

Design and assembly of microfluidic paper-based analytical devices (μ PAD's) for the quantification of nitrite and nitrate in saliva



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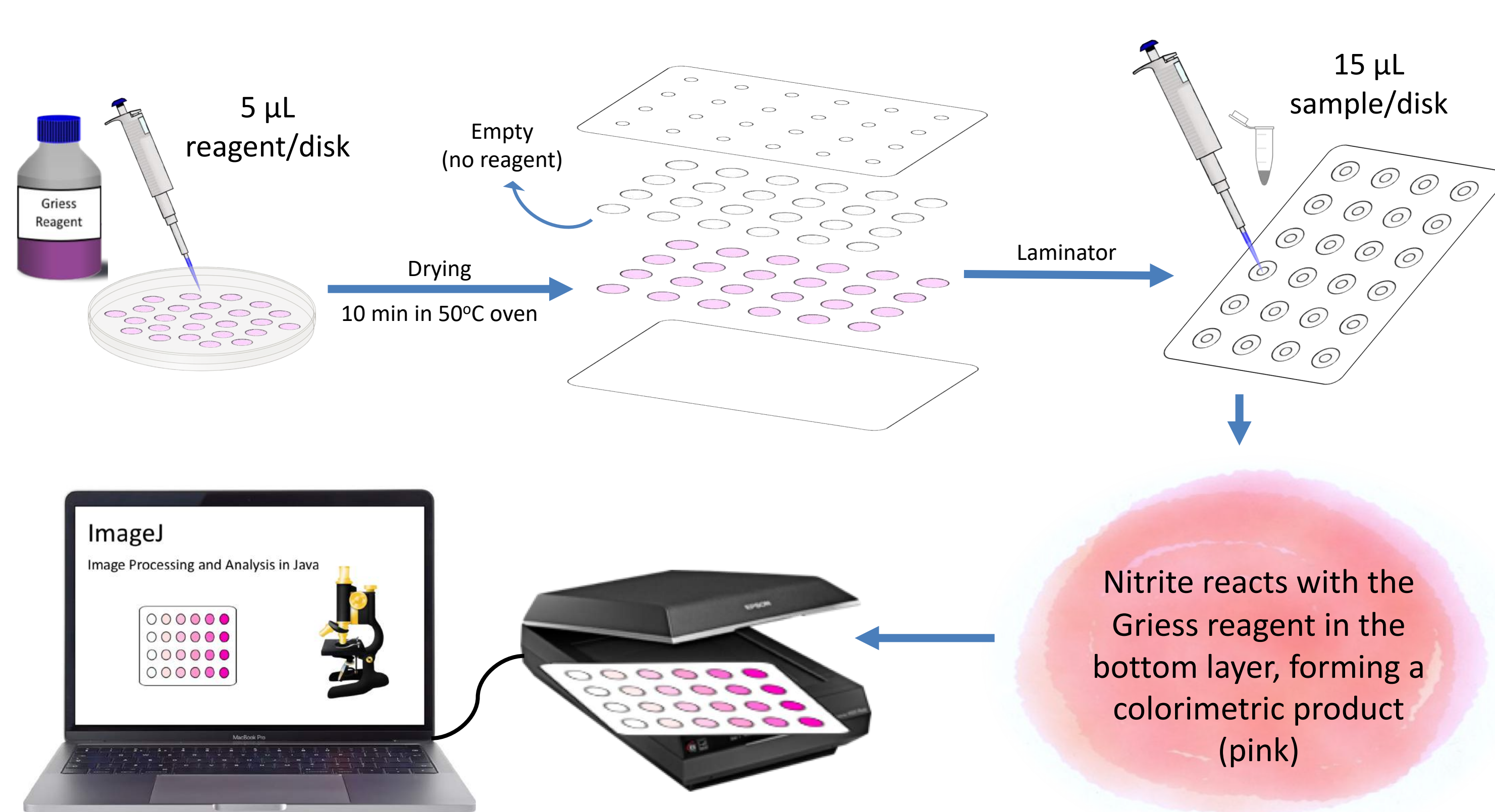
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Introduction and Objectives

