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Superoxide dismutase determination on silver nanostructured substrates through surface enhanced photoluminescence

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INTRODUCTION & AIM

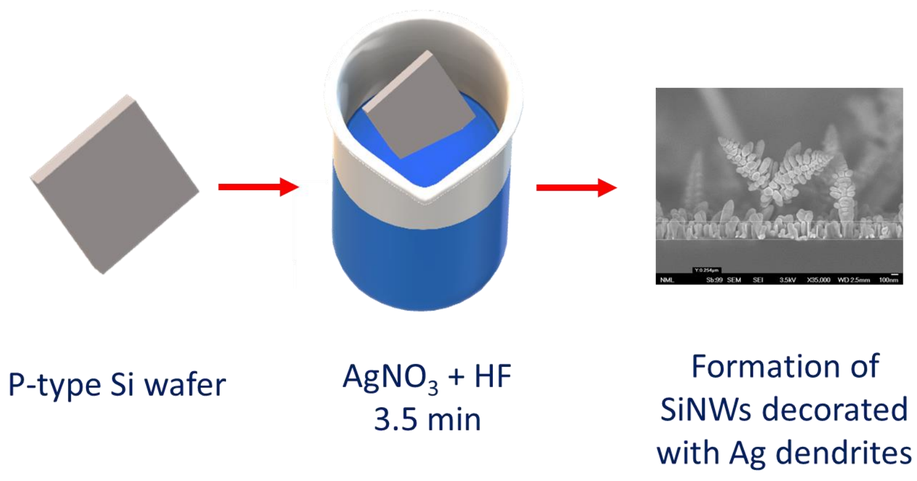
Oxidative stress is defined by an imbalance between the generation of reactive oxygen species and the biological system's ability to neutralize them. This condition is commonly linked to various pathological conditions [1]. Superoxide dismutase (SOD) is a widely used enzyme to assess oxidative stress and various techniques have been developed for its detection in biological samples such as blood, urine, and saliva [2]. Surface-enhanced photoluminescence (PL) is a particularly sensitive method, offering minimal interference from the sample matrix [3].

AIM:

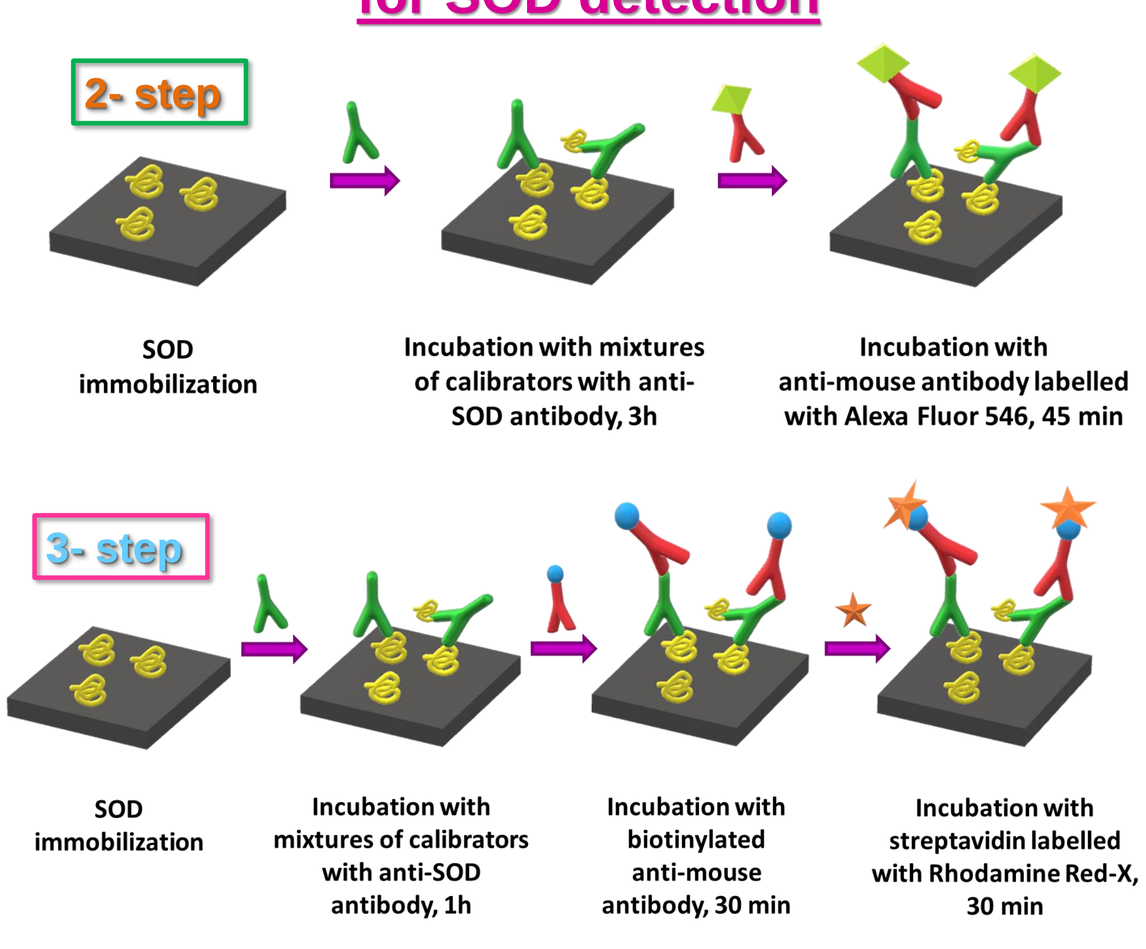
Immunochemical determination of SOD in saliva through Surface Enhanced Photoluminescence on substrates with silicon nanowires made by metal-assisted chemical etching (MACE) decorated with silver nanoparticles.

