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SOLVENT FOR DEGREASING IRON AND ALUMINUM

Walter Klabunde, Niagara Falls, N. Y., assignor
to E. I. du Pont de Nemours & Company, Wil-
mington, Del., a corporation of Delaware

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This invention relates to the prevention of trichlorethylene decomposition as catalyzed by the presence of aluminum or iron, particularly as is encountered in the metal vapor degreasing.

It is known that trichlorethylene when exposed to air, light, and heat decomposes by oxidation with the formation of dichloroacetyl chloride, hydrochloric acid, and phosgene. Several types of stabilizers are commonly used to inhibit the decomposition of trichlorethylene by oxidation. However, in metal degreasing where the solvent often is subjected to higher temperatures, trichlorethylene can undergo a condensation type decomposition to form hydrochloric acid, together with a resinous material. In the presence of aluminum or iron, the hydrochloric acid formed by either type decomposition reacts with these metals to form the chloride salts which act as catalysts for the condensation reaction. Thus, when the condensation reaction takes place in a metal degreaser, where the chips of these metals are often heaped in the boiling solvent, it often becomes autocatalytic, i. e., where aluminum is present, the hydrochloric acid forms aluminum chloride which decomposes more trichlorethylene to form more catalyst. When this occurs, the solvent decomposes very vigorously with the evolution of large quantities of hydrochloric acid and the formation of a tarry or gummy mass in the solvent.

Efforts have been made in the past to combat this type of decomposition of the trichlorethylene by the addition of water to the solvent. This practice has only been partially successful, primarily due to the low solubility of water in trichlorethylene. Certain alcohols have also been used in this connection. However, the addition of alcohols increases the solubility of hydrochloric acid in trichlorethylene, and this is undesirable in metal degreasing because of corrosion difficulties encountered.

The object of the present invention is to provide a stabilizer for trichlorethylene which will inhibit the condensation type of decomposition which is catalyzed by the presence of aluminum or iron. Another object of this invention is to provide a condensation inhibitor for trichlorethylene which is neutral to the solvent and can be readily recovered with the solvent and need only be present in relatively small concentration. A further object is to degrease iron and aluminum articles with chemically stable trichlorethylene. Still other objects will be apparent from the ensuing description.

The present invention is based on my discovery

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that certain alkyl esters of nitrogen acids inhibit the decomposition of trichlorethylene exposed to higher temperatures and which is catalyzed by the presence of aluminum or iron. These esters are alkyl nitrates in which the alkyl group contains from 2 to 4 carbon atoms and the alkyl nitrites in which the alkyl group contains 3 to 6 carbon atoms. In other words, the stabilizers of my invention are those having the formulas $C_nH_{2n+1}NO_3$, where n is a whole number from 2 to 4; and $C_nH_{2n+1}NO_2$, where n is a whole number from 3 to 6. The high volatility of these compounds is advantageous, inasmuch as they can be readily recovered with the trichlorethylene in a distillation step as in metal degreasing. Examples of these compounds, which are especially suited to this purpose because of their boiling points, are ethyl nitrate, B. P. 88° C., and isoamyl nitrite, B. P. 99° C.

Examples of alkyl nitrates and nitrites suitable for the practice of my invention are: ethyl nitrate, propyl nitrate, isopropyl nitrate, n-butyl nitrate, sec-butyl nitrate, ter-butyl nitrate, propyl nitrite, isobutyl nitrite, n-butyl nitrite, n-amyl nitrite, isopropyl nitrite, and n-hexyl nitrite.

These esters of nitric and nitrous acids are effective for the purposes described in concentrations of about 0.02 to 1 per cent by weight. Generally, excellent results are obtained at a concentration of around 0.1 per cent by weight.

Especially well suited for operations wherein it is desired to recover stabilized trichlorethylene by distillation are ethyl nitrate (B. P. 88° C.) and isoamyl nitrite (B. P. 99° C.), as these readily distill over with the trichlorethylene. The other nitrates and nitrites above described have boiling points within the range of 57 to 129° C. and are, therefore, distillable with trichlorethylene to a considerable extent.

Generally the solvent is used under conditions where decomposition by oxidation can also occur, and for this reason an antioxidant may also be incorporated in the solvent for optimum results.

I have demonstrated the stabilizing effect of the alkyl nitrates and nitrites by the following test. Separate portions of trichlorethylene were stored in the absence of air in closed glass containers under identical storage time and conditions. Certain portions, as shown by the following table, contained 0.04 g. per 100 cc. of hydrogen reduced iron powder (about 200 mesh size) and 0.2 g. per 100 cc. of 40 mesh size aluminum powder, respectively, with and without the addition of 0.1 per cent by weight of the nitrate

or nitrite, and one portion consisted of the trichlorethylene alone. Other portions consisted of trichlorethylene and 0.1 per cent by weight of alkyl nitrate or nitrite. At the end of the storage period, the samples were analyzed for chloride ion, thereby to determine the degree of decomposition which occurred. The following results were obtained:

Trichloro- ethylene Portion	Substances Added	Chloride Content (mg./100 cc.)
1.....	None.....	4
2.....	Iron.....	1,600
3.....	Iron and isoamyl nitrite.....	28
4.....	Aluminum.....	600
5.....	Aluminum and isoamyl nitrite.....	37
6.....	Isoamyl nitrite.....	3
7.....	Iron and ethyl nitrate.....	70
8.....	Aluminum and ethyl nitrate.....	17
9.....	Ethyl nitrate.....	1.3

In the practice of this invention many and various embodiments thereof may be employed. For instance, the trichlorethylene in addition to the alkyl nitrate or nitrite may also contain one of the known stabilizer against the oxidation decomposition reactions.

While trichlorethylene stabilized by the addition of the alkyl nitrates and nitrites is well suited for the various uses of this chlorohydrocarbon solvent, the present invention is especially useful in metal degreasing operations, wherein iron or aluminum articles are washed with trichlorethylene to remove oil and grease, particularly after machining operations. The various known metal degreasing processes and

apparatus may be used for this purpose, in which the solvent temperature may vary from room temperature to the boiling point. The stabilized trichlorethylene may be applied to the metal articles, for example, by dipping, spraying, or condensation of vapor on the articles.

I claim:

1. A solvent for degreasing iron and aluminum comprising trichlorethylene containing 0.02 to 1% by weight of an alkyl ester of a nitrogen acid selected from the group consisting of alkyl nitrates containing 2 to 4 carbon atoms and alkyl nitrites containing 3 to 6 carbon atoms, said ester serving to inhibit the condensation reactions of trichlorethylene catalyzed by the afore-said metals.
2. The solvent of claim 1 wherein said alkyl ester is ethyl nitrate.
3. The solvent of claim 1 wherein said alkyl ester is isoamyl nitrite.

WALTER KLABUNDE.

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