

Electronic Supplementary Information

Electrochemical Deposition of Polypeptides: Bio-based Covering Materials for Surface Design†

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Table of Contents

1. FT-IR spectra of T-Pala and PT-Pala (Fig. S1)	S2
2. Characterization and electrochemical behavior of PT-Pala (Fig. S2–S5)	S3-S4
3. Evaluation of antimicrobial activity (Table S1 and Fig. S6)	S5-S7
4. ¹H NMR of 3-(aminomethyl)thiophene (1c) (Fig. S7)	S8
5. ¹H NMR of L-Ala-<i>N</i>-(phenyloxycarbonyl) amino acid (Fig.S8)	S8
6. ¹H NMR of T-Pala (Fig.S9)	S8
4. References for Supplementary Information	S9

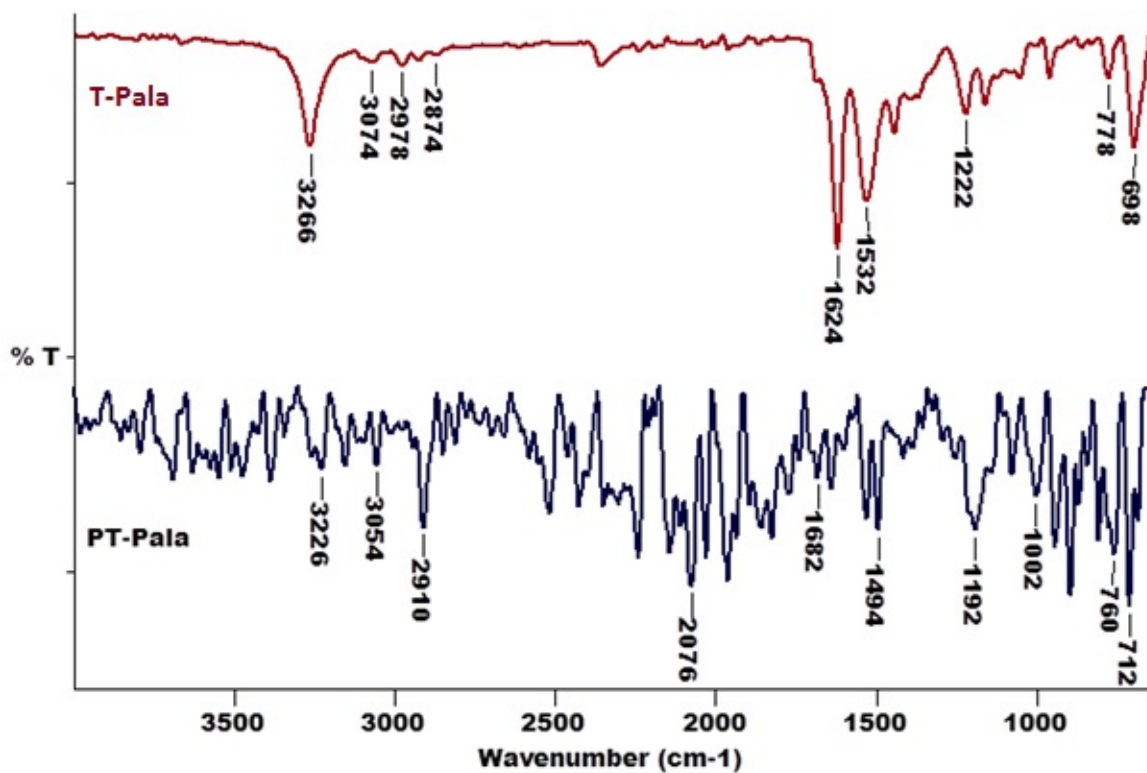
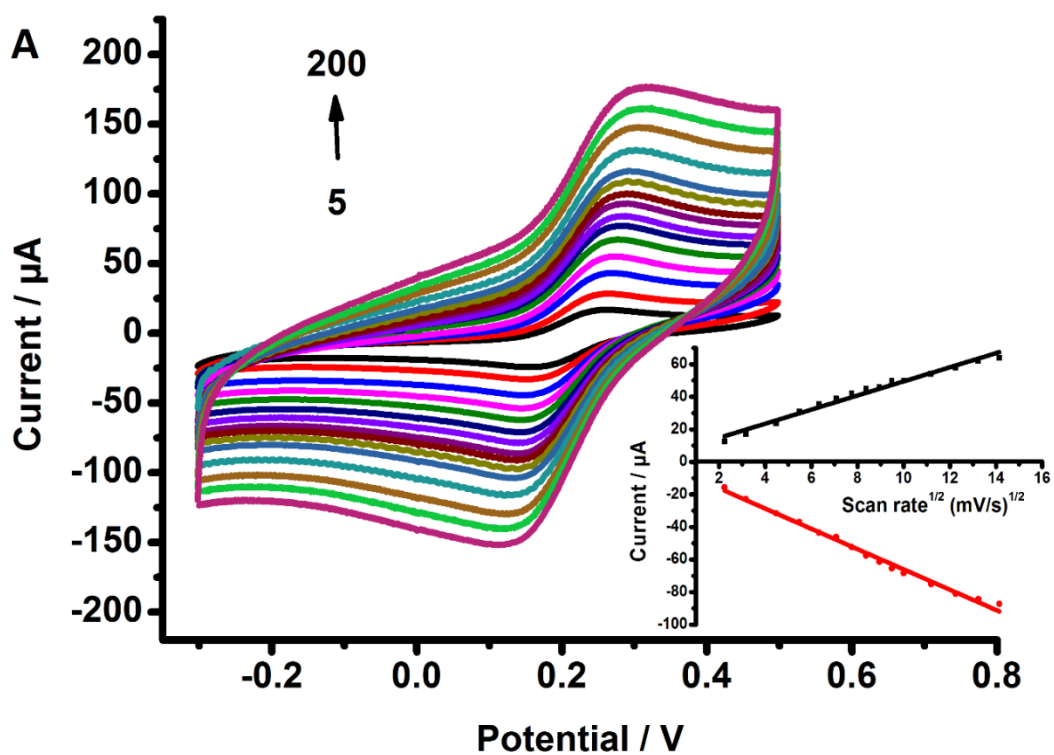