METHOD

Preparation of SERS substrates



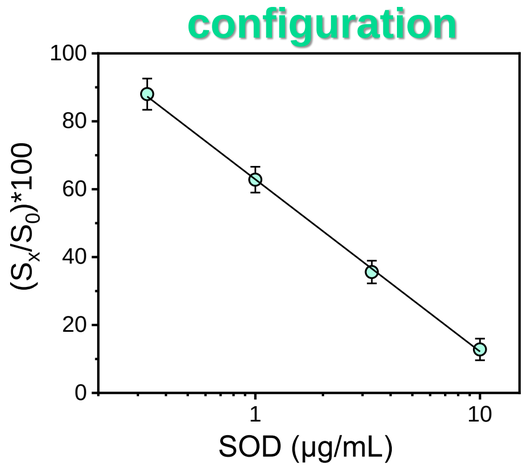
Competitive immunoassay configuration for SOD detection



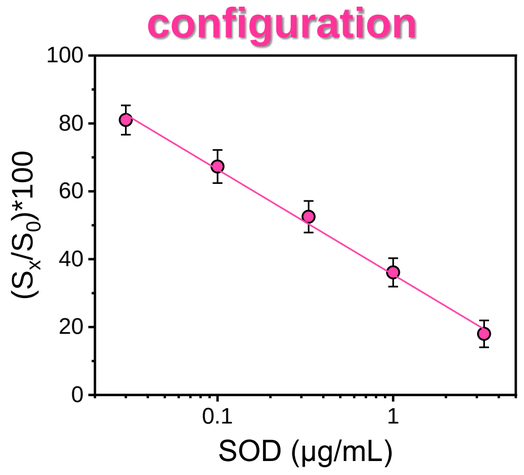
RESULTS & DISCUSSION

Calibration curves

2-step assay configuration



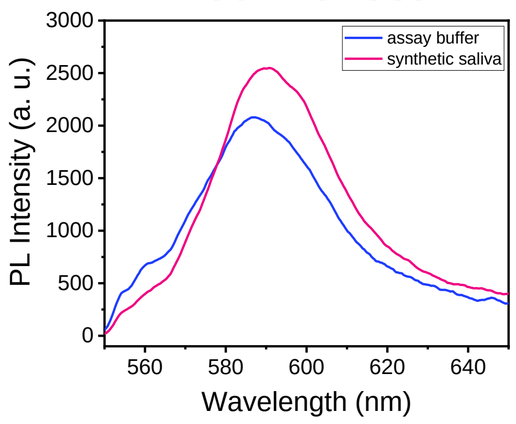
3-step assay configuration



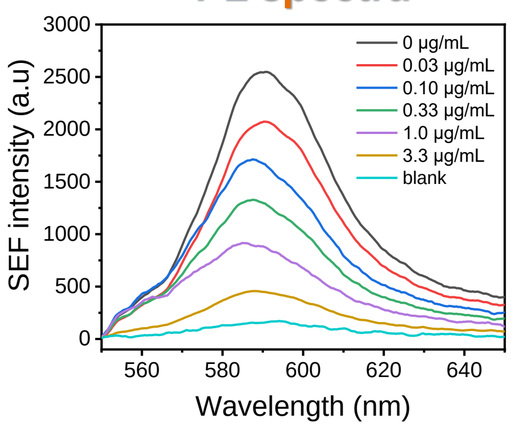
	2-step	3-step
Detection limit	0.16 µg/mL	0.015 µg/mL
Dynamic range	0.33-10 µg/mL	0.03-2.3 µg/mL
Inter-CV	8.7-12 %	7.5-10.5 %
Intra-CV	10-15 %	9.7-12.6 %
Time	285 min	180 min

The 3-step assay configuration exhibited 10 times higher detection sensitivity and the assay duration was significantly reduced (100 min less), compared to the 2-step assay configuration.

Matrix effect



PL spectra



The presence of synthetic saliva caused an 25 % increase in absolute PL intensity values without affecting the detection sensitivity.

CONCLUSION

- ✓ A 3-step competitive immunoassay was developed for SOD determination with 10 times higher sensitivity compared to the 2-step assay configuration
- ✓ The presence of synthetic saliva had a beneficial effect in PL intensity values as compared to measurements performed in assay buffer.

FUTURE WORK / REFERENCES

[1] Pizzino G., et al., Oxidat. Med. Cell. Longev. 2017 (2017), 8416763.
[2] L.A. MacMillan-Crow, D.L. Cruthirds, Free Radic. Res. 34 (2001) 325–336.
[3] Y. Jeong, et al., Biosens. Bioelectron. 111 (2018) 102-116.