

## Colorimetric paper-based analytical device for PFOS detection

Ruth F Menger,<sup>1</sup> Josianne J. Beck,<sup>1</sup> Thomas Borch,<sup>1,2</sup> Charles S. Henry<sup>1,3,4\*</sup>

\*Corresponding author: Charles S. Henry (chuck.henry@colostate.edu)

<sup>1</sup>Department of Chemistry, Colorado State University, Fort Collins, CO 80523 USA

<sup>2</sup>Department of Soil and Crop Sciences, Colorado State University, 1170 Campus Delivery, Fort Collins, Colorado 80523, USA

<sup>3</sup>Department of Chemical and Biological Engineering, Colorado State University, Fort Collins, CO 80523 USA

<sup>4</sup>School of Biomedical Engineering, Colorado State University, Fort Collins, CO 80523 USA

### Table of Contents

Figure S1. Device fabrication schematic.

Figure S2. Plot of PFOS color in spot test vs PFOS concentration.

Figure S3. Sample ImageJ profile of radial device.

Figure S4. Representative device images of PFOS with increasing ionic strength.

Figure S5. Representative device images of PFOS in increasing pH.

Figure S6. Representative device images with PFOA

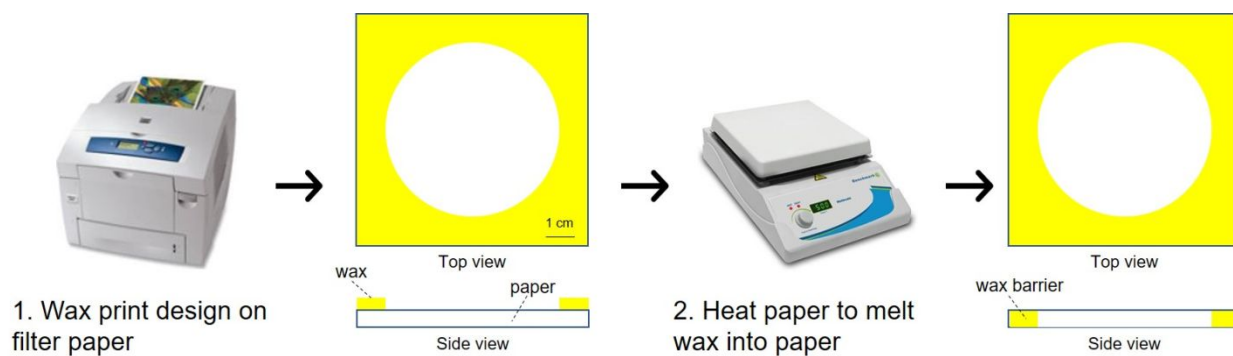
Figure S7. Representative device images with PFOS + other surfactant interactions.

Figure S8. Representative device images with PFOS + inorganic contaminants

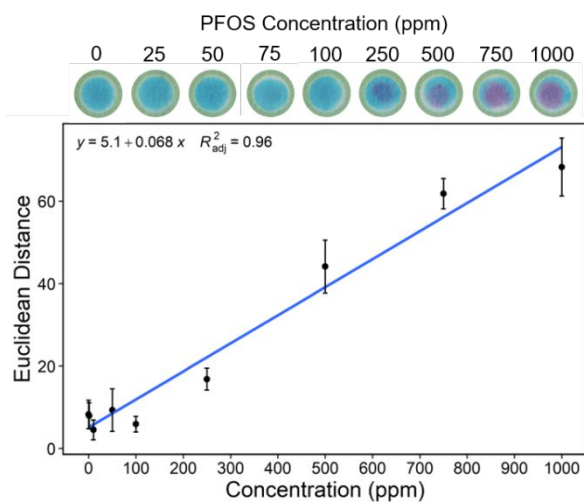
Figure S9. Representative device images with PFOS + heavy metal contaminants

Figure S10. Representative device images showing signal stability after PFOS addition

