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Short Communication

CAUSES OF CORROSION IN THE REINFORCED CEMENT CONCRETE (RCC) STRUCTURE AND STEEL ANCHORS OF TARBELA DAM

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Many experiments and practical trials have been made to find the causes of deterioration and corrosion of cement and concrete steel and mild steel surfaces. Hasson [1] reported that chloride ions have corrosive effect on steel and steel in RCC, Mehta [2] studied that sulphate ions deteriorates the portland cement and concrete. Gupta, *et. al.* [3] studied the effect of pH and sulfide ions on steel in aqueous solution and reported that generally corrosion rates were higher at lower pH at all sulfide ion levels, and at low pH values, the corrosion rates increase with the increase of sulfide concentration.

The present communication describes the causes of corrosion of Reinforced Cement Concrete (RCC) Structure and Steel Anchors of Tarbela Dam.

Table 1 and 2 indicate the corrosion/damage of RCC Structure and Steel Anchors may be due to the formation of intermediate (corrosive) products, formed as a result of oxidation of pyrite, high acidity, low pH values and enormously high sulphates contents.

Key words: Corrosion, RCC/Steel anchors, Tarbela Dam.

TABLE 1. CHEMICAL COMPOSITION OF WATER SAMPLES (IN PARTS PER MILLION).

	1	2	3	4	5	6
pH	2.9	2.5	3.5	3.2	6.0	6.3
Suspended matter	510 ppm	480 ppm	220 ppm	235 ppm	60 ppm	50 ppm
Total dissolved solid Total d 1340 ppm	6200 ppm	5800 ppm	1820 ppm	1870 ppm	1320 ppm	1340 ppm
Carbonated (as $CaCO_3$)	–	–	–	–	–	–
Bicarbonates (as $CaCO_3$)	–	–	–	–	88 ppm	65 ppm
Bicarbonates (as HCO_3)	–	–	–	–	53 ppm	45 ppm
Total acidity (as $CaCO_3$)	3300 ppm	3800 ppm	2600 ppm	2400 ppm	380 ppm	340 ppm
Calcium (as Ca^{++})	520 ppm	560 ppm	192 ppm	180 ppm	144 ppm	132 ppm
Hardness (as $CaCO_3$)	1300 ppm	1340 ppm	480 ppm	430 ppm	360 ppm	395 ppm
Magnesium hardness(as $CaCO_3$)	2000 ppm	1850 ppm	860 ppm	845 ppm	730 ppm	765 ppm
Iron (as Fe)	222 ppm	202 ppm	11 ppm	16 ppm	–	–
Sulphates (as SO_4)	4527 ppm	4825 ppm	1295 ppm	1330 ppm	864 ppm	832 ppm
Sodium (as Na^{++})	130 ppm	118 ppm	33.5 ppm	30.5 ppm	23 ppm	35 ppm
Potassium (as K^{++})	7 ppm	12 ppm	3.5 ppm	3 ppm	3 ppm	4.5 ppm

TABLE 2. CHEMICAL COMPOSITION OF ROCK AND ROCK ENCRUSTATION SAMPLE.

	Rock samples						Rock encrustation samples					
	1	2	3	4	5	6	1	2	3	4	5	6
Moisture	0.56%	0.62%	8.20%	7.25	0.83	0.72	22.23	20.18	21.21	21.85	20.21	20.85
Loss on ign.	10.44%	9.38%	11.42%	12.08	1.54	1.86	22.89	21.35	20.83	22.55	15.28	14.63
Free sulphur	Nil	Nil	Nil	Nil	Nil	Nil	15.88	13.35	14.56	15.35	12.32	13.36
SiO_2	42.47%	40.55%	46.80%	44.50	53.53	50.28	9.76	13.53	12.68	11.32	19.95	20.58
Fe_2O_3	7.12%	8.35%	1.92%	1.85	0.73	0.66	4.71	5.23	5.83	4.85	6.46	5.75
Al_2O_3	28.81%	30.15%	27.14%	29.38	25.27	28.35	22.50	20.25	21.15	20.58	8.26	7.83
CaO	1.66%	1.22%	1.02	1.22	0.68	0.53	0.92	2.22	1.85	1.05	3.04	2.83
MgO	2.93%	2.56%	0.96	0.90	6.72	7.38	1.65	2.83	1.15	1.36	8.88	9.32
Na_2O	6.74%	6.54%	0.73	0.65	10.49	9.55	0.27	0.45	0.35	0.28	5.60	4.36
K_2O	0.27%	0.35%	1.09	1.28	0.52	0.48	0.05	0.13	0.12	0.10	0.53	0.42
SO_3	Nil	Nil	1.24	1.02	Nil	Nil	0.04	0.03	0.04	0.03	0.04	0.04
Total:	101.00	99.72	100.52	100.13	100.32	99.88	100.9	99.57	99.77	99.32	100.57	99.97

References

1. C.M. Hasson, Cement and Concrate Research, **15**, (1) (1985).
2. P.K. Mehta, Cement and Concrete Research, **13**, (3) (1983).
3. Gupta, D.V. Satyanorayana, Corrosion (Houston), **37**, (2) (1988).