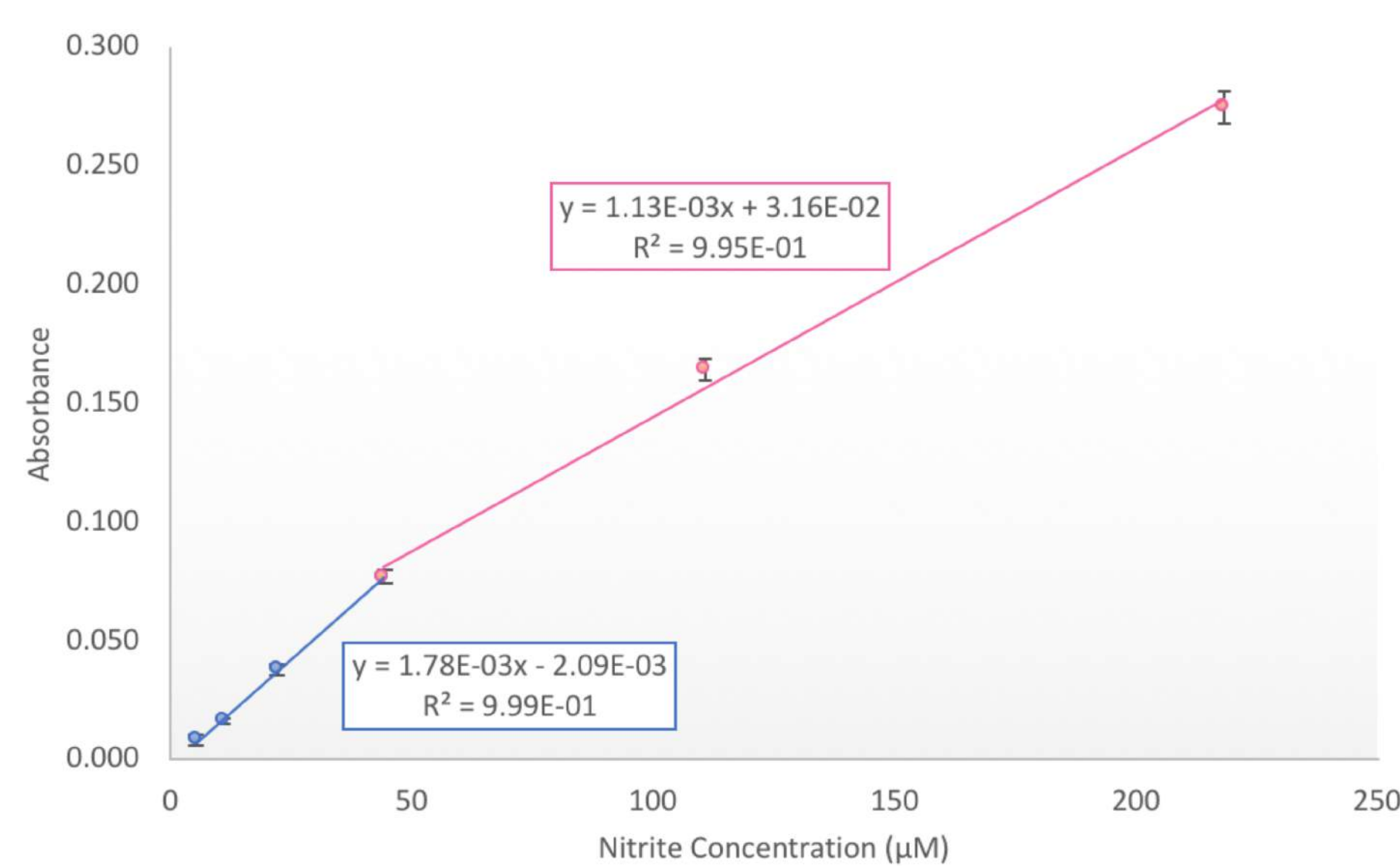
