TECHNICAL REPORT

2—MERCAPTOBENZOTHIAZOLE AS A CORROSION INHIBITOR FOR ALUMINIUM IN CHLORO-ACETIC ACIDS

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2-Mercaptobenzothiazole is investigated as an inhibitor of corrosion for aluminium in 0.1N acetic, monochloroacetic acid, dichloroacetic and trichloroacetic acids. It is effective only in trichloroacetic acid. It is predominantly an anodic inhibitor.

Aluminium sheets (26 S.W.G.) 3S type which has the composition: Mn—1 to 1.5%, Cu—0.15%, Fe—0.75%, Si—0.6% and rest aluminium, were employed for the loss in weight data. Rectangular specimens of area 3×6 cm with a small hole of about 1 mm. diameter just near the upper edge of the specimen for suspension were used. Specimens were cleaned and polished as usual.[1]

For the immersion of specimen, 250 ml. solution of the acids was taken. Experiments were carried out for 2 days at 30±2°C. The influence of current densities was also carried out according to the Evans' diagram.[2] The results are given in Table 1.

TABLE 1. Corrosion of Aluminium

Inhibitor con. (ppm.)	0.1N Acetic acid		0.1N Monochloro-acetic acid		0.1N Dichloro-acetic acid		0.1 Trichloro acetic acid	
	loss mg/dm²	% Inhibition	loss mg/dm²	% Inhibition	loss mg/dm²	% Inhibition	loss mg/dm²	% Inhiibtion
0 (blank)	8.9	—	13.0	—	34.1	—	1944	—
10	7.5	16	12.5	5	22.2	34	221	89
20	5.5	38	12.7	4	20.5	39	213	89
40	4.9	44	11.1	15	19.4	42	229	88
100	4.7	47	11.1	15	20.0	40	213	89
200	3.8	57	10.8	17	19.4	42	162	92

Discussion

The inhibition power of 2 mercaptobenzothiazole (MBT) in general increases with concentration of the inhibitor. It is effective as an inhibitor only in 0.1N trichloroacetic acid. MBT is a weak thio acid ionizing as

$$C_7H_4NS.SH \rightarrow C_7H_4NS.S^- + H^+$$

The ionic species form insoluble complex salt with metal ion. This acts as the protective coating on the metal surface. The inhibition effect is apparent only at low pH. It is likely that aluminium chelates form insoluble film at low pH.

Application of Tafel equation to corrosion phenomenon.

The influence of current densities on the metal was carried out according to the Evans' diagram, with and without the inhibitor. The external current was supplied from a storage battery and the change in potential was noted by making metal coupon either anode or cathode on D.C. microvolt meter (Philips India GM 6021) against a saturated calomel electrode. Attempt was made to minimize liquid junction potential by keeping the tip of the salt bridge very near to the metal surface. The specifications regarding experimental conditions were as under :-

1. Electrolyte: 0.1N Trichloroacetic acid
2. Temperature: 30±2°C
3. Concentration of MBT used was one which gave maximum protection i.e., 200 ppm.
4. The current density was varied with 25 μA to 2.5 mA/cm.²

The rise in cathodic potential on the addition of MBT may be due to the formation of insoluble film on cathode. The cathodic potential will vary as determined by Tafel's rule. In other words, at the same cathodic potential, the apparent current density falls in presence of inhibitor. By extrapolating Tafel's slope in the absence and presence of the inhibitor, one can determine current density in the absence (I_b) and presence (I_i) of the inhibitor at zero potential and the % efficiency is given by: % Efficiency $= (I_b - I_i)/I_b$. The inhibitor efficiency agrees with the efficiency determined by loss in weight method.

The inhibitor efficiency and Tafel's slope determined by Tafel's equation are summarised below:

	Current density (amp/cm²)		Tafel's slope		% efficiency
	Blank	with MBT	Blank	with MBT	
Aluminium	6.32×10^{-9}	2.51×10^{-10}	0.133	0.181	96.5

REFERENCES :

1. Shah R. S., Ph. D. thesis submitted to Guj. Univ. 1967 p. 13-16.
2. Patel N. K., Ph. D. thesis submitted to Guj. Univ. 1970 p. 342-43.