

## Supporting information

### Near-infrared “matchbox size” spectrometer to detect and quantify malaria parasitemia

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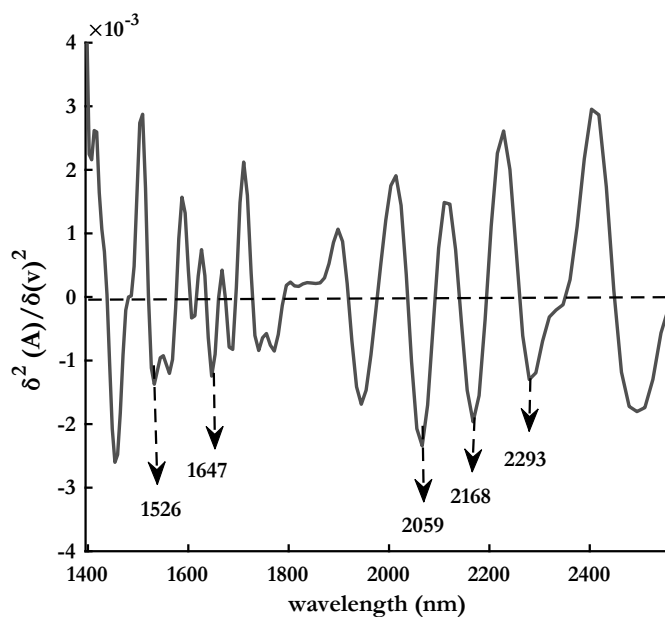
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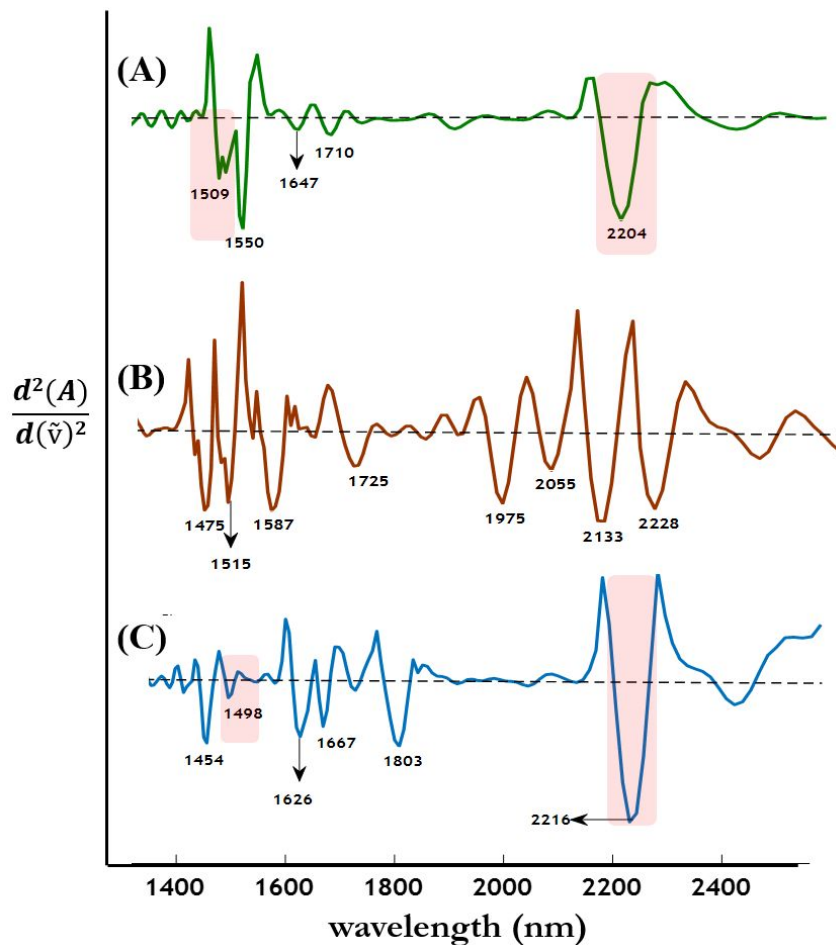
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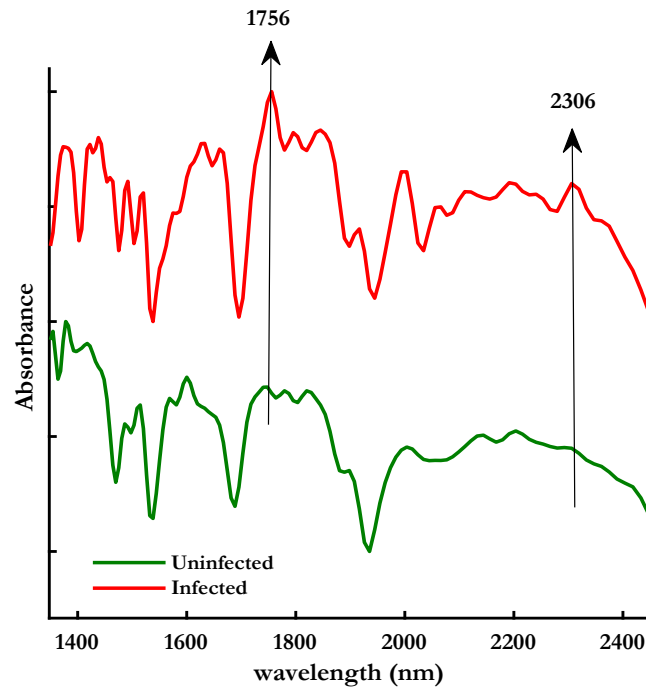
**Figure S1.** A representative NIR second derivative spectrum of human hemoglobin showing major bands measured with the miniature NIR device.