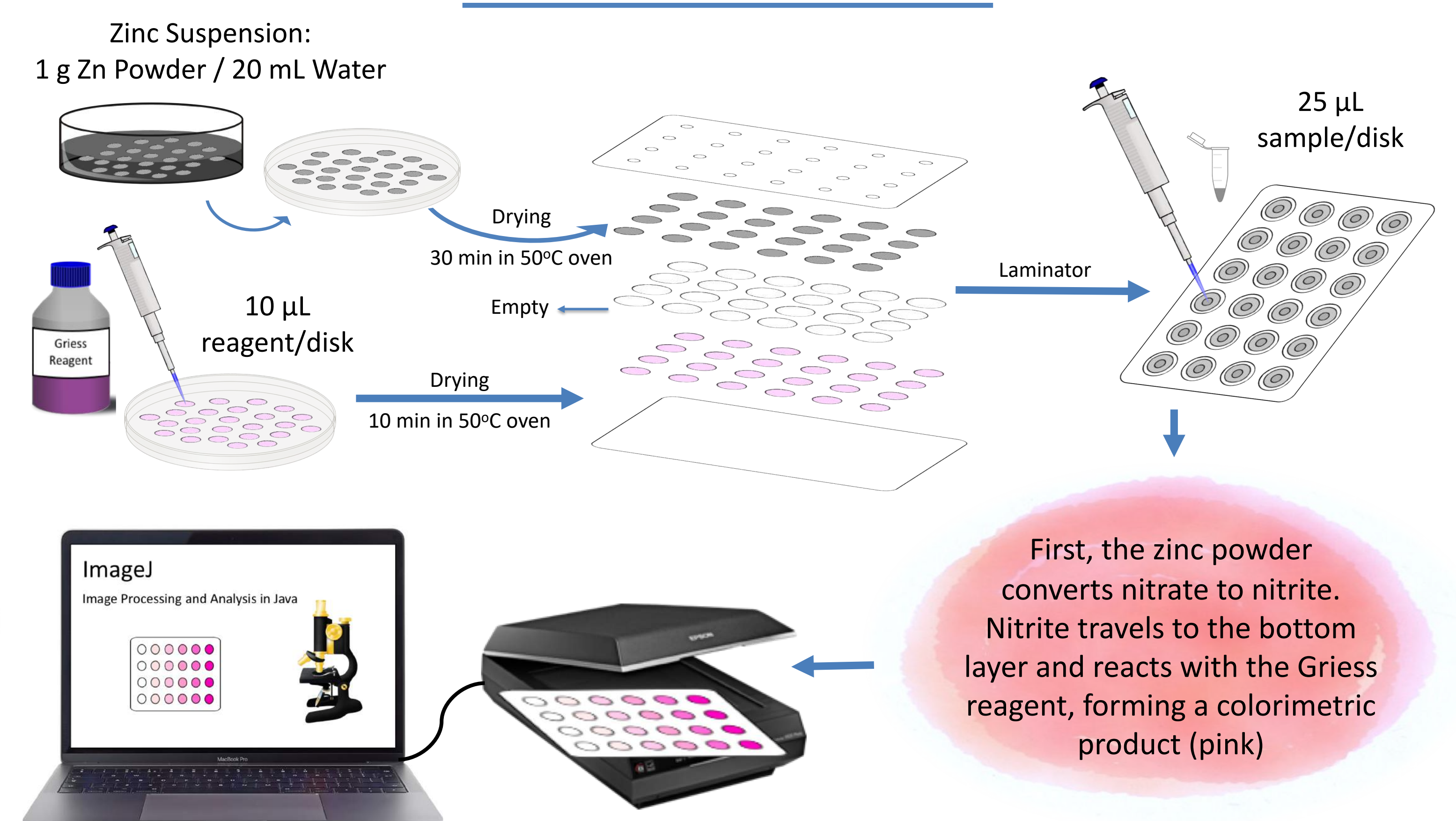


