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METHOD FOR STABILIZING HYDRAZINE AGAINST DECOMPOSITION BY COPPER IN CONTACT THEREWITH

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This invention relates generally to hydrazine and more particularly to a method for retarding the dissolution of copper in hydrazine or aqueous solutions thereof.

Hydrazine decomposes when exposed to air and it has been found that this decomposition is due to autoxidation of the hydrazine. It has also been known that copper as a solute in hydrazine catalyzes the autoxidation of hydrazine and consequently it has been necessary heretofore to avoid using any copper or copper alloy container or apparatus in the manufacture or handling of hydrazine.

It is an object of this invention to provide a method for repressing the dissolution of copper in hydrazine or aqueous solutions thereof. Another object of this invention is to prevent copper or copper compounds from accelerating the autoxidation of hydrazine. A further object of the invention is to provide hydrazine solutions which can be utilized or stored in copper apparatus, containers and the like. Still another object of this invention is to provide hydrazine and aqueous solutions thereof which are stabilized against autoxidation. A more specific object of this invention is to provide a method for retarding the decomposition of hydrazine by autoxidation in the presence of copper and similar contaminates which accelerate the autoxidation thereof.

In accordance with this invention the foregoing objects as well as others are achieved by dissolving an alkali metal carbonate or bi-carbonate in hydrazine. It has been found in accordance with this invention that a solute of an alkali metal carbonate or bi-carbonate such as, for example, sodium carbonate, potassium carbonate, sodium bi-carbonate, and potassium bi-carbonate will retard the dissolution of copper in hydrazine or aqueous solutions thereof and thus will prevent it from accelerating the autoxidation of hydrazine. In fact, the alkali metal carbonates are effective in retarding the autoxidation of hydrazine even if other contaminates such as chloride ions which are known to accelerate the decomposition of hydrazine are present. A concentration of alkali metal carbonates or bi-carbonates of as little as 0.001 mole may be used effectively in repressing the dissolution of metallic copper in hydrazine but the amount required for stabilizing a particular hydrazine solution will, of course, vary with the amount of copper and other contaminates such as chloride ion present. For most purposes, however, it is seldom necessary to use a concentration of alkali metal carbonates in excess of about 0.02 mole although greater concentrations are not objectionable in most instances and can be utilized to advantage in others.

In one embodiment of this invention about 0.008 mole sodium carbonate was dissolved in an aqueous solution containing about 54% hydrazine. This hydrazine solution was prepared and stored in a chemically clean glass container and the volume of the solution was only about ⅓ of the volume of the container in order to insure that air was at all times in contact with the solution. A spiral copper rod of such length that it extended

throughout the depth of the solution in the container and into the air above the liquid was placed in the container. The container was tightly closed and was permitted to stand at prevailing room temperatures of from about 68 to 90° F. for 7 months. At the end of this period of time the most sensitive available chemical test for copper failed to indicate the presence of any copper dissolved in the hydrazine solution. Chemical analysis of the solution indicated that it contained about 53% hydrazine at the end of the storage period.

In another embodiment conducted under conditions similar to those in the foregoing but differing therefrom in that the solution contained about 0.016 mole sodium chloride as well as about 54% hydrazine, it was found that 0.008 mole sodium carbonate solute prevented dissolution of any copper during a 7 month storage period and that the hydrazine concentration at the end of this period of time was about 53%, or that substantially no hydrazine had been lost.

In conjunction with the foregoing tests, a solution of about 54% hydrazine was stored in a similar container and under similar conditions with a copper rod extending through the solution and into the air above the liquid level. A dark heavy residue formed in the solution and at the end of 7 months the solution contained no hydrazine and a large amount of copper was dissolved therein. With certain concentrations of hydrazine, the copper does not precipitate as in this particular instant but the copper is deposited on the walls of the container.

In each of the foregoing examples an aqueous solution containing about 54% hydrazine was utilized for convenience but it has been found that the alkali metal carbonates are also effective as retardants to the dissolution of copper in aqueous solutions of other concentrations of hydrazine. The alkali metal carbonates do appear, however, to be most effective in the more concentrated solutions which is particularly advantageous because the invention thus provides a means for using copper and copper alloy apparatus in the storage of hydrazine solutions as well as in the manufacture and dehydration of hydrazine. "Hydrazine" as utilized in the appended claims is intended to be inclusive of aqueous solutions of hydrazine as well as substantially anhydrous hydrazine.

In the foregoing tests prevailing room temperatures were utilized but the alkali metal carbonates and bi-carbonates are also effective in retarding the dissolution of copper in hydrazine solutions at either lower or higher temperatures. The alkali metal carbonates may be utilized alone or may be mixed with bi-carbonates to effectively retard copper from dissolving in hydrazine and these inhibitors are effective against the dissolution of copper compounds as well as metallic copper.

Embodiments of this invention have been described in detail in the foregoing only for the purpose of clarification and many variations can be made therein by those skilled in the art without departing from the spirit of this invention or the scope thereof except as limited by the appended claims.

Having thus described the invention what is desired to secure by Letters Patent is:

1. A method for retarding the autoxidation of hydrazine by copper in contact therewith which involves repressing the dissolution of copper in the hydrazine by including in a concentration of at least 0.001 mole a solute of a compound selected from the group consisting of alkali metal carbonates, alkali metal bi-carbonates, and mixtures thereof.

2. A method for retarding the autoxidation of hydrazine by copper in contact therewith which comprises repressing the dissolution of copper in the hydrazine by including sodium carbonate as a solute in the hydrazine.

3. A method for retarding the autoxidation of hydra-

zine by copper in contact therewith which comprises repressing the dissolution of copper in the hydrazine by including sodium bi-carbonate as a solute in the hydrazine.

4. A method for retarding the autoxidation of hydrazine by copper in contact therewith which comprises repressing the dissolution of copper in the hydrazine by including potassium carbonate as a solute in the hydrazine.

5. A method for retarding the autoxidation of hydrazine by copper in contact therewith which comprises repressing the dissolution of copper in the hydrazine by including potassium bi-carbonate as a solute in the hydrazine.

6. A method for stabilizing hydrazine against decomposition by copper in contact therewith which comprises including in the hydrazine a solute of a compound selected from the group consisting of alkali metal carbonates, alkali metal bicarbonates and mixtures thereof.

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