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Al Atraktchi, Fatima Al-Zahraa; Molin, Søren; Johansen, Helle Krogh; Svendsen, Winnie Edith

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EARLY DETECTION OF CHRONIC BACTERIAL INFECTIONS BY MICROSENSORS

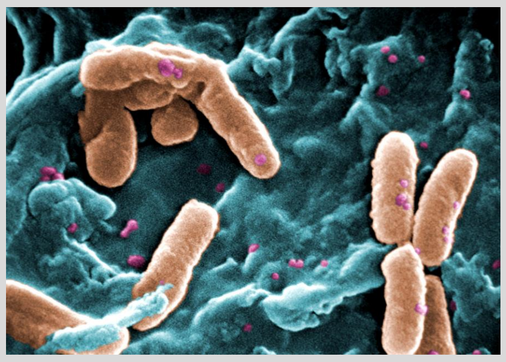
Fatima AlZahra'a Alatraktchi[1,2,3], Søren Molin[2,3], Helle Krogh Johansen[3,4], Winnie E. Svendsen[1]

[1] Department of Micro- and Nanotechnology - Technical University of Denmark
[2] Department of Systems Biology - Technical University of Denmark
[3] Novo Nordisk Foundation Center for Biosustainability - Technical University of Denmark
[4] Cystisk Fibrose Klinikken & Klinisk Mikrobiologisk Afdeling - Rigshospitalet

1 Motivation

The bacterial pathogen *Pseudomonas aeruginosa* is involved in many dangerous infections. A precise and early diagnosis of an infection is essential for successful eradication treatment. Thus, there is need for fast and sensitive methods, which can be used in the clinic to diagnose bacterial infections in patients.

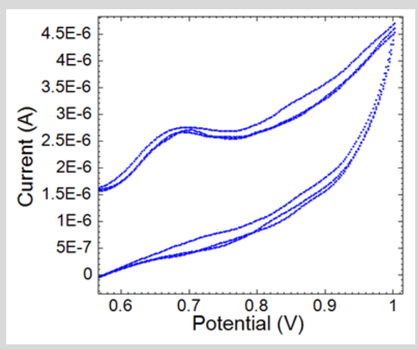
The redox-active pyocyanin is produced by *P. aeruginosa* prior to virulence activity. Monitoring of pyocyanin as an infection biomarker could consequently enable early detection of bacterial infections. This study has shown that electrochemical sensors can detect pyocyanin levels in the nanomolar range, which will enable early diagnosis of the bacteria before chronic establishment.



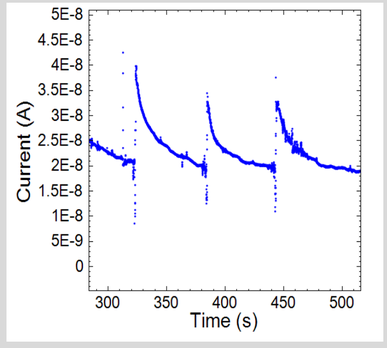
P. aeruginosa produce pyocyanin prior to virulent activity. *Ref: Free stock*

2 Concept

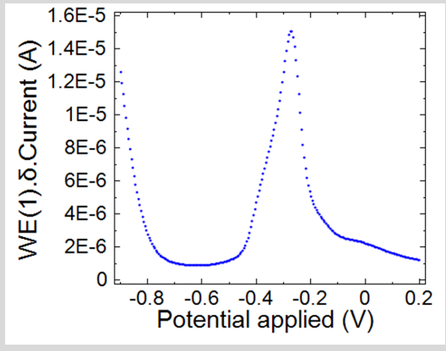
Micro-Electro-Mechanical Systems (MEMS) is a technology with devices ranging from micrometer to several millimeter scale. Commercial electrochemical microsensors were used to detect pyocyanin by cyclic voltammetry, chronoamperometry and square wave voltammetry using a three-electrode configuration.



Cyclic voltammetry of pyocyanin



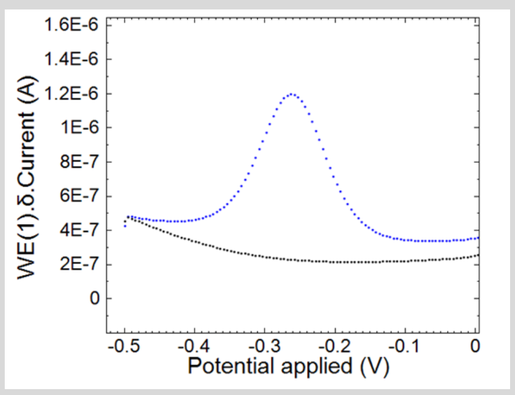
Chronoamperometry of pyocyanin



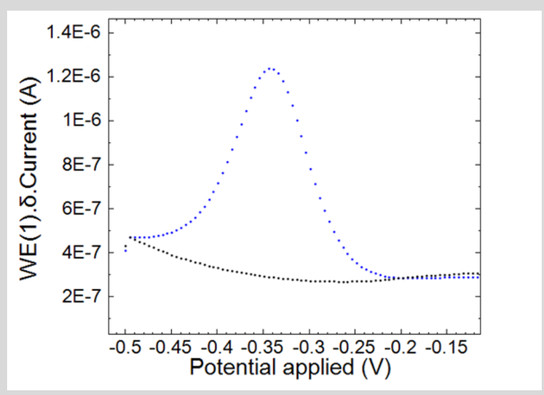
Square Wave Voltammetry of pyocyanin

3 Status

It is a goal to directly detect pyocyanin in sputum samples from patients to diagnose the stage of infection. Identification of pyocyanin in clinacally relevant media like lysogeny broth (LB) used for bacterial culturing is essential. Detection and quantification of pyocyanin has been conducted in both LB and Artificial Sputum (ASM) using square wave voltammetry.



Square Wave Voltammogram of pyocyanin in LB medium (blue) compared to pure LB medium (black)

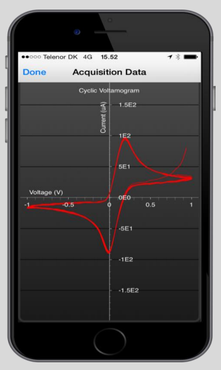


Square Wave Voltammogram of pyocyanin in ASM (blue) compared to pure ASM (black)

4 Impact

This study is expected to reveal valuable information regarding the progress of an infection. The technique will assist medical doctors in designing individual antibiotic treatment plans for each specific situation. An enhanced antibiotic treatment strategy could contribute to a longer lifetime of patients.

Pyocyanin is expected to be detected as a label-free biomarker for *P. aeruginosa* in point-of-care systems in the clinic or for home use to monitor the condition of the patients.



Mobile application to display measurements of pyocyanin. *Ref: Francois Patou, DTU*