Methods and Results

Nitrite Determination

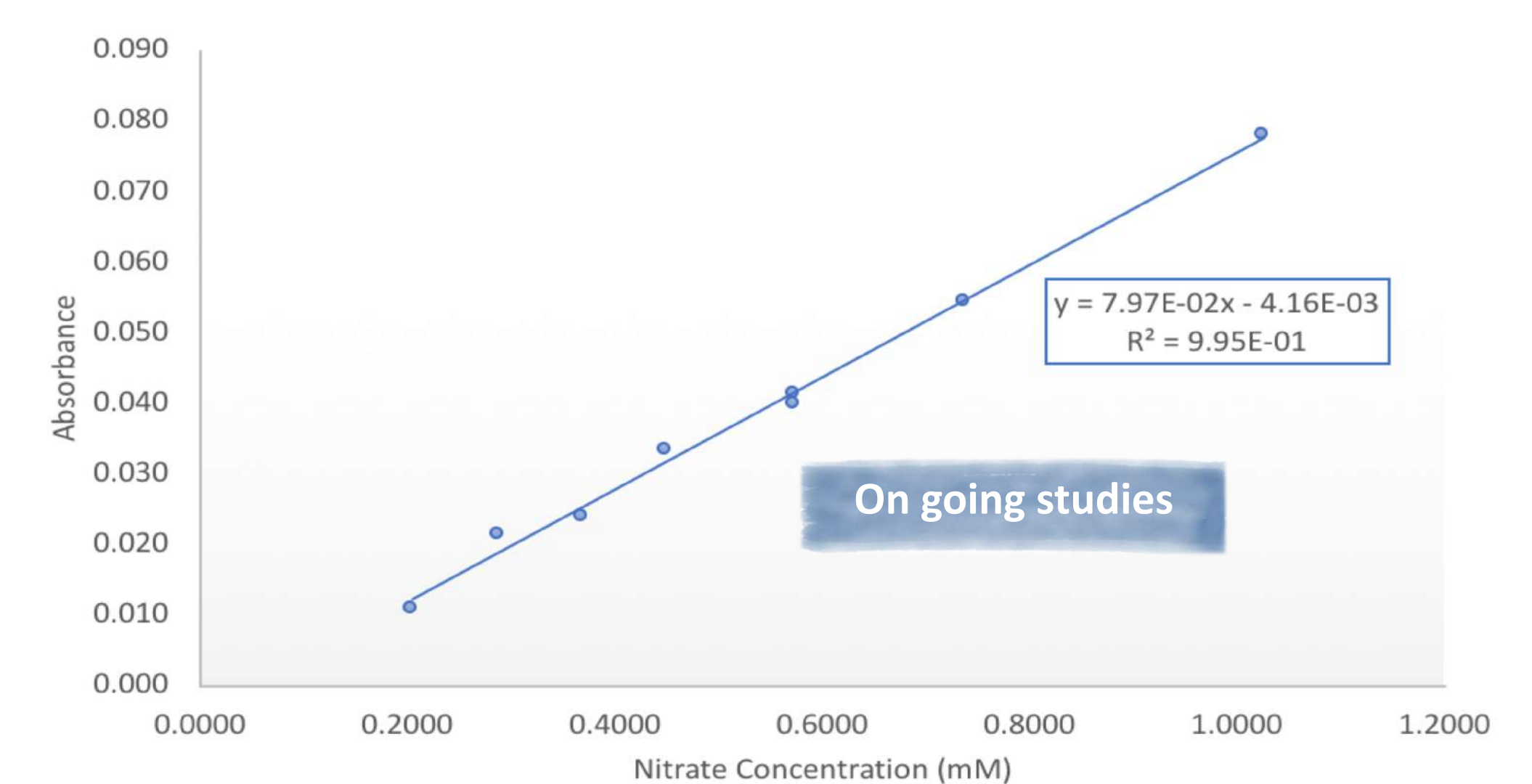


Nitrate Determination



After scanning the μ PAD, the ImageJ program was used to measure the average intensity of the pixels on each disk. These intensities were converted to absorbance values using the formula:

$$A = \log_{10} (I_{\text{blank}} / I_{\text{sample}})$$



NO_2^-	Options	Chosen Feature
Number of layers	1 or 2 layers	2 layers
Griess Reagent layer	1 st or 2 nd layer	2 nd layer
1 st layer paper (empty)	Whatman 1, 4, 5, 42, 50 or 541	Whatman 1
2 nd layer paper (reagent)	Whatman 1, 42, 50 or 541	Whatman 50
Reagent volume	5 μL or 10 μL	5 μL
Sample volume	10 μL , 15 μL or 20 μL	15 μL

NO_3^-	Options	Chosen Feature
Number of layers	2 or 3 layers	3 layers
1 st layer paper (zinc)	Whatman 1, 4 or 5	Whatman 1
2 nd layer paper (empty)	-	Whatman 1
3 rd layer paper (reagent)	Whatman 1, 42, 50 or 541	Whatman 50
Reagent volume	5 μL or 10 μL	10 μL
Sample volume	15 μL , 20 μL , 25 μL or 30 μL	25 μL

