Bukti Korespondensi AIP-JCC-1920

- Judul : Imprinted Zeolite Modified Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood Glucose
- Penulis : Miratul Khasanah*, Alfa Akustia Widati, Usreg Sri Handajani, Masfah Raudlotus Shofiyyah, Sabrina Aulia Rakhma, Herwin Predianto
- Prosiding : AIP Conference Proceedings 2237, 020011 (2020)



[PCC] Journal Registration

Teguh Endah Saraswati <jurnal@mail.uns.ac.id> To: Miratul Khasanah <miratul-k@fst.unair.ac.id>

The following message is being delivered on behalf of proceeding of

The following message is being delivered on behalf of proceeding chemistry conferences.

Miratul Khasanah

Here as scientific committee of 14th JCC, we inform that the article submitted to JCC with AIP preference will be processed by this PCC Open Journal System.

You have now been registered as a user with Proceeding of Chemistry Conferences. We have included your username and password in this email, which are needed for all work with this journal through its website. At any point, you can ask to be removed from the journal's list of users by contacting me.

Username: mkhasanah Password: 123456

Thank you, Teguh Endah Saraswati Fitria Rahmawati Chief Editor

Proceeding of Chemistry Conferences https://jurnal.uns.ac.id/index.php/pcc

Tue, Oct 29, 2019 at 12:28 PM



[PCC] Submission Acknowledgement

Teguh Endah Saraswati <jurnal@mail.uns.ac.id> To: Miratul Khasanah <miratul-k@fst.unair.ac.id>

The following message is being delivered on behalf of proceeding of chemistry conferences.

Miratul Khasanah:

Thank you for submitting the manuscript, "Imprinted Zeolite Modified Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood Glucose" to Proceeding of Chemistry Conferences. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Manuscript URL: https://jurnal.uns.ac.id/pcc/author/submission/35258 Username: mkhasanah

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

Teguh Endah Saraswati Proceeding of Chemistry Conferences

Proceeding of Chemistry Conferences https://jurnal.uns.ac.id/index.php/pcc

Tue, Oct 29, 2019 at 12:32 PM

Imprinted Zeolite Modified Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood Glucose

Miratul Khasanah^a, Alfa Akustia Widati^b, Usreg Sri Handajani^c, Masfah Raudlotus Shofiyyah^d, Sabrina Aulia Rakhma^e, Herwin Predianto^f

Chemistry Department, Faculty of Sciences and Technology, Airlangga University Kampus C Unair, Mulyorejo, Surabaya, 60115, Indonesia

> ^{a)}Corresponding author: <u>miratul-k@fst.unair.ac.id</u> ^{b)}alfaakustia@fst.unair.ac.id ^{c)}usreg-s-h@fst.unair.ac.id ^{d)}masfahrs@gmail.com ^{e)}sabrinaaulia63@gmail.com ^{f)}herwinpredianto@yahoo.com

Abstract. Imprinted zeolite modified carbon paste electrode as a potentiometric sensor for glucose analysis in blood serum sample has been developed. Zeolite used in this study was TS-1 synthetic zeolite. Imprinted zeolite (IZ) was synthesized with mole ratio of glucose/Si of 0.0306. The modified electrode prepared by mixing activated carbon, imprinted zeolite, and paraffin granule with mass ratio 9:4:7 produced measurement range of $10^{-5} - 10^{-2}$ M, Nernst factor of 28.6 mV/decade, and the detection limit of 4.79 x 10^{-5} M. The electrode was able to respond to glucose molecules in solution quickly (<30 s), stable for more than 9 weeks (130 times usage) and selective to glucose molecules. The urea, uric acid, and creatine with various concentrations did not interfere to glucose analysis by potentiometry using the electrode. Applying of the electrode for glucose analysis in spiked blood serum samples showed recovery of 91.73±3.48% (n=5), while its accuracy against spectrophotometry method as commonly used method in medical field was 90.58±4.65% (n=5). Based on its performance, potentiometry using the imprinted zeolite modified carbon paste electrode is recommended as an alternative method for routine blood glucose analysis in the medical field.