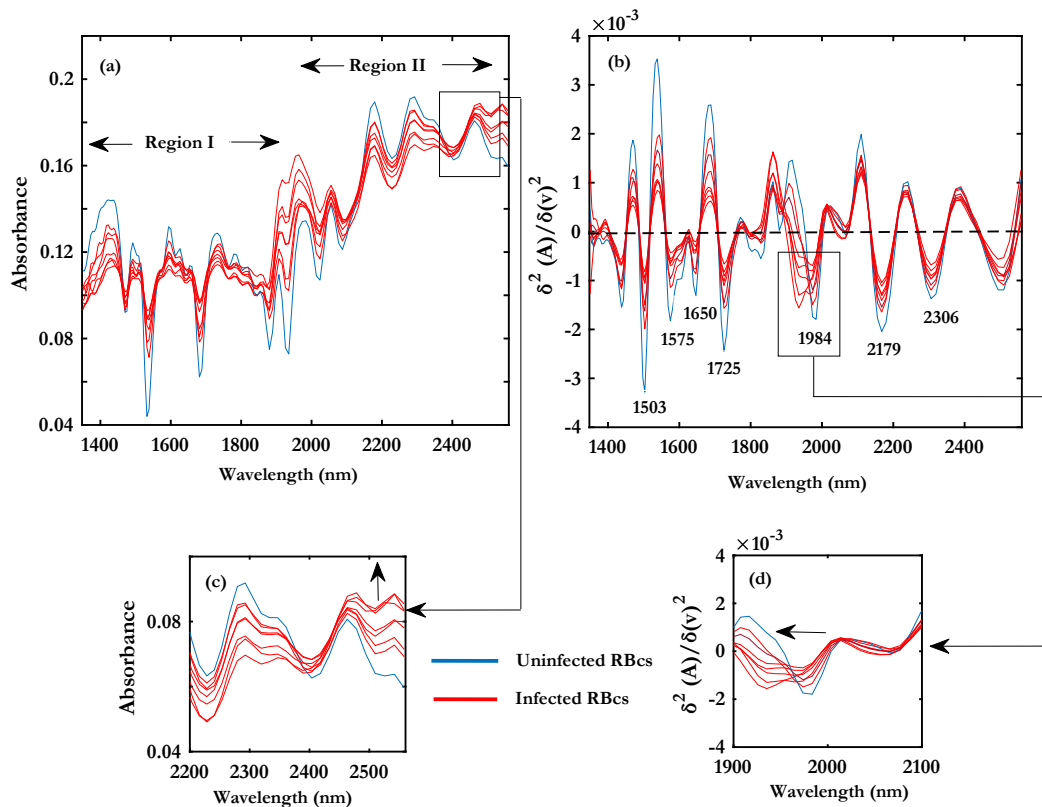
**Figure S2.** Representative second derivative spectra, a)  $\beta$ -hematin, b) dry hemozoin isolated from infected red blood cells, c) dry crystalline hemozoin purchased from Invivogen



