CLAIMS

What is currently claimed is:

1. A method for detecting a parasitic infection in a sample, the method comprising:

adding NaOH to a first side of a two-sided sample filter bag that includes a sample in the first side to form a first mixture;

performing a first homogenization of the first mixture for a first period of time;

incubating the first mixture for a second period of time;

adding a Sheather's solution to a second side of the two-sided sample filter bag;

performing a second homogenization of the first mixture for a third period of time;

removing an aliquot of the first mixture from the second side of the two-sided sample filter bag;

transferring the aliquot to a tube;

adding a ferrofluid to the tube to provide a second mixture;

vortexing the tube for a fourth period of time;

transferring the second mixture from the tube into a single sample well of an assay cartridge;

flowing the second mixture from the single sample well into an imaging window;

pushing cells, if present in the second mixture, to the surface of the imaging window;

acquiring an image of the imaging window;

determining a number of parasite oocysts or eggs present in the imaging window; and

determining a size distribution of parasite oocysts or eggs present in the imaging window.

2. The method of claim 1, further comprising adding in a fluorophore or fluorophore labeled agent to the tube.

3. The method of claim 1 or 2, wherein the parasite ocysts and/or eggs are labeled with at least one fluorophore or fluorophore labeled agent, wherein the fluorophore or

fluorophore labeled agent is selected from the group consisting of SYBR, fluorescent labeled lectins, fluorescent labeled antibodies, acid fast stains, membrane stains, and fluorophore labeled in-situ-hybridization probes.

4. The method of claim 2 or 3, wherein the fluorophore or fluorophore labeled agent is added prior to adding the ferrofluid to the tube.

5. The method of claim 1, wherein no fluorescent labeling agent is used, and the parasite oocysts and/or eggs are monitored by their intrinsic fluorescence.

6. The method of any one of claims 1 to 5, wherein the adding step comprises adding NaOH to the first side of the two-sided sample filter bag that comprises 0.1 g to 5 g of the sample.

7. The method of any one of claims 1 to 6, wherein the adding step comprises adding 1 mL to 5 mL of NaOH having a concentration of 0.1M to 1M to the first side.

8. The method of any one of claims 1 to 7, wherein the first period of time is in a range of 1 minute to 30 minutes.

9. The method of any one of claims 1 to 8, wherein the second period of time is in a range of 1 minute to 60 minutes.

10. The method of any one of claims 1 to 9, wherein adding the Sheather's solution comprises adding 1 mL to 5 mL of the Sheather's solution to the second side of the two-sided sample filter bag.

11. The method of any one of claims 1 to 10, wherein the third period of time is in a range of 1 to 30 minutes.

12. The method of any one of claims 1 to 11, wherein the aliquot has a volume of 200 µL to 300 µL.

13. The method of any one of claims 1 to 12, wherein the tube is a 1.7 mL to 2 mL tube.

14. The method of any one of claims 1 to 13, wherein adding the ferrofluid to the tube comprises adding 10 µL to 60 µL of the ferrofluid to the tube.

15. The method of any one of claims 2-14, wherein the fluorophore or fluorophore labeled agent is added to the tube in an amount of 1-5 µL.

16. The method of any one of claims 1 to 15, wherein the method is performed using a microfluidic device.

17. The method of any one of claims 1 to 16, wherein determining the number of parasite oocysts or eggs comprising counting the parasite oocysts or eggs using a hemocytometer and/or a McMaster chamber.

18. The method of claim 17, wherein the hemocytometer and/or the McMaster chamber are configured to cause fluorescence excitation/emission of fluorophore labeled parasite oocysts or eggs in the samples using wavelengths specific to the fluorophore used.

19. The method of any one of claims 1 to 18, further comprising flowing a plurality of samples into the assay cartridge for a predetermined period of time.

20. The method of any one of claims 1 to 19, wherein determining the number of parasite oocysts or eggs comprises counting the parasite oocysts and/or eggs without capture.

21. The method of claim 20, further comprising characterizing the counted parasite oocysts and/or eggs.

22. The method of any one of claims 1 to 21, further comprising characterizing a level of sporulation of individual parasite oocysts and/or eggs contained in the sample.

23. The method of any one of claims 1 to 22, further comprising determining a state of oocyst and/or egg sporulation.

24. The method of any one of claims 1 to 23, further comprising visualizing a level of sporulation of individual oocysts contained in the sample.

25. The method of claim 24, wherein sporulation is visualized by exposing the sample with at least one staining agent.

26. The method of any one of claims 1 to 25, wherein the sample is a vaccine preparation and determining the size distribution of parasite oocysts or eggs comprises determining a size distribution of Eimeria oocysts.

27. The method of any one of claims 1 to 26, wherein the sample comprises animal fecal matter.

28. An assay system configured to at least one of detect, enumerate, and characterize one or more parasite oocyst or egg from at least one fecal sample or a plurality of samples, comprising:

a ferrofluidic assay device configured to receive a ferrofluidic cartridge;

the ferrofluidic cartridge including a plurality of windows;

an imager configured to image each window of the cartridge either separately or together, wherein detecting, enumerating, and characterizing one or more parasite oocyst or egg is determined by an analysis of one or more images;

a controller configured to control at least one of the ferrofluidic assay device, the ferrofluidic cartridge, and the imager;

and

assay processing components comprising at least one of reagents, and controls

wherein the system is configured to at least one of: separate any and all of parasite oocysts or eggs; move or otherwise locate the parasite oocysts or eggs to one or more of the windows; detect, enumerate/count, and/or characterize the parasite oocysts or eggs.

29. A method for detecting parasitic infection in a sample in an assay system comprising:

preparing a plurality of samples for analysis, wherein preparing comprises, for each sample of the plurality of samples:

labeling each of a first tube and a second tube;

placing a predetermined amount of sample within the first tube;

placing a predetermined amount of NaOH at a pre-determined concentration in the first tube;

vortexing the first tube for a first predetermined period of time;

placing a predetermined amount of Sheather's sugar solution in the first tube to provide a NaOH mixture;

vortexing the first tube for a second predetermined period of time;

optionally removing an amount of the sample from the first tube and determining a reference count of oocysts;

transferring a third predetermined amount of the NaOH mixture from the first tube into a respective second tube;

adding a fourth predetermined amount of ferrofluid and a fifth predetermined amount of SYBR into the second tube;

vortexing the second tube for a third predetermined amount of time to provide a vortexed sample;

adding a portion of the vortexed sample to a lane of an assay cartridge having a plurality of channels/lanes;

flowing the NaOH mixture over at least one of the channels of the cartridge, wherein electromagnetic fields produced by the system and acting on the ferrofluid push up oocysts contained in the at least one sample to a channel window provided for each of the channels;

scanning each window of each channel to produce a respective scan image thereof;

processing each respective scan image so as to at least one of identify and count each oocyst imaged from a respective channel window;

converting each count from each processed image to oocysts per gram of original sample; and

optionally identifying and measuring the major axis of each counted oocyst such that the number of small (<18 μm), medium (18-25μm), and large (>25μm) oocysts are counted for each sample and optionally converted to oocysts per gram of original sample.