.26	0.05	0.04	0.53	0.48	0.16	0.120
18	0.12	0.09	0.04	--	0.26	0.05	--	--	0.72	0.24	0.34	0.16

**TABLE 3 : Corrosion rate (Corrosion rate in water samples collected in (Post monsoons season))**

Sample no.	Aluminum (Non Ferrous)				S-S 304 (Ferrous)				Mild Steel (Ferrous)			
	3hr	6hr	15hr	18hr	3hr	6hr	15hr	18hr	3hr	6hr	15hr	18hr
1	2.14	2.01	1.93	1.20	5.27	2.63	2.10	0.37	--	2.41	1.44	1.20
2	4.83	362	3.22	2.41	5.27	5.27	3.07	2.63	--	1.20	0.80	0.48
3	1.69	1.20	0.97	0.09	2.63	2.63	2.19	2.10	4.83	3.62	2.01	1.93
4	2.41	2.41	2.41	2.41	5.23	2.63	2.63	2.63	2.41	1.20	0.96	0.80
5	4.83	3.62	1.93	1.61	2.63	2.63	2.19	2.10	--	2.41	1.44	1.61
6	--	2.81	1.93	1.21	2.63	2.63	2.63	2.11	--	2.41	2.01	1.44
7	15.9	15.7	12.1	11.8	21.00	19.3	16.3	7.91	16.5	12.0	12.0	12.0
8	8.67	7.25	6.28	6.03	14.9	12.6	7.91	5.27	9.66	6.03	5.23	4.83
9	2.41	2.41	2.41	2.01	1.93	0.97	0.97	0.93	1.61	1.61	1.61	1.44
10	19.3	9.66	8.45	8.45	13.1	--	--	9.22	18.1	14.0	12.0	8.45
11	2.41	1.20	1.20	1.20	3.07	3.07	2.27	2.19	2.63	2.63	2.41	2.01
12	--	3.62	3.38	2.41	--	7.47	3.07	2.63	--	1.93	1.20	1.20
13	4.34	2.41	1.61	1.21	2.63	--	5.80	1.75	4.35	2.41	1.61	1.45
14	--	2.81	2.41	0.12	--	2.63	1.58	0.52	--	3.38	1.20	0.12
15	--	--	2.01	1.45	7.91	--	--	1.75	--	--	--	1.93
16	7.25	6.03	4.02	2.90	--	6.59	4.31	4.21	29.9	6.03	4.02	2.41
17	--	--	2.01	0.97	--	--	2.63	1.05	--	--	3.22	1.44
18	--	--	2.41	0.97	--	--	2.63	1.05	--	--	2.01	1.44

as compare to pre monsoon season due to more cations and anions present in water such as chlorides, sulphate, calcium, magnesium and sodium<sup>[13]</sup>. Corrosion of mild steel and S-S-304 particularly due to dissolved oxygen present in ground water<sup>[14]</sup>.

The chlorides and sulphates are highly aggressive to corrosion point of view and their concentration is also important. Corrosion of metal immersed in water is however controlled by amount of dissolved oxygen<sup>[15,16]</sup>.

The variation in corrosive rate with exposure time for ferrous and non ferrous metal in ground water is reported in TABLE 2, 3. The rate of corrosion is always high initially and then decreases slowly up to 18 hours. Some times after 6 hour rate is constant for some sample. Corrosion rate depend on dissolved ion concentration, pH and temperature of water.

## CONCLUSION

Corrosion rate is increases in post monsoon season due to high percentage of calcium, sodium, sulphate and dissolved oxygen. In post monsoon season

some samples contain high percentage of phosphate may be increases corrosion rate.

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