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COMPOSITION AND METHOD FOR INHIBITION OF CORROSION OF SURGICAL INSTRUMENTS DURING STEAM STERILIZATION

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This invention relates to improvements in methods for sterilizing instruments and, in particular, is concerned with methods for inhibiting corrosion during such sterilization and a composition therefor.

In the past it has been found that steam sterilization, such as by means of autoclaves and the like, has been very damaging to steel and other ferrous instruments conventionally used in hospitals and the medical practice. Such surgical and other hospital instruments must be thoroughly sterilized for obvious reasons and steam sterilization is the fastest means known. However, such steam sterilization can be very damaging because of the corrosive nature of the sterilizing medium. Various means have been devised to prevent such corrosion of the instruments, such as protective barriers by the use of corrosion protective films and the like, which however have been objectionable to the authorities because of the undesirability of coatings, which can conceal or carry or sometimes attract various forms of undesirable foreign objects, including bacteria, dirt, and the like.

By means of this invention there has been devised a composition and a process for treatment of ferrous materials and other metals attacked by water vapor and oxygen, and particularly a method that inhibits the corrosion due to the action of steam. Basically, this invention comprises contacting the instruments with the vapors of an organic nitrogen base nitrite preferably in association with morpholine os isoquinoline. The instruments may be very easily contacted with the composition by spraying a cloth or other porous material with the solution and then either wrapping the instruments with the material or placing the material next to them in the steam sterilizing chamber or autoclave. Where the instruments are boiled rather than placed in a steam atmosphere the composition may be placed in the water.

The composition and method are simple to employ by relatively unskilled personnel and provide a high degree of inhibition against corrosion. It has further been found that instruments treated according to this invention have a residual period of inhibition against corrosion after they are removed from the sterilizing apparatus and experience a better inhibition against corrosion than instruments which have been autoclaved without treatment, or other instruments that are sterile.

It is accordingly a primary object of this invention to provide a composition and process for inhibiting ferrous materials against corrosion by steam.

It is a further object of this invention to provide a composition comprising an organic nitrogen base, nitrite and morpholine or isoquinoline acting as a stabilizer and extender for the organic nitrite to inhibit corrosion by water vapor and oxygen.

Still another object of this invention is to provide a composition of an organic base nitrite with morpholine or isoquinoline in a volatile carrier that can be placed in contact with ferrous materials that are to be steam sterilized to inhibit their corrosion.

Yet a further object of this invention is to provide a composition of diisopropyl amine nitrite and morpholine in a volatile organic carrier and a process for using the same comprising contacting ferrous materials with said

composition to inhibit their corrosion by water vapors and oxygen.

Further objects of this invention will appear in the detailed description which follows and will be readily apparent to those skilled in the art.

Although steam sterilization or autoclaving of various instruments in hospital use and other fields has been conventionally carried out in the past, it has been subject to a number of disadvantages due to the very sharp corrosive action of the sterilizing media. Other means for obviating this corrosiveness are known, such as dry heat sterilization where no steam or water vapors are employed, but this requires high temperatures for a much longer period of time, which is disadvantageous because of the time period and tie-up of equipment. In the steam sterilizing of instruments it is desirable that no agents be employed to inhibit corrosion that would leave an appreciable residue or film upon the instruments. Such coatings or films of substantial thickness are objectionable since necessary cleansing or rinsing of the instruments to rid them of the coatings requires greater time after the steam sterilization. Also, any coating or film left upon the instruments that is necessarily slippery is objectionable as tissue will adhere to the instrument with the film protector acting as an absorbent. In obviating the above disadvantages to steam sterilization and the use of film or protective barriers, the dry heat sterilization is objectionable for the reasons pointed out above and also because of damage to the instruments resulting from repeated dry heat sterilization and high temperatures.

By means of the present invention a composition and method have been provided which in effect provides a three-phase inhibition agianst corrosion. The ternary or three-phase process provides for inhibition against corrosion by the water phase, a vapor phase, and a condensate phase. These can be considered to be protection in the water phase against inhibition by corrosion under ambient conditions, while the vapor phase provides inhibition against corrosion for steam sterilization, and the condensate phase provides inhibition against corrosion after steam sterilization. The nature of the actual condensate provided by the use of the composition of this invention is not fully known, but the residual effect has been fully demonstrated as will appear hereinbelow.

