process chemical programs. There thus exists an ongoing need for more sophisticated and effective online and/or automatic methods for monitoring parameters and reducing corrosion in crude units.

SUMMARY

[009] This disclosure~~invention~~ accordingly provides methods to generate reliable crude unit data in a feedback, feed-forward, or predictive loop(s) to make real-time adjustments to process stream treatments thus reducing corrosion and corrosion byproduct deposition (sometimes referred to herein as fouling). In a preferred embodiment~~aspect~~, the present disclosure~~invention~~ is implemented to provide continuous or intermittent feedback, feed-forward, or predictive information to process chemical injection pumps to make real-time adjustments. The present disclosure~~invention~~ incorporates programming logic to convert analyzer signals to pump adjustment logic and, in a preferred embodiment, controls one or each of a plurality of chemical injections with a unique basis. Examples include neutralizer injection based on pH, chloride, or acid content; caustic agent injection based on pH, chloride, or acid content; and filming inhibitor injection based on iron concentration or corrosion rate.

[0010] It is also envisioned that the present disclosure~~invention~~ will manage the readings from existing electrical resistance corrosion probes, linear polarization probes, and/or other techniques for measuring metal loss. These readings will be programmed through a Programming Logic Controller (PLC) to possibly override or modify the other chemical inputs and change pump rates. Moreover, because the crude unit atmospheric distillation tower overhead heat exchanger systems suffers frequent and costly issues with corrosion, the present disclosure~~invention~~ focuses on that part of the crude unit. However, the present disclosure~~invention~~ has utility on many other units in the refinery.

[0011] In an embodiment~~aspect~~, the present disclosure~~invention~~ includes a method of optimizing a system parameter in a process stream of a crude unit to reduce corrosion in the crude unit. A property associated with the system parameter is measured and/or predicted at or more points in the crude unit and is converted into an input electrical signal capable of being transmitted to a controller. In turn, the controller is operable to receive the transmitted input electrical signal, convert the received electrical signal into an input numerical value, analyze the input numerical value, generate an output numerical value, convert the output numerical value into an output electrical signal, and transmit the output electrical signal. An optimum corrosion-reducing range for the input numerical value is determined and if the input numerical value is outside of the optimum range,

the transmitted output electrical signal causes a change in an influx of a composition into the process stream. The composition is capable of adjusting the property associated with the system parameter in a manner to bring the input numerical value within the optimum range. In an embodiment, an influx of one or more different compositions into the process stream are collectively and/or individually capable of adjusting the property(ies) associated with the system parameter(s). The method is optionally repeated for a plurality of different system parameters, where each different system parameter has a unique associated property.

[0011a] In an aspect, there is provided a method of optimizing a system parameter in a process stream of a crude unit to reduce corrosion and/or corrosion byproduct deposition in the crude unit, the method comprising:

(a) measuring and/or predicting a property associated with the system parameter at one or more points in the crude unit;

(b) determining an optimum range associated with the measured and/or predicted property, wherein the optimum range is optionally user-defined;

(c) if the measured and/or predicted property is outside of the optimum range associated with that property, causing a change in an influx of a composition into the process stream, the composition capable of adjusting the property associated with the system parameter in a manner to bring the measured and/or predicted property within said optimum range;

(d) (i) converting the measured property into an input electrical signal capable of being transmitted to a controller and (ii) transmitting the input electrical signal to the controller; and

(e) repeating steps (a) to (d) for a plurality of different system parameters, each different system parameter having a unique associated property.

[0011b] In another aspect, there is provided a digital storage medium having computer-executable instructions stored thereon, the instructions operable to execute the method as defined herein.

[0011c] In another aspect, there is provided a system for optimizing a plurality of system parameters in a process stream of a crude unit to reduce corrosion and/or corrosion byproduct deposition in the crude unit, the system comprising:

(a) a sensing device operable to sense and/or predict a property associated with a system parameter and convert the property into an input electrical signal capable of being transmitted;

(b) a transmitter operable to transmit the input electrical signal;

(c) a controller operable to receive the transmitted input electrical signal from a plurality of system parameters, convert the received input electrical signal into an input numerical value, analyze the input numerical value, determine if the analyzed value is within an optimum range, generate an output numerical value based upon the analyzed value, convert the output numerical value into an output electrical signal, and transmit the output electrical signal; and

(d) a receiver operable to receive the output electrical signal and cause a change in an influx rate of a composition into the process stream if the output numerical signal is not within the optimum range, wherein the composition is capable of adjusting the property associated with the system parameter.

[0012] In another embodimentaspect, the present disclosureinvention includes a system for optimizing a system parameter in a process stream of a crude unit to reduce corrosion in the crude unit. The system comprises a sensing device operable to sense and/or predict a property associated with the system parameter and convert the property into an input electrical signal capable of being transmitted. A transmitter transmits the input electrical signal to a controller. The controller is operable to receive the transmitted input electrical signal, convert the received input electrical signal into an input numerical value, analyze the input numerical value to determine if the input numerical value is in an optimum range, generate an output numerical value, convert the output numerical value into an output electrical signal, and transmit the output electrical signal. A receiver receives the output electrical signal and is operable to cause a change in an influx rate of a composition into the process stream if the output numerical value is not within the optimum range, wherein the composition is capable of adjusting the property associated with the system parameter.

[0013] In an embodiment, one or more of the described controller functions may be imparted to one or more data capturing devices.

[0014] It is an advantage of the present disclosureinvention to provide continuous control of one or more key process corrosion control chemicals, an improvement over the current practice of manual, highly variable frequency optimization.

[0015] Another advantage of the present disclosureinvention is to provide a method to achieve optimum efficiency through reduced corrosion and fouling, minimizing the amount of product that does not meet specification, and reducing the amount of slop oil processing.

[0016] It is another advantage of the present disclosureinvention to provide an automated process to efficiently minimize disruptions and the resulting corrosion and fouling caused by a switch between various types of crude slates, including challenging crude, and minimize corrosion, disruptions, and downtime during such switching.

[0017] It is a further advantage of the present disclosure~~invention~~ to provide continuous data to measure the magnitude of a disruption and to more precisely identify the root cause of a disruption, including determining the concentration of corrosion byproduct(s) formed in the system due to a spike in corrosion during a disruption.

[0018] An additional advantage of the present disclosure~~invention~~ is to provide a method of optimizing system efficiency when crude slates are changed by quickly stabilizing system operating parameters.

[0019] It is yet another advantage of the present disclosure~~invention~~ to provide data leading to a level of corrosion control that will help prevent expensive metallurgy upgrades in crude refining systems in order to process acidic crudes.

[0020] Additional features and advantages are described herein, and will be apparent from, the following Detailed Description, Examples, and Figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Figure 1 is a diagrammatic view of an embodiment of the invention showing various crude unit components and exemplary points at which system parameters are measured.

[0022] Figure 2 shows a flowchart of a preferred embodiment of controlling the introduction of neutralizer(s) into the system based upon measured pH.

[0023] Figure 3 illustrates an embodiment of the invention for controlling the introduction of caustic agent(s) into the system driven by the chloride ion concentration signal.

[0024] Figure 4 illustrates an embodiment of the invention for controlling the introduction of filming inhibitors into the system driven by the iron ion concentration signal.

[0025] Figure 5 depicts an embodiment of the invention for controlling the override of the introduction of neutralizer(s), caustic agent(s), and filming inhibitors into the system driven by the corrosion rates derived from one or more corrosion probes or other corrosion monitoring devices at any point in the system.