A Novel Biosensing Platform using RAFT Polymer-Based Molecular Templating

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Abstract

This poster presents a synthetic polymer receptor-based biosensing platform. Reversible addition-fragmentation chain transfer (RAFT) technique has been used to synthesize the templated polymer receptor. Vinyl ferrocene (VF) was included to the polymer chain as a redox tag. Brush like templated polymers are immobilized on gold electrode surface for sensing target analyte. As the targets bind to the polymer receptor, the polymer experiences conformational change which can be interpreted by means of electrochemical methods.

Introduction

- Synthetic approach to mimic natural recognition entities
- Templated polymer shows high selectivity & affinity for target molecule
- Low synthesis cost and the storage life of the polymers can be very high

Approach

Polymer composition

N-isopropylacrylamide(NIPAM)	74%
Methacrylic acid (MAA)	10%
4-Vinylpyridine(4-VP)	14%
Vinyl ferrocene(VF)	2%
Molar ratio: 4-Nitrophenol (4-NP) : Monomers	1 : 100

Electrochemical Sensing Method

Electrical Impedance Spectroscopy (EIS) and Differential Pulse Voltammetry (DPV)

- Biologic potentiostat
- Working Electrode(WE): Gold Electrode, ID = 3mm

Sensing Components:

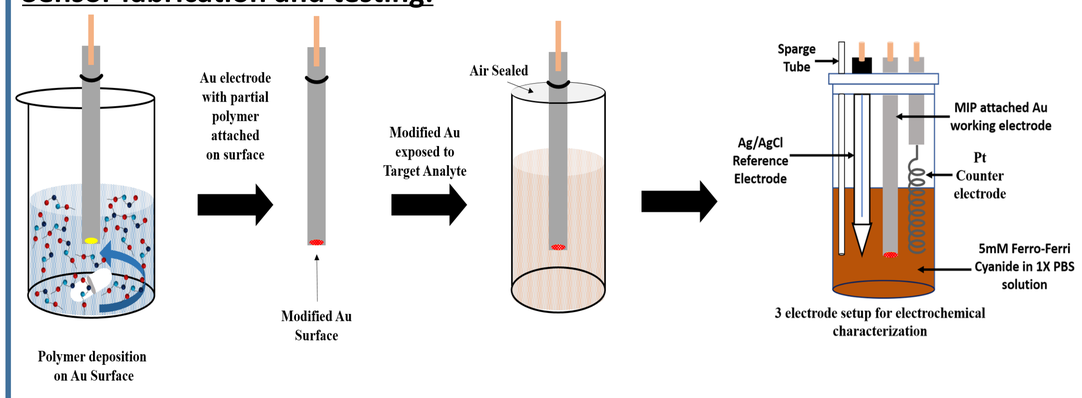
The **working electrode** is the electrode in an electrochemical system on which the reaction of interest is occurring.

The **counter electrode** (also known as auxiliary electrode), is an electrode which is used to close the current circuit in the electrochemical cell.

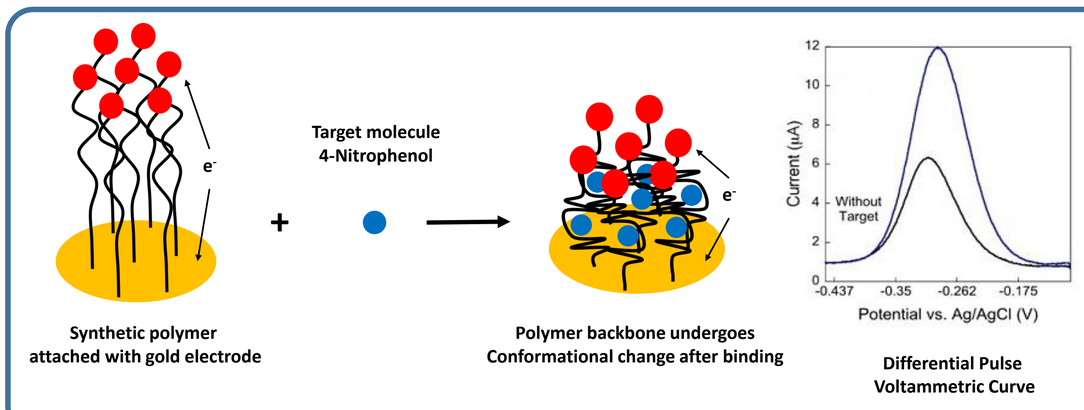
A **reference electrode** is an electrode which has a stable and well-known electrode potential. The stability of the electrode potential is usually reached by employing a redox system with constant concentrations of each participant of the redox reaction.