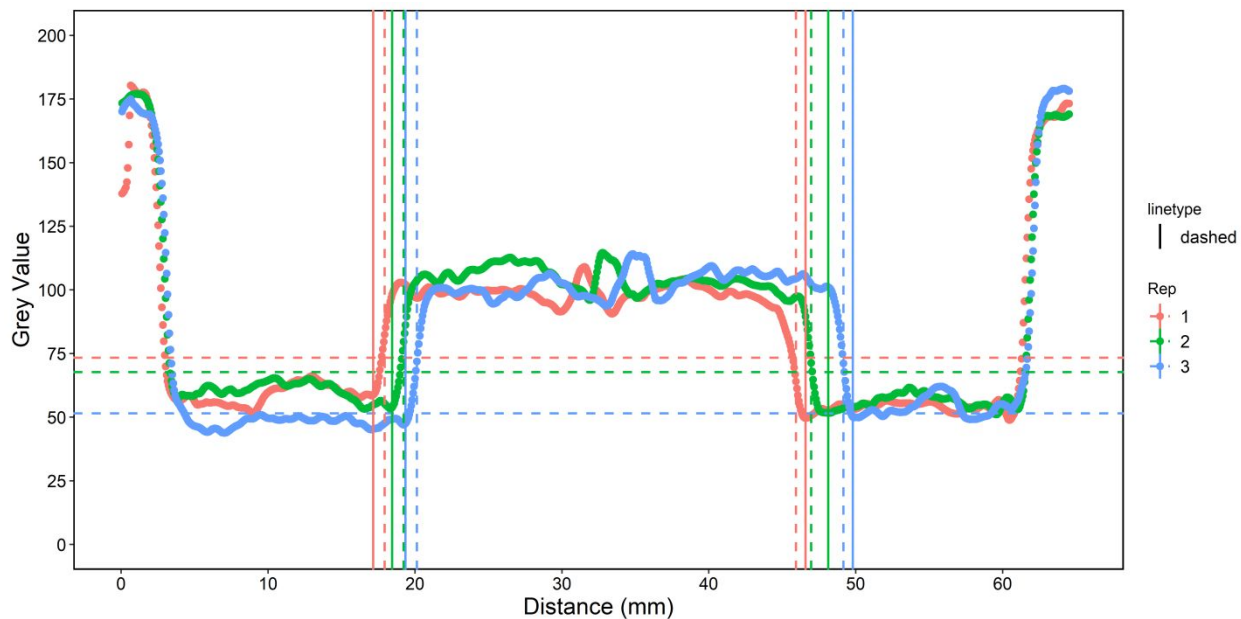
ImageJ Macro



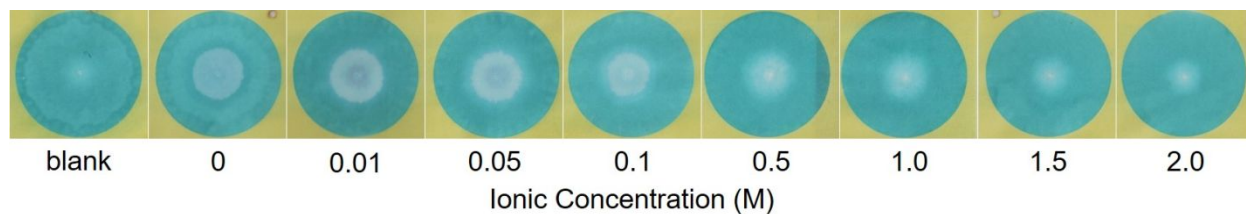
**Figure S1** Device fabrication schematic.



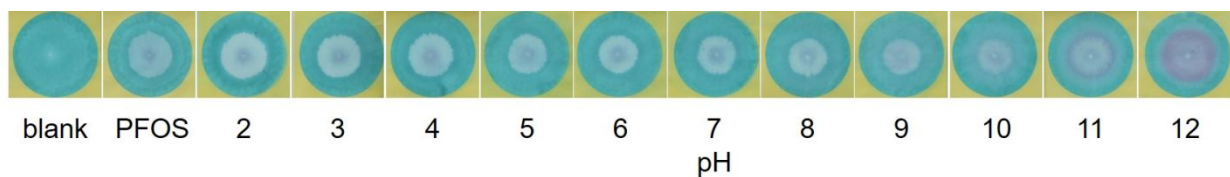
**Figure S2** Spot test calibration curve of PFOS detection by methylene green (top). Calibration curve of color change as measured by Euclidean distance vs PFOS concentration (bottom). The Euclidean distance was calculated by the change in color between blue and purple in red-green-blue (RGB) color space. The data points are the average of 3 replicates for each PFOS concentration and the associated error bars are  $\pm 1$  standard deviation ( $1\sigma$ ) around the mean.



