Supplementary materials

1. Data baseline determination

Sample preparation:

Natural water was collected from a creek near a major city (Red Butte Creek, SLC, UT, USA). Grade 4 filter paper (Zenpore) with 20 – 25 µm particle retention (similar to a coffee filter) was cut into size (15 mm Ø) and inserted into a reusable syringe-type membrane filter holder. The water was collected into a 1 mL syringe, and manually pushed through the filter.

Experiment setup:

The filtered city creek water was then injected into the device at 2 uL/min flowrate at 1 MHz and 500 kHz excitation frequencies. A total of 3 injections were made, up to 1000 sec (over 16 minutes) at a time.

Experiment result:

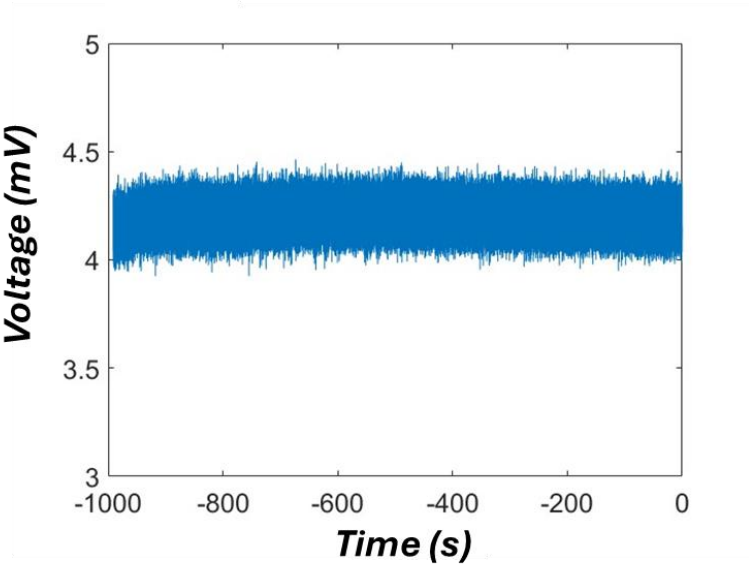

Fig. S1 1000 sec of raw amplitude data at 1 MHz, showing only background noise (± 0.2 mV) without any signal peaks present, while also indicating the noise baseline ± ~200 µV of the IFC system.

Fig. S1 represents the raw amplitude measurement for the filtered city creek water -1000 sec long at 1 MHz excitation frequency. No characteristic double-peak signals were observed except for the background noise. The same was observed in all amplitude and phase measurements, resulting in a blank baseline in the 2D data domain (e.g. [amplitude, phase]) for analyzing the parasite samples spiked in filtered city creek water. The absence of signal pulses indicates the simple filtration process was adequate to remove detectable particles, possibly due to the water source being relatively clean (it was running instead of stagnant). However, particles such as colloidal particles could still be present, but not detected by the device due to their size in the submicron range.

2. *G.lamblia* and *C.parvum* (oo)cysts mixtures detection

Sample preparation:

1 part of *G.lamblia* cysts and 1part of *C.parvum* oocysts (nonviable, 5~10% formalin and 0.01% tween in PBS) were added together to create a sample mixture. The mixture was diluted to varying concentrations and therefore buffer solution conductivities using filtered city creek water (see above) as diluent.

