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BOILER CLEANING PROCESS

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This invention relates to a cleaning process and relates more particularly to a process for cleaning boilers and other types of equipment wherein water is heated or cooled.

In the operation of boilers and other types of equipment wherein water is heated or cooled, hereinafter referred to collectively as boilers, there is a tendency for scale to deposit on the surfaces of said boilers with which the water, in either liquid or vapor form, comes into contact. As the scale accumulates on the boiler surfaces it reduces the efficiency with which heat is transferred through the said surfaces so that it is necessary to clean the said surfaces from time to time in order to maintain the efficiency of the boiler at a reasonably high level. One of the methods that has been suggested for cleaning the boilers is to introduce a strong mineral acid, such as hydrochloric or sulfuric acid, into the boilers to react with the scale, usually in an amount equal in weight to the weight of the scale. Corrosion inhibitors are added to the boilers together with the mineral acids to minimize attack by the mineral acids on the boiler surfaces themselves. However, the danger is ever present that the mineral acids will attack the boiler surfaces despite the presence of corrosion inhibitors. Moreover, the use of mineral acids involves a considerable inconvenience owing to the precautions that must be taken to insure safety during the handling and application of the same.

It is an important object of this invention to provide a process for cleaning boilers which will be free from the foregoing and other disadvantages.

A further object of this invention is to provide a process for cleaning boilers by introducing an organic acid into the water contained in said boilers to bring the pH of said water to a predetermined level.

Other objects of this invention will be apparent from the following detailed description and claims.

According to the present invention, boilers are cleaned by adding to the water present in said boilers an organic acid in an amount sufficient to bring the pH of said water to a value of between about 3 and 5. The water in said boilers is held at an elevated temperature until the scale is removed from the boiler surfaces, after which the boilers are drained and washed. Through the use of this process, it is possible to achieve a rapid cleaning of the boilers with little danger of attacking the boiler surfaces and with a minimum of expense and inconvenience.

In carrying out the present invention, it is preferred to employ acetic acid as the treating acid owing to its ready availability and low cost and the good results obtained therewith. However, other acids may also be employed such as, for example, formic, propionic, benzoic, butyric, fumaric, malonic, phthalic, and oxalic or mixtures of the said acids. The quantity of acid added to the water in the boiler should be sufficient to bring the pH thereof to between about 3 and 5, or preferably to between about 3 and 4. Advantageously, the acid is introduced into the boiler system slowly so as to avoid the presence in localized parts of the system of high concentrations of acid which will bring the pH of the water in such localized parts to a value much below the lower limit specified above since, in this case, the danger may arise that the acid will attack the boiler surfaces.

While there is little or no danger that the organic acids in the concentrations specified will attack the boiler surfaces, so that it is not essential to employ a corrosion inhibitor therewith, it may be desirable in certain cases to employ such an inhibitor as a precautionary measure. A large number of suitable inhibitors are available for this purpose, including, for example, sodium sulfite, rosin amines, octyldecylamine, tolylthioureas, organic sulfides, and mercaptans. The amount of inhibitor that will be needed will, of course, depend on its nature. In general, however, there should be employed between about 10 and 200 p.p.m. of the inhibitor based on water present.

The water to which the organic acid is added is held at an elevated temperature for a period of time sufficient to remove the scale therefrom. The precise temperature of treatment is not critical and may be as high as the normal operating temperature of the boiler which may range as high as 210° C., or even higher, or the treating temperature may be as low as 100° C., or even less. The time of treatment should be sufficient to remove substantially all the scale from the boiler and will depend on the nature and thickness of the scale, the precise pH of treatment, and the temperature of treatment. For any given boiler and set of conditions, such time may be readily ascertained by a simple trial.

The following example is given to illustrate this invention further:

Example

The boiler to be cleaned is brought down, opened, and thoroughly washed down with water. After washing, the boiler, a commercial 100,000 lb./hr., 250 p.s.i.g., water tube boiler is brought up to approximate operating pressure (220 p.s.i.g.) and steamed at minimum rate, venting the steam produced to the atmosphere. 275 gallons of acetic acid plus inhibitor (octadecylamine) sufficient to maintain 100 p.p.m. concentration is fed into the mud drum of said boiler over a twenty-four hour period. Rate of acid-inhibitor feed is that necessary to maintain a pH of between 3.7 and 4.0. The boiler is heavily blown down by hand periodically (every three to four hours). At the completion of this operating period, the boiler is brought down and thoroughly washed again and is found to be thoroughly clean and free of scale.

It is to be understood that the foregoing detailed description is merely given by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention, what I desire to secure by Letters Patent is:

1. Process for cleaning boilers which comprises introducing acetic acid into the water contained in said boilers to bring the pH thereof to between about 3 and 4, the rate of introduction of the acetic acid being such that the pH does not fall below the values specified in any localized portions of the boiler system, and holding the water in said boilers at a temperature of about 100 to 210° C. until the cleaning has been carried out.

2. Process for cleaning scaly boilers which comprises introducing an organic acid into the water contained in said scaly boilers to bring the pH thereof to between about 3 and 5, and holding the water in said boilers at an elevated temperature of at least about 100° C. until the cleaning has been carried out.

3. Process for cleaning scaly boilers which comprises introducing an organic acid into the water contained in said scaly boilers to reduce the pH thereof to between about 3 and 5, the rate of introduction of the organic acid being such that the pH does not fall below the values specified in any localized portions of the boiler system,

and keeping the water in said boilers hot until the cleaning has been carried out.

4. Process for cleaning scaly boilers which comprises introducing acetic acid into the water contained in said scaly boilers to bring the pH thereof to between about 3 and 5, and keeping the water in said boilers hot until the cleaning has been carried out.

5. Process for cleaning boilers which comprises introducing acetic acid into the water contained in said boilers to bring the pH thereof to between about 3 and 5, the rate of introduction of the acetic acid being such that the pH does not fall below the values specified in any localized portions of the boiler system, and holding the water in said boilers at an elevated temperature of at least about 100° C. until the cleaning has been carried out.

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