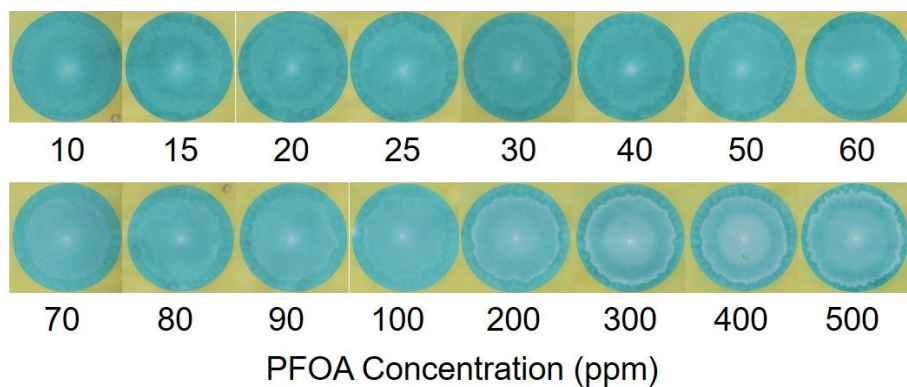
**Figure S3** Sample ImageJ profile. The dashed horizontal lines correspond to the signal threshold that was determined for each profile by 3\*standard deviation of the baseline. The dashed vertical lines are the maximum increase (on the left side) or maximum decrease (on the right side) to find a point to start looking for a continuous increase (or decrease) in grey value. The solid vertical lines represent where the purple color starts and ends.



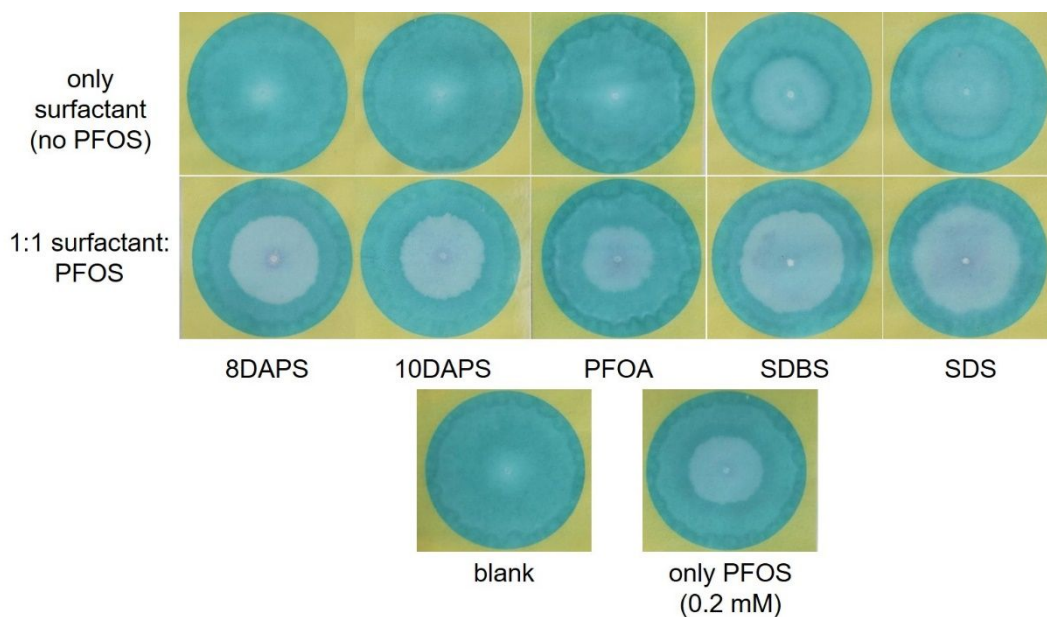
**Figure S4** Representative device pictures of increasing ionic strength with 100 ppm PFOS. Ionic strength was adjusted by changing the NaCl concentration.