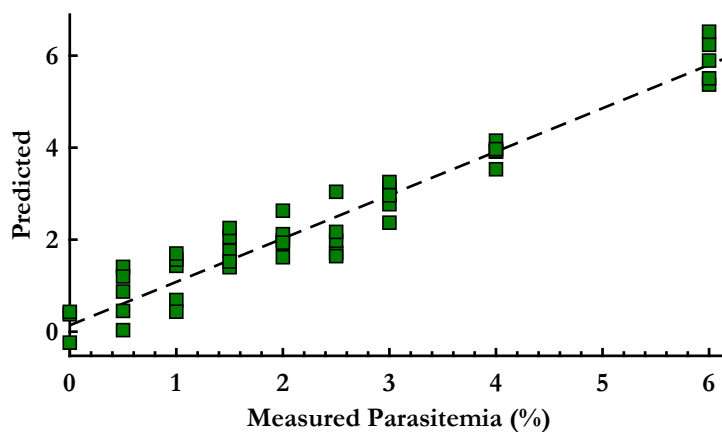
**Figure S3.** Average spectrum of lipid extracted from infected (red) and uninfected (green) red blood cells. The bands with the upward arrow indicated the most important areas where lipid showed increase in absorption due to malaria infection.



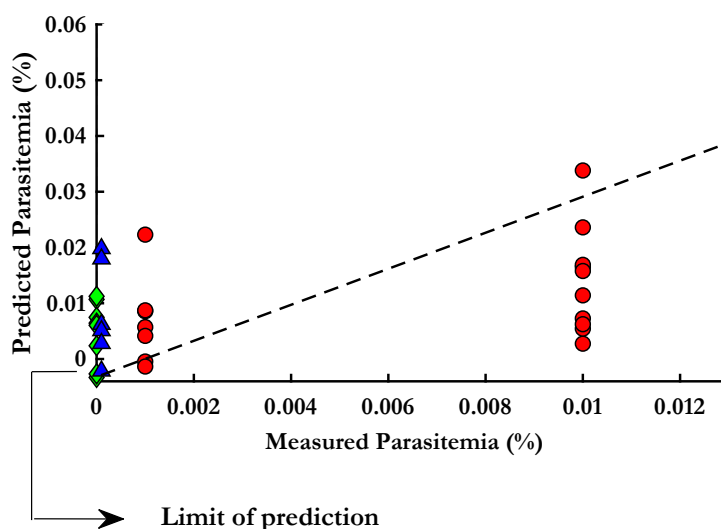
**Figure S4. a-d).** Average spectra from all technical replicates acquired from all parasitemia dilutions. Blue spectra denote the uninfected RBCs, while red spectra are the 0.00001 % - 6% parasitemia samples a) Unprocessed whole spectra region b) second derivative spectra c) enlarged region for 2200 – 2500 nm (unprocessed) d) enlarged region from 1900 – 2100 nm (derivatized)



**Figure S5.** Calibration curve used for the prediction of different concentration of malaria parasitemia in spiked samples.



**Figure S6.** Magnified PLS-R score plot for the extremely low parasitemia region (0.012 – 0%) showing a quantifiable detection limit of 0.001%



**Table S1.** NIR band positions and their assignments for malaria biomarkers

Biomarkers	Band assignment (nm)	Possible band type
<b>Hemozoin</b>	1498	N-H first overtone
	1626, 1667	CH <sub>2</sub> first overtone
	2216	C=O stretch combination
<b>Isolated Hz from iRBCs</b>	1475, 1515, 1587	N-H first overtone
	1725	CH <sub>2</sub> first overtone
	1974	Amide IIB combination
	2060	N-H bending mode
	2165	Asym C-H stretch
	2228	C-O stretch combination
<b>β -Hematin</b>	1550	N-H first overtone
	2204	C-H stretch combination

<b>Lipid</b>	1756	$\nu$ (C=O) second overtone
	2306	$\nu$ (C-H) second overtone

**Table S2.** Statistical parameter associated with the model developed<sup>T</sup>

<b>Model</b>	<b>RMSECV (%)</b>	<b>RMSEP (%)</b>	<b>R-square</b>	<b>RPD</b>	<b>CV bias</b>	<b>preprocessing</b>
PCA	-	-	-	-	-	SD, SNV, MC
Calibration set	0.466	-	0.929	0.0533	0.0069	SD, SNV, DT, MSC
PLS -R (6 -0.00001%)	0.265	0.446	0.947	0.0656	0.004	SD, SNV, DT, MSC
PLS-R (0.1 - 0.00001%)	0.0083	0.001	0.931	6.5783	0.0002	SD, SNV, DT, MSC

\*SD: Second derivative, SNV: Standard normal variant, MC: Mean centering, DT: Detrend, MSC: Mean scatter correction