Fig. S1 FT-IR spectra of T-Pala and PT-Pala.



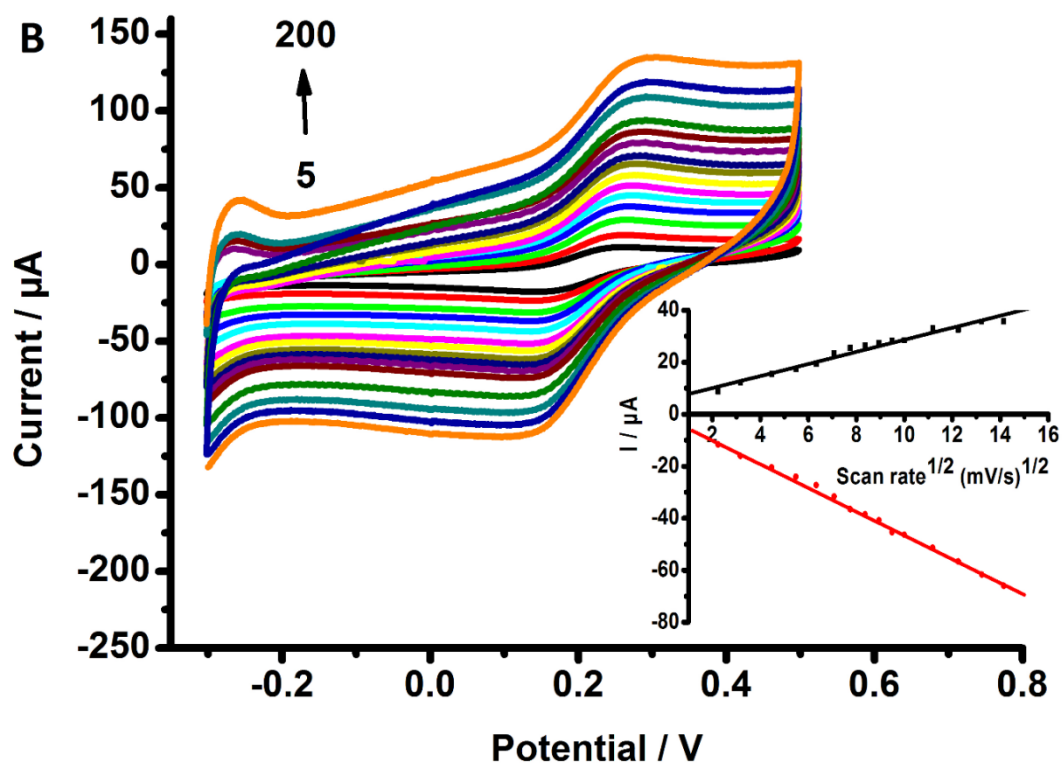


Fig. S2 Cyclic voltammograms of prepared electrodes. (A) CVs of PT-Pala modified and (B) PT-Pala/GOx modified electrodes at the different scan rates, Inset: The correlation between the current and square root of the scan rate.