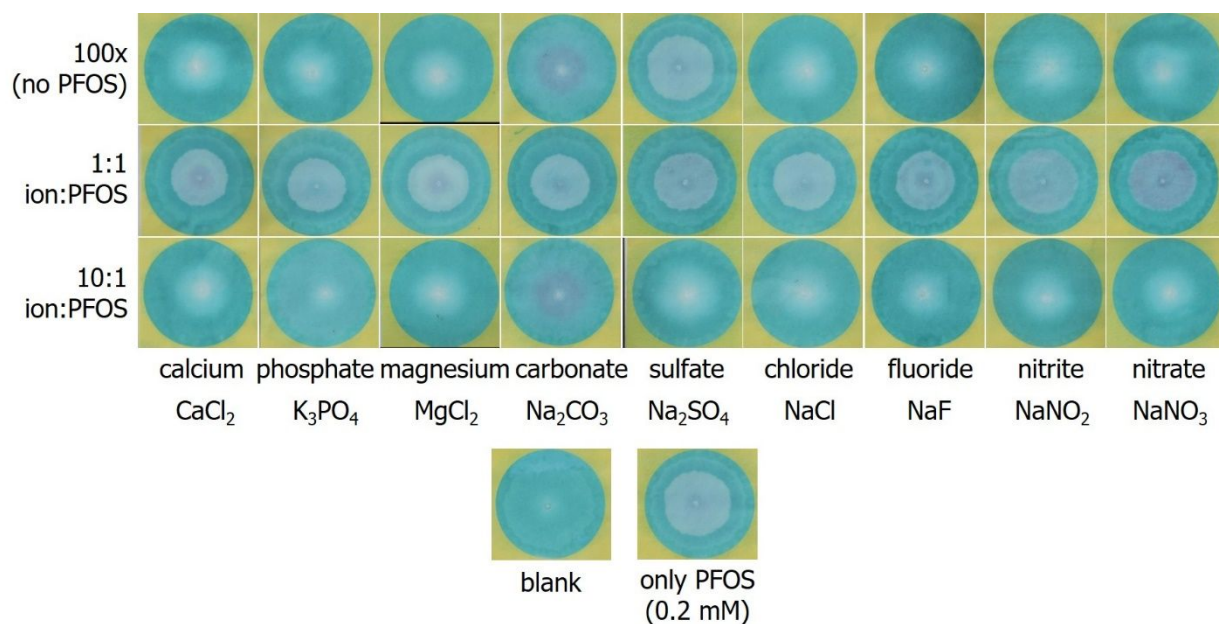
**Figure S5** Representative device pictures of 100 ppm PFOS prepared in 40 mM Britton Robinson buffer. The pH of each solution was adjusted with 1 M NaOH.



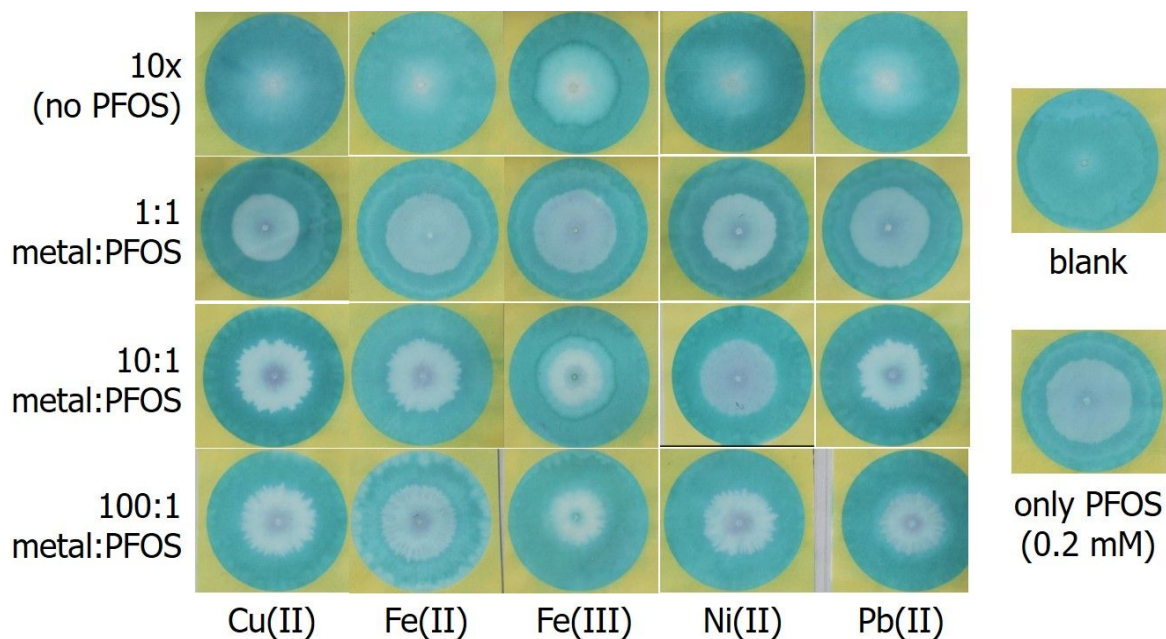
**Figure S6** Representative device pictures of W4 filter paper prepared with 150 ppm methylene green. An aliquot (300  $\mu$ L) of PFOA prepared in water was added to each device.