INTRODUCTION

Carbon paste electrodes are the type of carbon electrode most widely used in electrochemical studies because of its inertness, low manufacturing costs, and suitability for various applications [1]. Carbon paste electrodes are easily renewed, porous, easy to miniaturized [2] and the response is fast [3]. Carbon paste electrodes can chemically modified to improve their performance in detecting samples at very small levels by mixing the modifier as one of the electrodes (bulk modified) or by coating the surface of the electrode with a thin film of the modifier (surface modified).

Among inorganic materials, zeolite has been widely used to modify carbon electrodes to form zeolite modified electrode (ZME) due to its unique porosity size, selectivity, high ion exchange ability, high thermal stability, adsorption capacity and resistance to extreme conditions [4]. The carbon-based electrodes include glassy carbon electrodes, graphite electrodes, diamond electrodes modified with boron-doped (BDE), screen printed electrodes, polymer [5] and zeolites modified electrode (ZME) [6,7] have been widely developed.

Zeolites are crystalline aluminosilicates which have pores in molecular dimensions, unique micro pore structure, catalytic activity and good hydrothermal stability [8]. Titanium silicate-1 (TS-1) is a zeolite with MF-1 structure, usually used for selective oxidation reactions under mild conditions using hydrogen peroxide as an oxidant [9]. TS-1 type zeolites are superior types of zeolites due to nanoscale pores [10], excellent adsorption properties [11] and photocatalytic activity. The inherent activity of Ti atoms in TS-1 is higher than photocatalytic TiO₂.

Modified electrodes as sensors for electrometry analysis of organic or inorganic compound have been developed including zeolite modified electrodes for the analysis of uric acid [12], Cr^{3+} ions [2], creatinine [7], creatine [13]; and polymer-based electrodes for phenol analysis [14]. Nanoparticle material has also been used to increase the selectivity and sensitivity of electrodes [15].

In this study, an imprinted zeolite modified carbon paste electrode has been developed to the detection of glucose in blood serum. Need to develop methods of glucose detection in the blood because diabetes mellitus has become a threat to human health in the world. World Health Organization (WHO) predicts an increase in the number of people with diabetes mellitus in Indonesia from 8.4 million in 2000 to around 21.3 million in 2030. Increasing the blood glucose levels (> 200 mg/dL or equivalent to 2×10^{-2} M) is a major cause of diabetes mellitus. In the body, normal blood glucose levels are 60-100 mg/dL ($3.3 \times 10^{-3} - 5.5 \times 10^{-3}$ M) while serum glucose is 70-110 mg/dL ($3.88 \times 10^{-3} - 6.1 \times 10^{-3}$ M) [16]. Determination of blood glucose levels in the medical field is generally done using a spectrophotometer or glucometer. Spectrophotometers use venous blood sample, while glucometers use capillary blood sample [17].

The electrodes were fabricated from a paste made by mixturing activated carbon, paraffin granule and imprinted zeolite with varying compositions. Zeolites were synthesized by the mole ratio of TEOS, TBOT, TPAOH, H_2O namely 1:0.017:0.24:21.2 [18]. The parameters studied in this study were the optimization of the ratio of activated carbon, paraffin and IZ as electrodes material and the optimum pH of glucose solution. Electrode performance was expressed from the measurement range (linear dynamic range), Nernst factor value, detection limit, selectivity, accuracy, response time and electrode life time (stability). Furthermore the sensor was applied for the analysis of glucose levels in blood serum samples and compared with the spectrophotometric method as a commonly method used in the medical field.