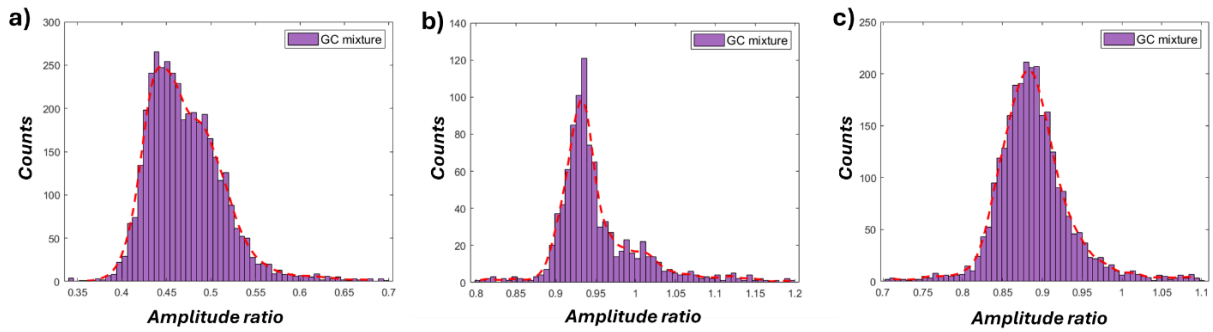

Fig. S2.1. Examples of amplitude ratio histograms of mixtures of *G.lamblia* and *C.parvum* (oo)cysts measured using the proposed continuous waterborne parasitic protozoa monitoring system. a) 1:3 dilution using filtered creek water, b) 1:6 dilution, and c) 1:9 dilution. Note that the amplitude ratio axes (x-axes) are of equal length at 0.4.

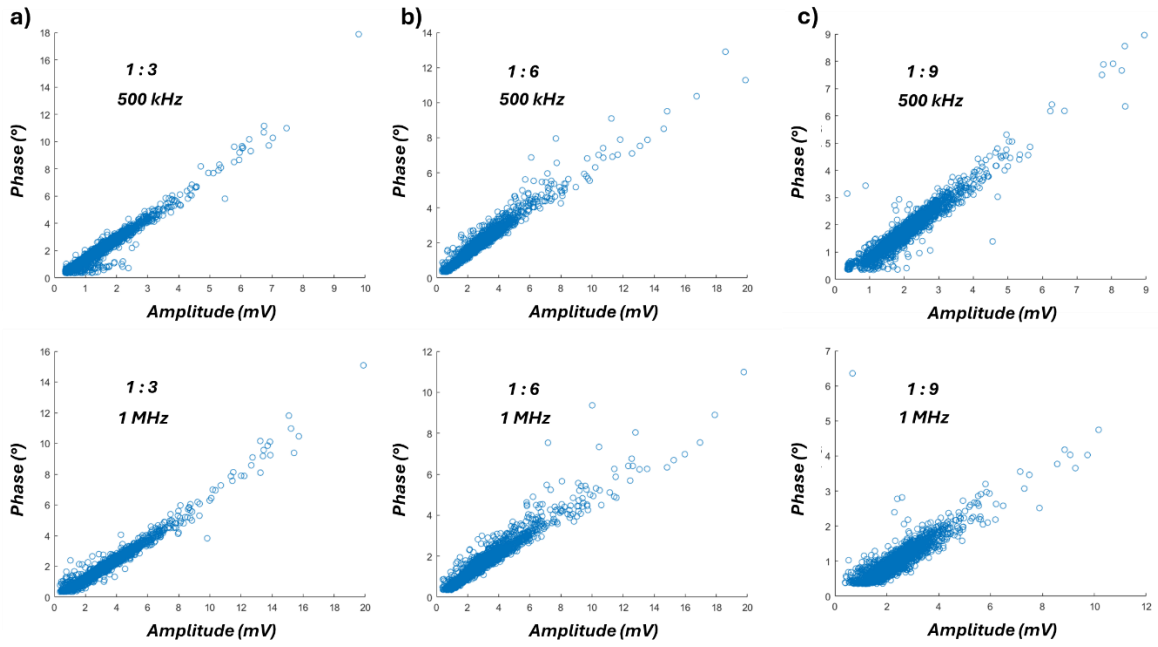

Fig. S2.2. Amplitude vs phase scatter plots at 500 kHz and 1MHz excitation frequencies for mixtures of *G.lamblia* and *C.parvum* (oo)cysts spiked in filtered city creek water at different concentrations.