

What is claimed is:

1. A well plate inspection system, comprising:
 - a stage configured to receive a plate including a vessel containing a fluid;
 - a source configured to generate source light;
 - an optical element disposed between the light source and the stage, the optical element being configured to:
 - direct the source light through the fluid contained in the vessel to produce scattered light as a result of an interaction between the source light and particles suspended in the fluid, and
 - divert the source light away from an imager that is configured to acquire images using the scattered light; and
 - a controller configured to determine, from the images, a size and a number of particles in the fluid.
2. The system of claim 1, wherein the optical element includes an axicon.
3. The system of claim 1 or claim 2, wherein the light source is a light emitting diode (LED).
4. The system of claim 1 or claim 2, wherein the stage is configured to selectively agitate, and
 - wherein the imager is configured to acquire a first image prior to the stage being agitated and a second image after the stage is agitated.
5. The system of claim 1 or claim 2, wherein:
 - the stage is configured to selectively agitate, and
 - the imager is configured to acquire a plurality of images after the stage is agitated; and
 - the controller is further configured to generate a minimum intensity projection (MinIP) from the plurality of images, to subtract the MinIP from each of the plurality of images to generate an image stack, and to determine the size and the number of particles in the fluid from

the image stack.

6. The system of claim 1 or claim 2, wherein:

the vessel is from among a plurality of vessels included in the plate,

the controller is further configured to determine the size and the number of particles in each of the plurality of vessels included in the plate, and

the stage further includes a plate holder configured to selectively receive and release the plate, the plate holder being further configured to hold the plate in the stage and to maintain each vessel from among the plurality of vessels in the same field of view with respect to one another while the controller determines the size and the number of particles in each of the plurality of vessels included in the plate.

7. The system of claim 1 or claim 2, wherein the vessel is configured to hold a volume of fluid up to 200 microliters.

8. The system of claim 1 or claim 2, further comprising:

an optical system configured to direct the scattered light to the imager.

9. A well plate inspection system, comprising:

a stage configured to selectively agitate and to receive a plate including a vessel containing a fluid;

a light-emitting diode (LED) light source configured to generate source light;

an axicon disposed between the LED light source and the stage, the axicon being configured to refract the source light to produce refracted source light,

wherein the refracted source light interacts with particles suspended in the fluid contained in the vessel to produce scattered light that is directed to a mirror while the refracted source light is diverted away from the mirror;

an imager configured to acquire sequential images using the scattered light that is reflected off the mirror; and

a controller configured to determine, from the sequential images, a size and a number of particles in the fluid.

10. The system of claim 9, wherein the sequential images include a background image and an analysis image, the background image being acquired prior to the stage being agitated, and the analysis image being acquired after the stage is agitated.

11. The system of claim 10, wherein the background image and the analysis image are associated with the fluid being viewed from an underside of the vessel.

12. The system of claim 9, wherein the imager is configured to acquire the sequential images after the stage is agitated, and

wherein the controller is further configured to generate a minimum intensity projection (MinIP) from the sequential images, to subtract the MinIP from each of the sequential images to generate an image stack, and to determine the size and the number of particles in the fluid from the image stack.

13. The system of any one of claims 9-12, wherein the plate has a 96-well standard format including 96 vessels.

14. The system of any one of claims 9-12, wherein:

the vessel is from among a plurality of vessels included in the plate,

the controller is further configured to determine the size and the number of particles in each of the plurality of vessels included in the plate, and

the stage further includes a plate holder configured to selectively receive and release the plate, the plate holder being further configured to hold the plate in the stage and to maintain each vessel from among the plurality of vessels in the same field of view with respect to one another while the controller determines the size and the number of particles in each of the plurality of vessels included in the plate.

15. The system of any one of claims 9-11, wherein the vessel is configured to hold a volume of fluid up to 200 microliters.

16. The system of any one of claims 9-11, wherein the axicon is configured such that the sequential images acquired by the imager using the scattered light reflected off the mirror have a depth of field corresponding to the entire volume of fluid contained in the vessel.

17. A method for calculating a size and a number of particles in a fluid contained in a vessel included in a plate placed on a stage, comprising:

generating, via a light source, source light;

refracting, via one or more optical elements, the source light to produce refracted source light;

supplying, via an optical system, scattered light to an imager as a result of an interaction between the refracted source light and particles suspended in the fluid;

diverting, via the one or more optical elements, the refracted source light away from the imager;

acquiring, via the imager, sequential images using the supplied scattered light; and

determining, via a controller, a size and a number of particles in the fluid using the sequential images.

18. The method of claim 17, further comprising:

agitating the plate, and

wherein the act of acquiring the sequential images using the scattered light comprises:

acquiring a first image prior to the plate being agitated; and

acquiring a second image after the plate is agitated.

19. The method of claim 17, wherein the act of determining the size and the number of particles in the fluid using the sequential images includes subtracting, via a controller, the first image from the second image to provide a difference image, and determining the size and the number of particles in the fluid by analyzing the difference image.

20. The method of claim 17, wherein the act of acquiring the sequential images includes acquiring the sequential images after the plate is agitated, and

wherein the act of determining the size and the number of particles in the fluid using the sequential images includes generating a minimum intensity projection (MinIP) from the

sequential images, subtracting the MinIP from each of the sequential images to generate an image stack, and determining the size and the number of particles in the fluid from the image stack.