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**CORROSION INHIBITORS FOR
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Delaware****No Drawing. Filed Sept. 29, 1967, Ser. No. 671,588****Int. Cl. C09k 3/02; C23f 11/14, 11/18****U.S. Cl. 252—75****10 Claims****ABSTRACT OF THE DISCLOSURE**

The corrosive effect of methoxypropanol is inhibited by a three component mixture of (1) an alkali metal nitrite, (2) a piperazine, and (3) benzotriazole.

BACKGROUND OF THE INVENTION

Antifreeze fluid is usually essentially ethylene glycol, though lower alkanols are used to some extent. A combination of several corrosion inhibitors is added because a typical engine contains a variety of metals in contact with the fluid and no one inhibitor will protect all these metals. A great variety of inhibitors has been suggested in the art; these include the metal borates, phosphates, arsenates, arsenites, molybdates, chromates, nitrates, nitrites, amines, piperazines, benzothiazole, and benzotriazole, and some of their combinations. Methoxypropanol has also proven to be suitable as a heat transfer agent but, in itself, it is corrosive to the commonly used cooling system metals.

SUMMARY OF THE INVENTION

It has now been discovered that a three component system comprising an alkali metal nitrite, a piperazine and benzotriazole is a very effective corrosion inhibitor for methoxypropanol. By the latter term I means to include both 2-methoxy-1-propanol and 1-methoxy-2-propanol. The commercially available material is predominantly the latter but contains a small proportion of the former.

According to this invention, the corrosiveness of methoxypropanol on the common metals of construction, particularly those used in heat-exchangers, is inhibited by dissolving in the methoxypropanol a small but effective amount of a corrosion-inhibiting composition comprising an alkali metal nitrite, a piperazine, and benzotriazole.

The alkali metal nitrite can be sodium nitrite, potassium nitrite, or the other alkali metal nitrites.

The piperazine compound can be piperazine itself, an alkylpiperazine wherein the alkyl group contains up to eight carbon atoms, or an amino-alkylpiperazine wherein the alkyl group contains up to eight carbon atoms. Examples of alkyl or amino-alkylpiperazines which are useful are 2-methylpiperazine, N-butylpiperazine, N-(2-aminoethyl)piperazine, and N-(3-aminopropyl)piperazine.

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While the proportions of the three essential components can be varied considerably, the most satisfactory inhibitors are those which have compositions falling within the range of the following table. All parts therein are by weight, based upon the total weight of the named components.

TABLE I.—CORROSION INHIBITOR COMPOSITION

Components	Percent by weight	
	Useful	Preferred
Piperazine compound.....	50-95	80-85
Benzotriazole.....	1-20	8-12
Alkali metal nitrite.....	1-20	8-12

In formulating an inhibited composition, such as one suitable for use as a heat-transfer medium, the above inhibitor system is dissolved in the methoxypropanol in an effective concentration, suitably about 0.5 to 3.0% by weight. This is an especially small weight percent of inhibitor and thus presents an economical concentrate. As optional additives there may also be included dyes, acid-base indicators, water-pump lubricants, antifoam agents, or other conventional inhibitors or additives but this invention does not concern them. The above composition may be diluted with water, suitably to a concentration of from 30 to 70%, by volume, for use as an automotive antifreeze. The undiluted material is also useful as a heat-transfer medium.

**DESCRIPTION OF PREFERRED
EMBODIMENTS**

The practice of our invention is illustrated by the following example.

An inhibited methoxypropanol composition was prepared by blending the following ingredients. The concentration is given in weight percent based on the total mixture.

Component:	Weight percent
Methoxypropanol	98.3
Piperazine	1.0
Benzotriazole	0.1
Sodium nitrite	0.1
Water ¹	0.5

¹ Water was added so as to facilitate the solubility of the nitrite; its presence is not necessary in the antifreeze concentrate.

The above composition was tested for corrosiveness according to the standard glassware test procedures for automotive antifreezes described in the following methods: ASTM D1384, General Motors Corp. GM 1899M, and Ford Motor Co. BL1-1, each sample being diluted to 33⅓%, by volume, as specified in the methods. Also, the composition was tested according to the General Motors Corp. simulated service test (G.M. 1899M) procedure. The corrosion loss in mg./sq. in. is reported below in Table II.

TABLE II.—CORROSION TESTS

ASTM	Corrosion loss mgs./sq. in.					
	G.M. glassware		Ford glassware		G.M. simulated service	
	Observed	Allowable	Observed	Allowable	Observed	Allowable
Copper.....	1	2	2	2	3	5
Solder.....	4	4	4	4	3	10
Brass.....	1	1	2	2	4	5
Steel.....	1	1	2	2	1	10
Cast iron.....	2	1	1	2	4	10
Aluminum.....	4	9	21	7	3	30

I claim:

1. A corrosion inhibitor comprising:

Component:	Percentage by weight
(a) Benzotriazole -----	1-20
(b) Alkali metal nitrite -----	1-20
(c) Piperazine, alkylpiperazine or amino-alkylpiperazine wherein the alkyl or aminoalkyl moiety contains 1-8 carbon atoms -----	Balance

all percentages being based upon the total weight of (a), (b) and (c). 10

2. A corrosion inhibitor as defined in claim 1 comprising:

Component:	Percent by weight
(a) -----	8-12
(b) -----	8-12
(c) -----	Balance

3. A corrosion inhibitor as defined in claim 1 wherein the piperazine compound is an alkylpiperazine having up to eight carbon atoms in the alkyl group. 20

4. A corrosion inhibitor as defined in claim 1 wherein the piperazine compound is an amino-alkylpiperazine compound having up to eight carbon atoms in the alkyl group. 25

5. A corrosion inhibitor as defined in claim 1 wherein the piperazine compound is piperazine.

6. A corrosion inhibitor as defined in claim 1 wherein the alkali metal nitrite is sodium nitrite. 30

7. An anticorrosive composition consisting essentially of methoxypropanol containing a small but effective proportion of a corrosion inhibitor as defined in claim 1.

8. A composition as defined in claim 7 wherein the corrosion inhibitor comprises from 0.5 to 3.0% by weight of the composition, based on the methoxypropanol.

9. A composition as defined in claim 8 wherein the corrosion inhibitor comprises:

Component:	Percent by weight
(a) -----	8-12
(b) -----	8-12
(c) -----	Balance

10. An antifreeze composition consisting essentially of the composition as defined in claim 2 and water wherein the water comprises from 30 to 70% by volume of the fluid.

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