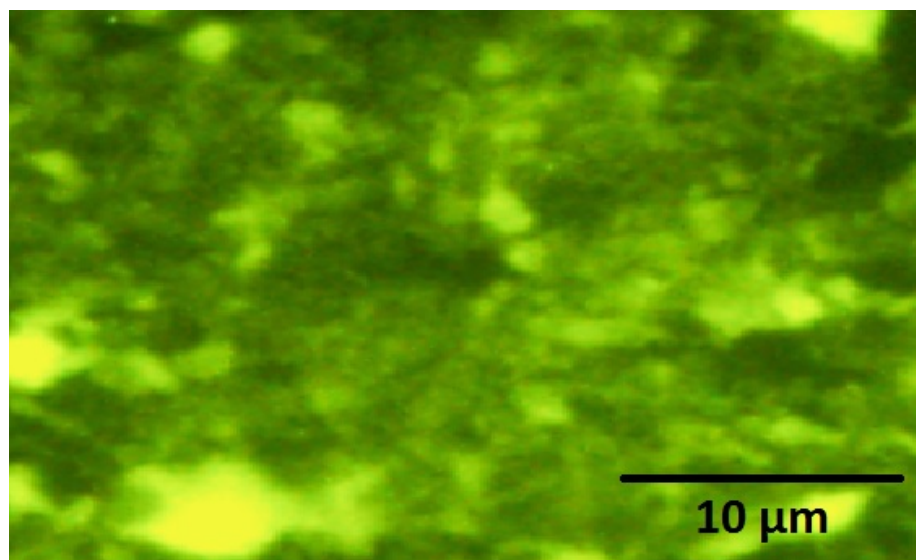


Fig. S3 Fluorescence microscope image of PT-Pala coated electrode.

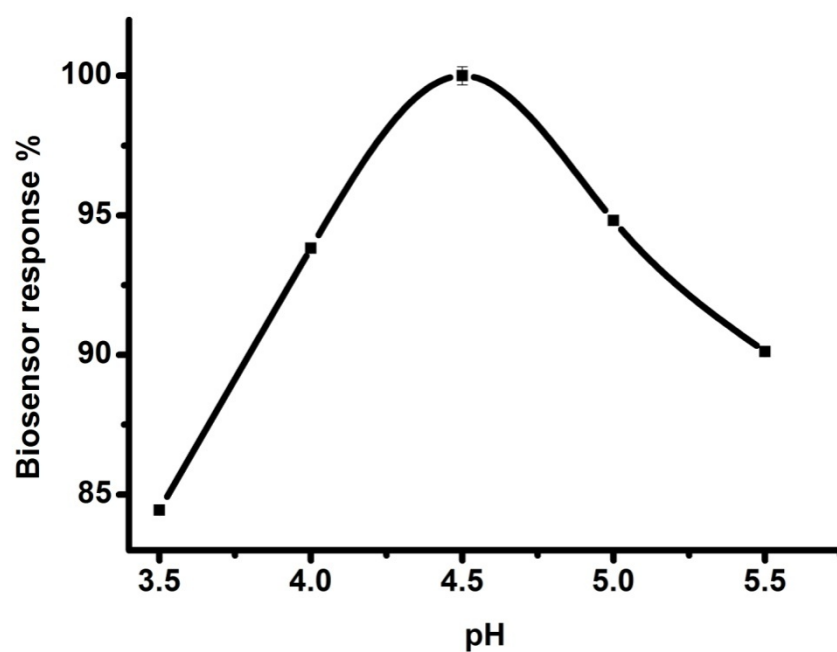


Fig. S4 The effect of pH. (in 50 mM sodium acetate, at pH 3.5-5.5, 25 °C, -0.7 V). Error bars show standard deviation.