Biologic VSP Potentiostat

Sensor fabrication and testing:



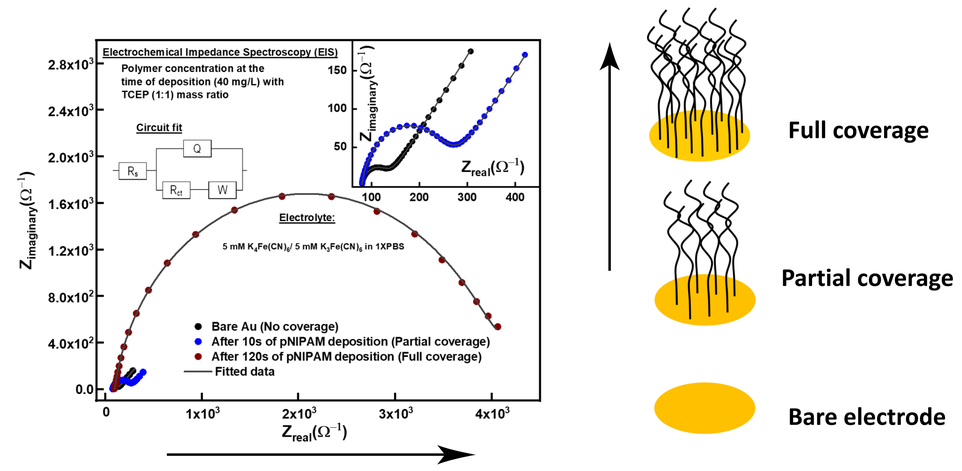
Electrochemical Sensing Hypothesis



Results and Discussion

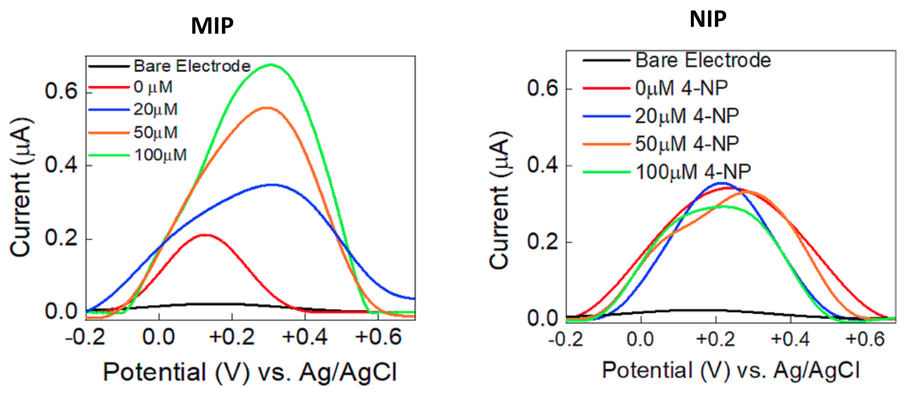
Polymer deposition on gold electrode

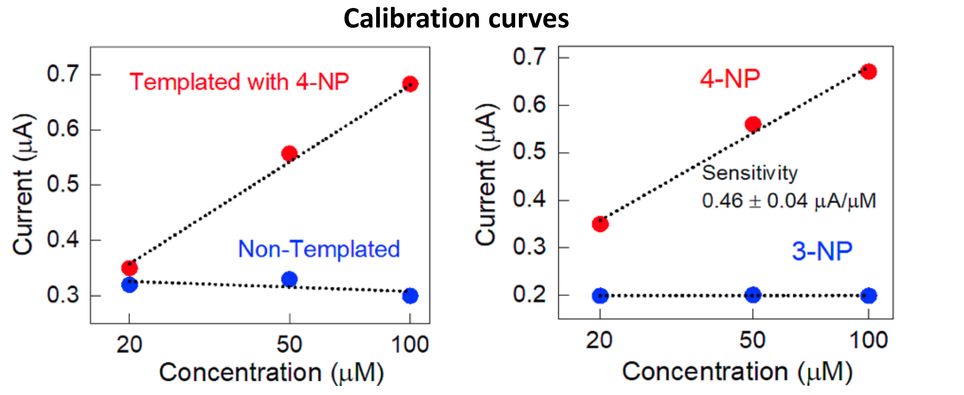
The impedance is gradually increased with the incubation time, indicating successful attachment of the polymer on the gold surface.



Detection performance of MIP and NIP

The charge transfer is promoted in the templated polymer due to the collapsing of the polymer upon target recognition. NIP, on the other hand, shows negligible response to the 4-NP, indicating no significant conformational change for the polymers.





- MIP exhibits higher affinity toward 4-NP compared with the NIP.
- The selectivity of molecular templating is demonstrated by comparing with 3-nitrophenol (3-NP).

Conclusions

A novel sensing platform using templated polymer is successfully implemented. 4-NP templated polymer undergoes a conformation change during specific target recognition. Furthermore, the sensing platform shows a potential to be used in other applications such as neurotransmitter detection and drug delivery monitoring.

Acknowledgement

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References

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