Inhibited Acids for Recovering Tin from Tin Cans

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If an inhibited acid would dissolve tin and not iron, a method of treating scrap tin cans would be possible. Such an inhibitor must not reduce the activity of the acid for the tin itself. These experiments tested out the possibility of such a detinning method.

There are many inhibitors, usually organic, which will reduce the activity of acids, e.g., sulfuric acid, upon metallic iron. These inhibitors are widely used in the acids for the pickling of iron to remove oxide and scale whose solubility in acids is not affected by the inhibitors. It is thus apparent that much less acid will be required and much less iron will be dissolved and lost during the time required to dissolve the oxide and scale, if an inhibitor is used.

Discussion of Inhibitors

1. Arsenious oxide is very effective even in hydrochloric acid which is much more difficult to inhibit than is sulfuric acid. There is always an objection to the use of a poisonous substance. With arsenic there is the possibility of the evolution of the very toxic substance, arsine.

2. Formaldehyde is very convenient for laboratory use on account of its cleanness and its ready availability. It is not especially effective.

3. Quinoline ethiodide is claimed to be especially active, but it is expensive.

4. Glycerine foots is the residue remaining in the stills after glycerine has been recovered by distillation in soap making. It contains some glycerine, large quantities of sodium chloride and many other things in small quantities. In a previous research in this laboratory, glycerine foots was found to be a good brightening agent in cadmium electroplating baths.

Glycerine foots is available in large quantities and, so far as the author knows, no very extensive use for it have been found.

Experimental

These experiments were all run at room temperature with 2 N. solutions of hydrochloric and of sulfuric acid. Square pieces of ordinary tin cans 1½ inches on a side were used. These pieces were bent into S-shapes so that the acid could attack both sides. Fifty ml. of acid was used in each experiment.

The loss in weight in mgm. of each piece of tin can (original weight of each was near 3.5 gm.) after 24 hours in the acids was:

	No Inhibitor	0.5 gm. As_2O_3	2 ml. HCHO	1 gm. quinoline ethiodide	3 gm. glycerine foots
HCl	337.0	99.	019.	28.2	10.1
H_2SO_4	16.9	17.4	008.9	9.0	9.7

After 18 days, the losses were

HCl	...	398.8	...	...	...
H_2SO_4	...	046.9	425.9	163.1	94.8

Where there are blank places in the table, the metal pieces were too completely dissolved to be handled and weighed. These data indicate that the tin coating itself is rather resistant to the acids for a short period of time and that most of the inhibitors give good protection even for 18 days in the sulfuric acid. Arsenic was the only inhibitor that gave much protection in hydrochloric acid for 18 days. An explanation for the poor showing of the formaldehyde in the 18 day run is that it was destroyed by oxidation or lost by evaporation.

Pieces of the same can, after removing the tin with acid, were tried in the 2 N. acids to see the action on the iron itself.

Loss in 24 hours

	No Inhibitor	0.5 gm. As_2O_3	2 ml. HCHO	0.5 gm. quinoline ethiodide	3 gm. glycerine foots
HCl	...	11.4 mg.	7.7 mg.	19.2 mg.	301.0 mg.
H_2SO_4	...	8.3	45.5	9.5	125.1

Loss after 14 days

HCl	...	111.6	164.1	...	Note 1
H_2SO_4	...	85.8	930.9	1104.3	Note 1

Note 1. Not tried.

Conclusions

1. These experiments indicated that inhibitors would not solve the problem of recovering tin from tin cans because no inhibitor sufficiently prevented acids from dissolving iron.

2. The tin coating, itself, was much less soluble in the acids than is the iron.