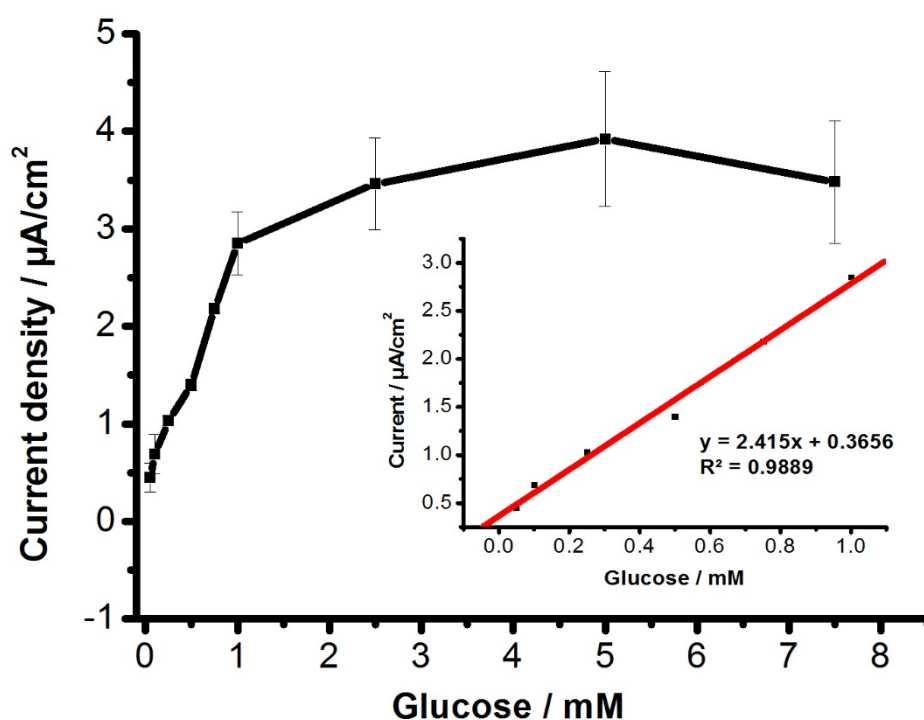


Fig. S5 Calibration curve for glucose. PT-Pala/GOx biosensor constructed without glutaraldehyde in 50 mM sodium acetate, pH 4.5, 25 °C, -0.7 V. Error bars show the standard deviation of three measurements (the inset shows the linear range).

Evaluation of Antimicrobial Activity

Method: T-Pala and electropolymer of T-Pala (PT-Pala) that were successfully coated on the surface of graphite electrode were evaluated for *in vitro* antibacterial activity against Gram-positive *Staphylococcus aureus* ATCC 25923 and Gram-negative *Escherichia coli* ATCC 25922 (strains belonging to the American Type Culture Collection, LGC Standarts GmbH, Wesel, Germany). Antimicrobial activity was investigated according to the recommendation of the National Committee for Clinical Laboratory Standards (NCCLS) by using disk diffusion method.¹ It was performed on Nutrient Agar (NA, Oxoid) plates. Plates were dried at approximately 36 °C for about 30 min in an incubator before inoculation. Three to five freshly grown colonies of bacterial strains were inoculated into 25 mL of Nutrient Broth (NB, Oxoid) medium in a rotary shaker at 200 rpm for 4 to 6 h until a turbidity of 0.5 McFarland (1×10^8 CFU/mL) was reached. Final inocula were adjusted to 5×10^5 CFU/mL using a spectrophotometer. 50 μL of inoculum from the final inocula was applied to each of agar

plates and were uniformly spread with a sterilized cotton spreader over the surface. Absorption of excess moisture was allowed to occur for 30 min before application of sterile filter-paper discs (6 mm in diameter, Oxoid, England,). The paper discs were impregnated with 15 μ L of the T-Pala sample solutions in dimethylsulphoxide (DMSO) which include 5.0 mg per 1.0 mL of DMSO (solution was filter-sterilized using a 0.45 μ m membrane filter) and electropolymer of PT-Pala coated graphite disc (3 mm diameter) were applied to the agar surface. These plates were incubated at 37 °C for 24 h. At the end of the incubation time, the diameters of the inhibition zones were measured in millimeters using an inhibition zone ruler. Standard antibiotic discs (all from Oxoid) of ofloxacin (OFX, 5 μ g/disc), amoxicillin/clavulanic acid (2:1) (AMC, 30 μ g/disc), imipenem (IMP, 10 μ g/disc), erythromycin (E, 15 μ g/disc) were individually evaluated as positive controls, while the disc imbued with 15 μ L of pure DMSO and graphite discs were accepted as negative control.