Essentially, this invention provides a treatment for autoclaving surgical instruments, particularly carbon steel cutting edge instruments, also hinged or jointed instruments, and other ferrous materials or metals that are corroded by water in any of its physical forms. The basic agents employed are organic nitrogen base nitrites. These agents have been known before for their effectiveness in the vapor phase at room temperatures for inhibition against corrosion, but have been found to be desirable for use below about 120–150° F., because of decomposition at said temperatures. As a particular incident of this invention it has been found that these agents have been fully effective with steam in the process of stream sterilization at the very high temperatures employed in autoclaving. In autoclaving process as conventionally carried out by hospitals for steam sterilization of instruments, the steam pressures vary from about 15 to 35 pounds gauge pressure and temperatures of 250° F. to 280° F. for periods of time varying from 3 to 30 minutes. In general, the higher the pressure and temperature, the shorter is the period of duration, and, correspondingly, the lower the pressure and temperature the longer will be the period of sterilization. Thus, for example, at about 270° F. and 27 pounds pressure inhibition against corrosion is fully effective.

It has further been found that in association with the organic nitrogen base nitrite, morpholine and isoquinoline

can be employed to stabilize the organic nitrogen base nitrite and also to extend their effectiveness. These agents have some germicidal effect and some value as inhibitors against corrosion per se, and work particularly well in association with the organic nitrogen base nitrite to provide a synergistic effect. In the stabilization action the morpholine and isoquinoline have a degree of basicity and raise the pH of the composition to a safe level to inhibit the composition against decomposition upon storage.

The third agent employed in the composition is a volatile carrier, such as methanol. Methanol has been found to be particularly advantageous as it is a known readily available solvent, but other solvents can likewise be employed, such as straight chain alcohols containing up to five carbons in length. In general, the solvent should be one that is sufficient to obtain about 10% of the organic nitrogen base nitrite in solution.

The organic nitrogen base nitrites that are particularly useful are diisopropyl ammonium nitrite, dicyclohexyl ammonium nitrite, cyclohexylamine nitrite, dibenzylamine nitrite, morpholine nitrite, and piperidine nitrite. Of these, diisopropyl ammonium nitrite has been found to be of the greatest effectiveness.

The composition is prepared in general by dissolving in a solvent the organic nitrite base, which for purposes of example will hereinafter be described as diisopropyl ammonium nitrite, although it is to be understood that the other organic nitrogen base nitrites can also be employed in like manner. The range of diisopropyl ammonium nitrite in a solvent, which for purposes of example will be termed methanol, is in the general order of 5–47%, the 47% representing the upper limit of solubility in methanol. Preferably, about 10% diisopropyl ammonium nitrite is employed as this has been found to be most suitable. The composition may be used in this manner in the process of inhibition against corrosion against steam sterilization. However, it has been found as pointed out above that the use of morpholine or isoquinoline greatly extends and also stabilizes the composition. These two agents can be used in the amount of 2–20% of the weight of the composition. Here, however, it has been found that about 5% is most effective.

Thus, as pointed out above, a preferred example of the liquid composition may be employed using 10% diisopropyl ammonium nitrite by weight, 5% morpholine by weight, and 85% methanol. The isoquinoline can be satisfactorily used in place of the morpholine as pointed out above, but is not as preferable as it has been found that the compositions prepared with it do not provide the same high degree of inhibition against corrosion as those prepared with the morpholine, which is quite superior in its action.

Method of Application

In the application of the process of this invention inhibition against corrosion can be obtained by spraying a cloth or other porous material and wrapping it around the instruments. This provides protection against water vapor present in the air before the package is steam sterilized. The instruments can be stored for quite appreciable periods of time if they are also enclosed in an impermeable container whether it be a polyethylene wrap or other sealed enclosure. It has been found in such usage that the composition of this invention employing the organic nitrogen base nitrite and the morpholine or isoquinoline provides quite superior stability and inhibition against corrosion over the use of the organic nitrogen base nitrite by itself.

Subsequently when the instruments are ready to be autoclaved and steam sterilized the instruments may be placed with the porous wrap directly in the autoclave. In the application of this invention the amount of material to be employed, which is sprayed on the porous wrap, is in the general order of 0.05 to 0.5 gram of the organic nitrogen base nitrite per cubic foot of space. This is true whether the instruments are wrapped with the porous wrap or whether the composition is sprayed directly in the autoclave or sprayed upon a towel or other porous material placed next to the instruments to provide a source of volatile material. Also, where the instruments are to be sterilized in boiling water or the like, the composition may be sprayed into the water in an amount sufficient to provide like concentrations as set forth above. The most convenient method of application is one utilizing a simple polyethylene squeeze bottle, such as used in the application of various types of perfumes or various fluid materials. The squeeze bottle as is well known is one that is one that is made of polyethylene or similar plastic that is flexible and dispenses a liquid through an orifice in the form of a spray and the like.

