[0005] An example of a contact lens cleaning and sterilization system is described in U.S. Patent No. 4,687,997. This cleaning system requires insertion of the lenses into a disinfecting solution for a preset time period followed by insertion into a neutralizing solution for a second preset time period. A first indicator shows a steady light while the disinfectant is in the cleaning case and a second indicator when the neutralizing solution is in the case. The system distinguishes the disinfecting solution from the neutralizing solution by measuring the electrical conductivity of the solution within the cleaning case. After a predetermined amount of time, both lights flash to indicate the item has been disinfected and neutralized, respectively. This system does not monitor the efficacy of cleaning, disinfecting or neutralization of the solutions, however; the indicator lights flash to show completion of the disinfecting and neutralization cycles solely in response to the passage of time.

[0006] Another example of a cleaning and sterilization system is described in U.S. Patent No. 6,183,705. The system uses ultrasonic waves to clean contact lenses, and heat to disinfect contact lens solution medium. The system includes a housing, control circuit assembly, ultrasonic waveguide, a heating rod with two electrodes and a graduated cleaning cup that is operated using the automatic control circuit. The control circuit includes a microprocessor for controlling the heating rod and the ultrasonic waveguide. The microprocessor operates the ultrasound transducer for a preset time, then stops. After a rest time, the microprocessor heats the cleaning solution to a preset temperature of 90° C as measured by a temperature sensor, then turns off the heating rod, allowing the lenses to soak in the hot solution for another preset time. Once again, this system does not monitor the efficacy of the cleaning solution; the cleaning process always proceeds along the same preset time intervals, and the indicator lights merely show which stage the cleaning process is in.

SUMMARY ~~OF THE DISCLOSURE~~

[0007] In a first aspect, there is provided a contact lens cleaning system comprising: a contact lens holder; a vial adapted to contain the contact lens holder and a cleaning solution; an agent capable of reacting with the cleaning solution; a reaction sensor adapted to monitor a rate of reaction between the agent and the cleaning solution; a processing device in communication with the reaction sensor to receive a reaction signal from the reaction sensor; and a display in communication with the processing device, the processing device being adapted to operate the display to provide cleaning efficacy information based on the reaction signal.

[0007a] In a second aspect, there is provided a method for cleaning a contact lens and displaying cleaning efficacy information, the method comprising: receiving a contact lens into a contact lens holder; receiving cleaning solution into a vial, the vial containing the contact lens and contact lens holder; determining a chemical reaction rate of the cleaning solution and cleaning efficacy information based on the chemical reaction rate; and displaying the cleaning efficacy information.

[0007b] In a third aspect, there is provided a contact lens cleaning system comprising: a contact lens holder; a vial adapted to contain the contact lens holder and a cleaning solution; an agent capable of reacting with the cleaning solution; a reaction sensor adapted to measure a characteristic of a chemical reaction between the agent and the cleaning solution; a processing device in communication with the reaction sensor to receive a reaction signal from the reaction sensor, wherein the processing device is adapted to use the reaction signal to determine an approximate rate of the chemical reaction; and a display in communication with the processing device, the processing device being adapted to operate the display to provide cleaning efficacy information based on the reaction signal.

[0007c] The present disclosure~~invention~~ uses a hydrogen peroxide solution for cleaning and disinfecting soft (hydrophilic) and rigid gas permeable contact lenses, and uses a platinum disk for peroxide neutralization. Neutralization is required to convert hydrogen peroxide to water and oxygen, so the residual solution on the contact will not irritate the eye during contact lens insertion. The system monitors the cleaning solution within the device, and guides the user through the contact lens cleaning process with lights and/or textual directions.

[0008] The system may also monitor the internal and external temperatures and verify that the hydrogen peroxide solution is neutralizing properly. The monitoring is done by verifying the exothermic peroxide-neutralization process is occurring at an acceptable rate. Causes of poor neutralization can include old or expired peroxide solution, poorly stored cleaning solution,

extreme solution temperatures, or the platinum disc has decreased catalytic ability. The device can determine if the user accidently used a bottle of saline solution, instead of a bottle of hydrogen peroxide solution. If a bottle of saline solution is used instead of a bottle of hydrogen peroxide solution, the cleaning and disinfection of the contact lenses will not occur increasing the risk of infection of the eye. Additionally, the device minimizes the desire to rinse the contacts with saline solution after cleaning and prior to insertion in to the eye; if hydrogen peroxide was mistakenly used instead of saline solution, chemical conjunctivitis or keratitis may result.

[0009] The present disclosure~~invention~~ generally relates to an apparatus for cleaning and disinfecting contact lenses. Provided herein are apparatus, systems and methods for use with a cleaning solution used to clean a medical device in which one or more messages are displayed to encourage compliance with the normal medical device cleaning protocol.

[00010] The following embodiments, aspects and variations thereof are exemplary and illustrative are not intended to be limiting in scope.

[00011] In one embodiment, a contact lens cleaning system includes a contact lens holder; a vial adapted to contain the contact lens holder and a cleaning solution; a reaction sensor adapted to monitor a chemical reaction rate of the cleaning solution; a processing device in communication with the reaction sensor to receive a reaction signal from the reaction sensor; and a display in communication with the processing device, the processing device being adapted to operate the display to provide cleaning efficacy information based on the reaction signal. A catalyst element may be disposed within the vial and adapted to react with the cleaning solution. The reaction sensor may be a temperature sensor. The temperature sensor may be disposed in a cap covering the vial or outside of the vial. The processing device may be adapted to determine a temperature change rate from the reaction signal.

[00012] In an embodiment, the system may determine cleaning efficacy by comparing the temperature change rate to a theoretical temperature change rate. The system may include an ambient temperature sensor disposed outside of the vial and may measure a temperature of air surrounding the vial. The processing device may display cleaning efficacy information based on a temperature signal from the ambient temperature sensor. The system may include a use counter communicating with the processing device. The processing device may display information corresponding to the number of cleaning uses of the cleaning system.

[00013] The reaction sensor may be a pressure sensor. The system may include a caddy to support the vial. The display may be disposed within the caddy. The display may be disposed in a cap on the vial. The system may include a solution sensor disposed within the vial. The processing device may determine the presence of cleaning solution within the vial based on a