Antimicrobial Activity: The antimicrobial activities of the T-Pala and its electropolymer (PT-Pala) were also studied to identify the surface properties using a disc diffusion assay recommended by NCCLS against two test microorganisms. Table S1 shows the results of the antibacterial activities of the standard antibiotics against tested microorganisms. The DMSO (15 μ L) and graphite disc negative control showed no inhibiting effect. All microorganisms were evaluated as susceptible for treated standard antibiotics.

T-Pala did not showed any activity against Gram-negative *E. coli* ATCC 25922 and Gram-positive *S. aureus* ATCC 25923 at the studied concentration in this work. Although the antimicrobial activity of graphite coated with PT-Pala did not showed antimicrobial activities against *E. coli* ATCC 25922, whereas surprisingly exhibited moderate antimicrobial activity was observed against *S. aureus* ATCC 25923. Our data revealed that standard ATCC strains of Gram-positive bacteria were more sensitive than Gram-negative ones towards PT-Pala. From this point of view, it could be conclude that the mechanism of the antimicrobial effects involves the inhibition of various cellular processes, followed by an increase in plasma membrane permeability and finally ion leakage from the cells.²

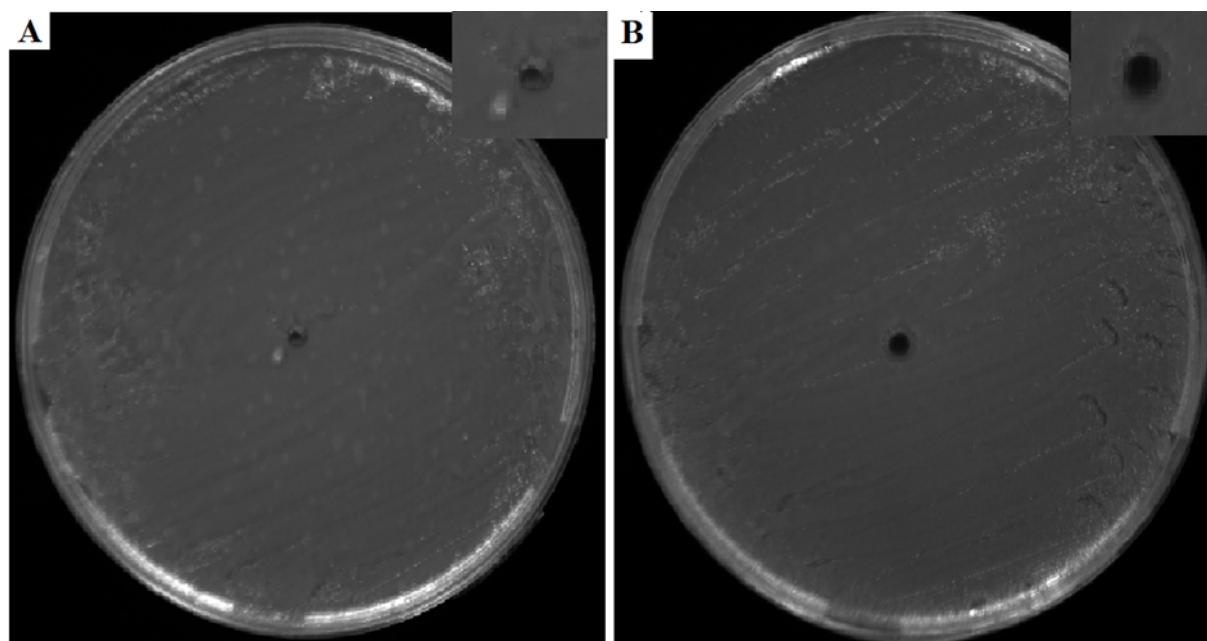
The results denoted that PT-Pala showed moderate antibacterial activity versus Gram-positive bacteria. Graphite covered with PT-Pala also exhibited significant antibacterial activity against Gram-positive *S. aureus* ATCC 25923. PT-Pala indicated 7.0 mm inhibition zones against *S. aureus* ATCC 25923 (Fig. S6).