**Figure S7** Representative device pictures of surfactant interference study. Top row: only 0.2 mM surfactant prepared in water was added to each device. Second row: 0.2 mM surfactant + 0.2 mM PFOS. Bottom row: blank and only PFOS (100 ppm = 0.2 mM). 300  $\mu$ L were added to each device (60 mm).

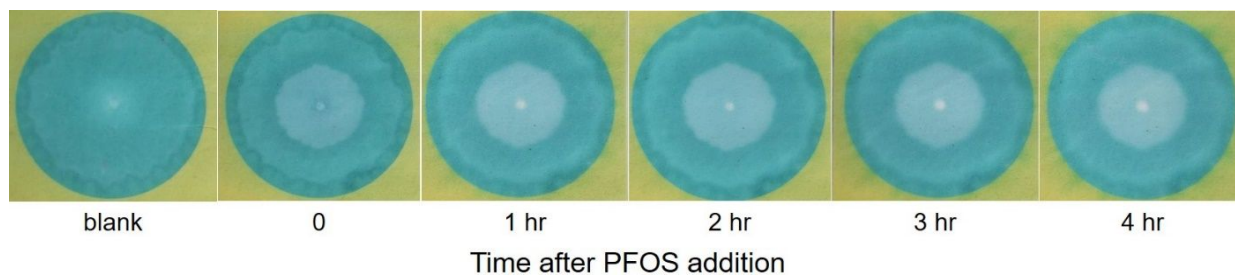


**Figure S8** Representative device pictures of common ion interferences. Top row: 20 mM (100x) ion prepared in water was added to each device. Second row: 0.2 mM (1x) + 0.2 mM PFOS. Third row: 2.0 mM (10x) + 0.2 mM PFOS. Bottom row: blank and just PFOS (0.2 mM = 100 ppm). 300  $\mu$ L were added to each device.



**Figure S9** Representative device pictures of heavy metal interferences. Top row: just 2 mM (10x) heavy metal prepared in water was added to each device. Second row: 0.2 mM (1x) + 0.2 mM PFOS. Third row: 2.0 mM (10x) + 0.2 mM PFOS. Bottom row: 20.0 mM (100x) + 0.2 mM PFOS. Right panel: blank and just PFOS (0.2 mM = 100 ppm). 300  $\mu$ L were added to each device.





**Figure S10** Representative device pictures of signal stability after PFOS (100 ppm) addition.

### ImageJ Macro

```

imageTitle=getTitle();
run("Split Channels");
selectWindow(imageTitle+" (green)");
close();
selectWindow(imageTitle+" (blue)");
close();
selectWindow(imageTitle+" (red)");
run("Specify...", "width=1000 height=30 x=0 y=470");

run("Clear Results");
profile = getProfile();
for (i=0; i<profile.length; i++)
    setResult("Value", i, profile[i]);
updateResults;
for (i=0; i<profile.length; i++)
    setResult("Label", i, imageTitle);
updateResults;

// Plot profile
Plot.create("Profile", "X", "Value", profile);
selectWindow("Profile");
close();

run("Read and Write Excel", "stack_results");

```