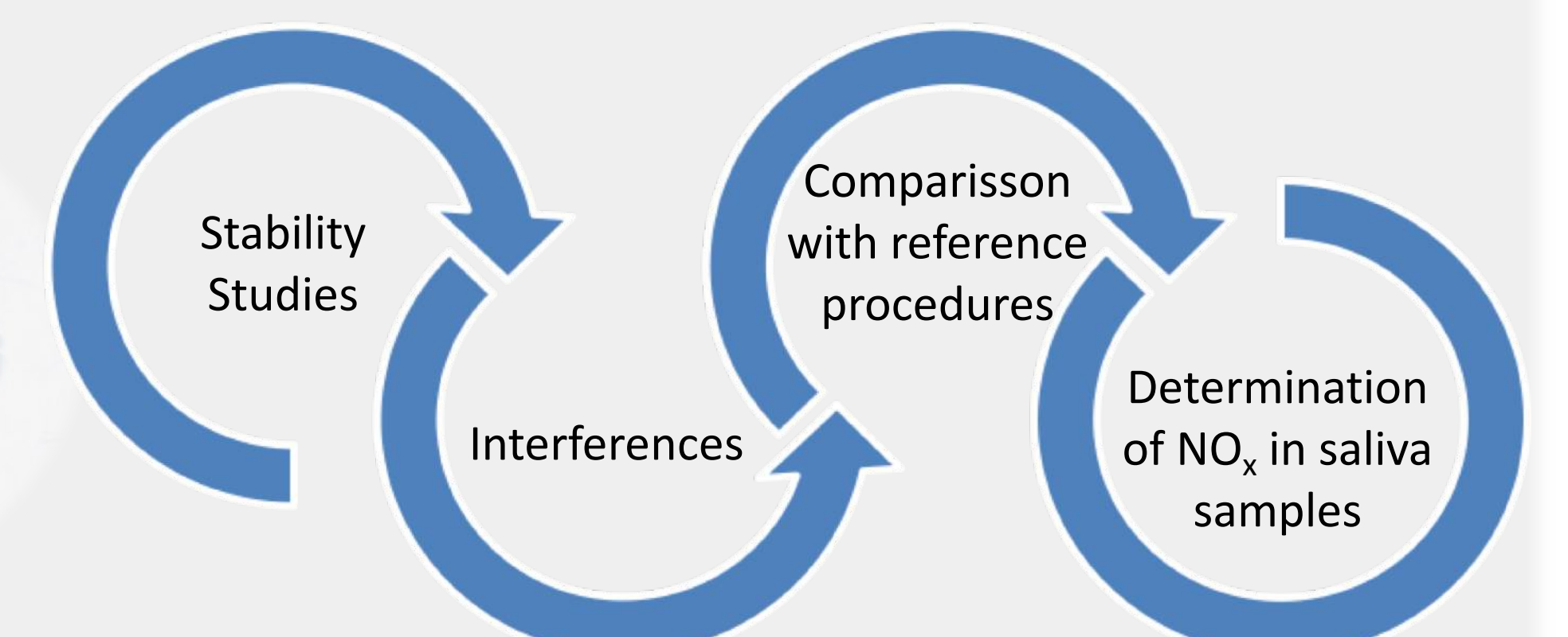
Analyte	Dynamic Range	Calibration Curve $A = S \times [\text{NO}_x^-] + b$	LOD	LOQ	RSD
Nitrite (NO_2^-)	5 – 50 μM	$A = 1.78 \times 10^{-3} (\pm 8.13 \times 10^{-5}) \times [\text{NO}_2^-] + 2.09 \times 10^{-3} (\pm 6.88 \times 10^{-4})$	1.2 μM	3.9 μM	4.6 %
	50 – 220 μM	$A = 1.24 \times 10^{-3} (\pm 2.87 \times 10^{-5}) \times [\text{NO}_2^-] + 11.0 \times 10^{-3} (\pm 5.51 \times 10^{-4})$			
Nitrate (NO_3^-)	0.2 – 1.0 mM	$A = 7.97 \times 10^{-2} \times [\text{NO}_3^-] + 4.16 \times 10^{-3}$	On going studies		

Sample Drying Time: 15 min
Scanning Time: 20 min

Sample Drying Time: 5 min
Scanning Time: 25 min

Conclusions and Future Work

The microfluidic paper-based analytical devices are a promising method to be used in NO_x determination in saliva.



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