Table S1 Antimicrobial activities of T-Pala, PT-Pala and standard antibiotics

Tested microorganisms	Zones of inhibition (mm)					
	Tested materials		Standard antibiotics			
	T-Pala (75) ^a	PT-Pala ^b	OFX (5) ^a	AMC (30) ^a	IPM (10) ^a	E (15) ^a
<i>Escherichia coli</i> ATCC 25922	–	–	26	16	20	10
<i>Staphylococcus aureus</i> ATCC 25923	–	7	22	30	>30	20

OFX: ofloxacin; AMC: amoxicillin/clavulanic acid (2:1); IPM: imipenem; E: erythromycin; (–) not active.

a) $\mu\text{g}/6.0$ mm paper disc; b) graphite disc coated with electropolymer of PT-Pala (3.0 mm diameter).

**Fig. S6.** Antimicrobial activity of PT-Pala against *S. aureus* ATCC 25923 (A) graphite disc (B) graphite disc coated with PT-Pala.

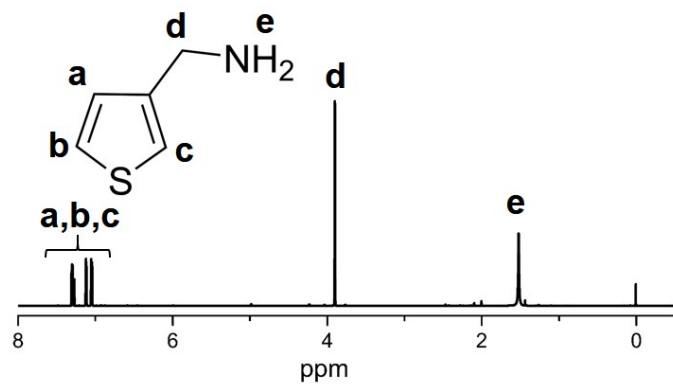


Fig.S7. ^1H NMR of 3-(aminomethyl)thiophene (1c).

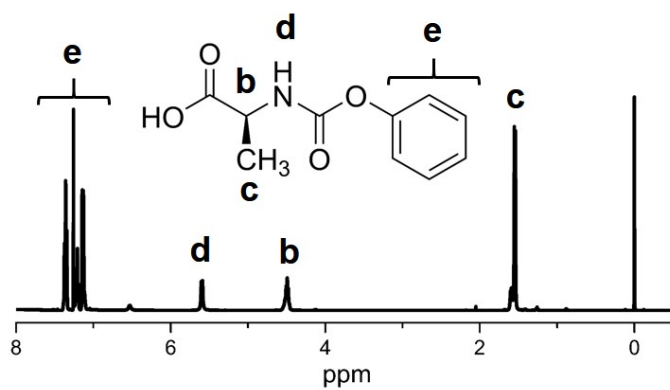


Fig.S8. ^1H NMR of L-Ala-N-(phenyloxycarbonyl) amino acid.

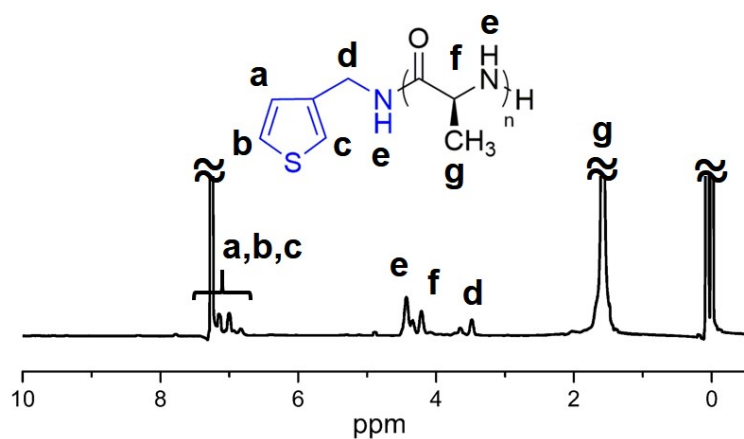


Fig.S9. ¹H NMR of T-Pala;

References for Supplementary Information

- 1 C. L. Clark, M. R. Jacobs and P. C. Appelbaum, *J. Clin. Microbiol.* 1998, **36**, 3579.
- 2 S. E. Walsh, J. Y. Maillard, A. D. Russell, C. E. Catrenich, D. L. Charbonneau and R. G. Bartolo, *J. Appl. Microbiol.* 2003, **94**, 240.