When the instruments are autoclaved at steam temperatures of 270° F. and pressures of 27 pounds, as examples, according to the process of this invention as outlined above, it has been found that inhibition against corrosion is quite effective. This inhibition continues after the instruments are removed from the autoclave and it is believed that there is a residual coating that is molecular in thickness, since it cannot be observed. Tests have shown that this inhibition against corrosion continutes for a substantial period after removal from the autoclave. Thus, in one such test two polished strips of carbon steel, one autoclaved according to the process of this invention and the other not autoclaved, were employed. A spot test with water showed perceptible rust with the one not autoclaved in five minutes. In thirty minutes the test on the one strip not autoclaved showed complete rusting while the strip that was autoclaved according to this invention showed no change.

Accordingly, by means of this invention there has been provided a composition that is stable and quite effective for use in inhibiting corrosion for various ferrous metals. Although this invention has been particularly described with respect to hopital instuments and the like where the invention is of a quite high value, it will be readily apparent that it is equally effective where other ferrous materials or metals are employed that are subject to corrosion by water vapors. The composition and method provide a very high degree of inhibition against corrosion by steam and can be very simply employed without the use of any complicated or expensive equpment. The composition and method also provide a quite advantageous process for protection against corrosion even where steam is not employed when compared to other agents.

Also, where silicones or related compounds and other film forming agents or lubricants have been employed in the past, there is a disadvantage due to the pick-up of foreign materials due to the nature of the film. Also, repeated autoclaving tends to form gums of the material and the films have a tendency to oxidize undesirably. The composition and method of this invention has obviated such objections.

It is therefore apparent that there has been provided a novel composition and method for use in the inhibition against corrosion that can be readily employed by relatively unskilled personnel to provide a high degree of effectiveness. Various changes and modifications may be made within the composition and process of this invention as will be readily apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended hereto.

What is claimed is:

1. A method for steam autoclave sterilizing metal instruments and inhibiting corrosion during the sterilization process by contacting them with an agent that inhibits corrosion while the instruments are contacted with steam and does not form an objectionable coating and which leaves the instruments ready for immediate use which comprises placing said instruments in a confined space

and introducing steam under super atmospheric pressure and a corrosion inhibiting agent, said agent being comprised of an organic nitrogen base nitrite and at least one member of the group consisting of morpholine and isoquinoline, said agent being added in an amount of about 0.05 gram to 0.5 gram of said organic nitrogen base nitrite per cubic foot of confined space.

2. A method for steam autoclave sterilizing metal instruments and inhibiting corrosion during the sterilization process by contacting them with an agent that inhibits corrosion while the instruments are contacted with steam and does not form an objectionable coating and which leaves the instruments ready for immediate use which comprises placing said instruments in a confined space and introducing steam under super atmospheric pressure and a corrosion inhibiting agent, said agent being comprised of diisopropyl ammonium nitrite and morpholine, said agent being added in an amount to provide about 0.05 to 0.5 gram of said nitrite per cubic foot of confined space.

3. A method for steam autoclave sterilizing metal instruments and inhibiting corrosion during the sterilization process by contacting them with an agent that inhibits corrosion while the instruments are contacted with steam and does not form an objectionable coating and which leaves the instruments ready for immediate use which comprises placing said instruments in a confined space and introducing steam under super atmospheric pressure and a corrosion inhibiting agent, said agent being comprised of an organic nitrogen base nitrite, at least one member of the group consisting of morpholine and isoquinoline, and a volatile carrier miscible with water, said organic nitrogen base nitrite being present in an amount from about 5% by weight up to about 47% by weight, and said last named member of the group consisting of morpholine and isoquinoline being present in the amount of about 2% to 20%, said agent being added in an amount of about 0.05 gram to 0.5 gram of said organic nitrogen base nitrite per cubic foot of confined space.

4. A method for steam autoclave sterilizing metal instruments and inhibiting corrosion during the sterilization process by contacting them with an agent that inhibits corrosion while the instruments are contacted with steam and does not form an objectionable coating and which leaves the instruments ready for immediate use which comprises placing said instruments in a confined space and introducing steam under super atmospheric pressure and a corrosion inhibiting agent, said agent being comprised of diisopropyl ammonium nitrite, morpholine and a volatile carrier miscible with water, said diisopropyl ammonium nitrite being present in the amount of about 10% by weight and said morpholine being present in the amount of about 5%, said agent being added in an amount to provide about 0.05 to 0.5 gram of said nitrite per cubic foot of confined space.

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