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[54] **METHOD FOR OPERATING A COMPRESSOR**

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[58] **Field of Search** 415/1, 121; 60/39.53; 134/7, 23, 40

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[57] **ABSTRACT**

A method for operating a compressor whereby fouling materials are removed from the compressor.

7 Claims, No Drawings

METHOD FOR OPERATING A COMPRESSOR

In the operation of compressors utilized for receiving vapors for example, and increasing the pressure of said vapors, fouling materials sometimes form at different locations in the compressor which result in reducing the efficiency of the compressor and associated equipment which in turn results in the waste of labor, equipment, time, and valuable materials.

This invention therefore resides in a method for operating a compressor whereby fouling materials are removed from the compressor.

Other aspects, objects, and advantages of the present invention will become apparent from a study of the disclosure and the appended claims.

In the operation of compressors, particularly centrifugal compressors, it has been found that fouling materials such as polymers, hydrates, etc., can form in the compressors during the operation thereof. It should be understood that the term "fouling materials" utilized herein means materials which form in the compressor in its suction and discharge assemblies, on the blades and other parts, from materials passing through the equipment.

Generally, this fouling material builds up during the operation of the compressor and at some period in time reaches a magnitude at which the efficiency of the compressor is lowered by a detectable value. An object of this invention is to remove the fouling material in an easy economical manner.

In the method of this invention, the compressor receives a fluid stream and increases the pressure of said fluid stream. At preselected times during operation of the compressor, for example, every 6 hours, the suction and discharge temperatures and pressures of the compressor are measured.

The data from each measurement period is thereafter plotted as $\log T_2/T_1/\log P_2/P_1$ versus compressor cumulative onstream time

where T_1 = suction temperature, T_2 = discharge temperature, P_1 = suction pressure, P_2 = discharge pressure.

It is preferred that the temperature be in °R, the pressure in psia, and the onstream time in hours.

The fouling material can be removed from the compressor when the value of $\log T_2/T_1/\log P_2/P_1$ of the last measurement is 1.1 times greater than the value of $\log T_2/T_1/\log P_2/P_1$ of previous measurements made upon initial use of the compressor or after a prior cleaning of the compressor.

It is also understood that the reciprocals of the measurements can be used or other mathematical manipulations performed which measure compressor efficiency thereon which will alter the response on which the compressor is cleaned without departing from this invention. It should also be understood that the calculations and plotting of measurements can be made by any means adaptable thereto, for example, by the preferred use of paper and pencil. The fouling material is removed by injecting a solvent into the suction of the compressor during the operation of said compressor. Where the solvent is utilized for removing the fouling material, it is preferred that the solvent be liquid at the temperature and pressure at which the compressor operates, the solvent have a freeze point lower than the lowest temperature encountered by the stream passing through the compressor and that the fouling material

being soluble in the selected solvent in order to prevent waste of time, labor, equipment and product. Such solvents include (1) methanol as well as the higher aliphatic alcohols such as ethanol, isopropanol, butanol, etc., (2) glycols such as ethylene glycol, diethylene glycol, propylene glycol, etc., (3) ketones such as acetone, methyl ethyl ketone, etc., (4) aldehydes such as acetaldehyde, butyraldehyde, etc., (5) ethers such as methyl ether, n-propyl ether, isopropyl ether, etc., (6) glycol ethers such as methyl carbitol, methyl cellosolve, etc.

One example where the method of this invention was utilized and resulted in saving of down time for cleaning was in the fourth stage of a multiple-stage centrifugal compressor system utilized for compressing an overhead vapor stream discharging from a deethanizer of a gas processing system. The fourth stage generally had a suction temperature below about −25° F. and a suction pressure less than about 200 psia, a discharge temperature above about +50° F. and a discharge pressure greater than about 350 psia.

During the operation of the compressor, efficiency began to decrease and it was interpreted as mechanical problems, the correction of which would require the expenditures of large amounts of labor, equipment, and time and the loss of valuable product. Fouling materials were not contemplated by the skilled operators owing to the operating pressure and temperature of the compressors and product being compressed. As a last resort to avoid disassembling the compressor, about 20 gallons of methanol was injected into the suction of the fourth compressor during the operation of the compressor. Soon after the methanol was injected, the efficiency of the compressor returned to a normally expected value.

The reasons said fouling materials formed in this compressor are unknown and unexpected by those skilled in the art. It is believed, however, that the compressor's design and operation caused some phenomenon therein which permitted fouling materials to form.

Since operating data cannot be obtained in all locations in a compressor, these unexpected locations of fouling material build-up can sometimes occur and be misinterpreted as mechanical problems. The method of this invention therefore provides an operational procedure which will avoid the waste associated with said situations.

The invention also provides a method for operating any compressor for maintaining the compressor's operating efficiency high wherein it is known or not known that fouling materials form.

In another embodiment, the operator can calculate the average compressor operating time between periods of compressor operation which dictate the need for fouling material removal and associated cleaning of said compressor. The operator can then terminate the periodic or intermittent measuring and plotting of temperatures and pressures of the compressor and thereafter remove the fouling material from the compressor in response to said compressor operating for a period of time of about the calculated average operating time.

Where methanol is the selected solvent, it has been found that a volume of methanol in the range of about 10 to about 20 gallons should be injected over a period of time in the range of about 5 minutes to about 60 minutes.

The use of less methanol than about 10 gallons would generally not sufficiently remove the fouling material and at greater than about 20 gallons the product being compressed might be caused to be off specification and in addition there will generally be a waste of methanol. At injection of the methanol over a time period less than about 5 minutes, the contact time of the methanol with the fouling material would generally not be sufficient to remove the fouling material and at injection periods greater than about 60 minutes, the concentration of the methanol in the stream being compressed would generally not be sufficient to sufficiently completely remove the fouling material.

In some compression operations it is desirable to inject the solvent continuously so as to prevent any build-up or accumulation of foreign material in the compressor. This is especially true when a gas stream is being compressed under conditions of temperature and pressure conducive to the formation of hydrates and/or polymer. Compression of ethylene and other olefin containing streams at low temperatures is an example.

Other modifications and alterations of this invention will become apparent to those skilled in the art from the foregoing discussion, and it should be understood that this invention is not to be unduly limited thereto.

What is claimed is:

1. A method for operating a centrifugal compressor utilized for receiving a fluid stream and increasing the pressure of said fluid stream, comprising:

injecting a solvent selected from the group consisting of aliphatic alcohols, glycols, ketones, aldehydes, ethers, and glycol ethers into the fluid stream at a location upstream of the compressor during the operation of said compressor as the sole additive for improving the operating efficiency of the compressor, said solvent being a liquid at the temperature and pressure at which the compressor operates and having a freeze point lower than the lowermost temperature encountered by said stream passing through the compressor.

2. A method in accordance with claim **1** wherein said solvent is injected into said fluid stream continuously during the operation of said compressor.

3. A method in accordance with claim **1** wherein the solvent is methanol.

4. A method in accordance with claim **3** wherein said solvent is injected into said fluid stream continuously during the operation of said compressor.

5. A method in accordance with claim **3** wherein a volume within the range of from about 10 to about 20 gallons of methanol is injected into the compressor over a period of time within the range of from about 5 to about 60 minutes.

6. A method in accordance with claim **1** wherein the compressor has a suction temperature below about −25° F., a suction pressure less than about 200 psia, a discharge temperature above about +50° F., and a discharge pressure greater than about 350 psia.

7. A method in accordance with claim **6** wherein said compressor is the fourth-stage gas compressor of a multi-stage compressing system.

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