EXPERIMENTAL SECTION

Materials

The chemicals used in this study were glucose (Sigma Aldrich, 99.5%), creatine (Sigma Aldrich 98%), urea (Sigma Aldrich, 99.5%), and uric acid (Fluka, 99%), tetraethyl orthosilicate (Merck, 99%), tetra butyl ortho titanate (TBOT; *Merck*, 98%), tetra propyl ammonium hydroxide (TPAH; *Merck*, 40%), isopropanol (Merck, 98%), paraffin granule (Merck, 99%). Creatine and urea solution were prepared using distilled water, while the 10^{-2} M uric acid solution was prepared by dissolving uric acid powder in 1: 1 NaOH (w/w). Acetate buffer was prepared from glacial acetic acid (Merck 100%) and sodium acetate trihydrate (Merck, 99.5%) while phosphate buffers are prepared from sodium dihydrogen phosphate dihydrate (Merck, 98.5%) and sodium hydrogen phosphate dihydrate (Merck, 99%) in distilled water. Carbon powder was chemically activated by immersing it in 0.01M H₃PO₄ and n-hexane, respectively. Furthermore, the carbon powder was heated at a temperature of 300 °C for 2 hours [19]. Ag wire was used as connector of carbon paste and potentiometer.

Instrumentation

The equipments used in this study were a Cyberscan 510 potentiometers with Ag/AgCl as reference electrode, fourier transform infrared (FTIR) spectrophotometer (Shimadzu), X-ray diffraction (Shimadzu), Gas Sorption Quantachrome ASIQwin, Analytical balance Mettler AE 200, hotplateTermolyne S46410-2, pH meter Cyberscan Eutech instruments pH 510, HITTECH EBA 20 centrifuge, Vacuum Oven Model 5851, magnetic stirrer, polypropylene bottle, agate mortar, 1000 µL micropipet tip and glassware commonly used in laboratories.

Procedure

Synthesis and characterization of zeolite

Synthesis of zeolite TS-1 was carried out by mixing TEOS, TBOT and TPAOH according to the procedure developed previously [18]. Amount of 5.0 mL of isopropanol was mixed with 0.2361 g of TBOT in a polypropylene bottle. Then 9.0 mL of TEOS was added dropwise and stirred for 30 minutes at room temperature. Then was added dropwised with 4.8 g TPAOH and stirred for 15 hours. Next 12.2 mL of water was added to the mixture. Furthermore, the mixture formed is heated hydrothermally at 80°C for 4 days. As much as ¹/₃ of the mixture was

neutralized by washing using distilled water, then it was dried at 80°C. As much as ²/₃ part of the mixture was added by 0.2205 g of glucose in 1 mL of distilled water. Then the mixture is allowed to stand for 3 hours. As much as $\frac{1}{2}$ part of this mixture was dried (NIZ) and the other was extracted using hot water (80 °C) by centrifugation and oven it until dry (IZ).

Fabrication of carbon paste-imprinted zeolite electrode

Fabrication of carbon paste-IZ electrodes was initiated by filling 3/4 of the micropipette tip with melting paraffin. Silver wire (Ag) used as a connector between the electrodes and the potentiometer was first inserted into the micropipette tip. The remaining part of the micropipette tip was filled with a paste made from mixture of solid paraffin, carbon, and IZ (the composition in Table 1). The electrode surface was rubbed using HVS paper, and immersed in a 10⁻³ M glucose solution for 24 hours for conditioning.

Electrode code	Composition (% weight)						
Electrode code	Activated carbon	IZ	Paraffin				
E1	65	0	35				
E2	60	5	35				
E3	58	7	35				
E4	55	10	35				
E5	50	15	35				
E6	45	20	35				
E7	40	25	35				

TABLE 1. The composition of activated carbon, IZ, and paraffin in the fabrication of carbon paste-IZ electrodes

Determination of Electrode Performance

The carbon paste-IZ electrode was used to measure the glucose solution 10⁻⁸-10⁻² M and determined its performance including the measurement range, the Nernst factor, the limit of detection, precision, accuracy, response time and life time. Electrode selectivity -expressed by the coefficient of selectivity ($K_{i,i}^{pot}$) was studied by applying the electrodes to measure a series of standard solutions of urea, uric acid, and creatine (compounds that coexist with glucose in serum samples) and calculated using matched potential methods (MPM). The potential obtained is substituted into the linear regression equation of standard glucose. K_{i,i}^{pot} values are calculated using equation 1 [20].

$$(\mathbf{K}_{i,j}^{\text{pot}} = \frac{\Delta \mathbf{a}_i}{\mathbf{a}_j}) \tag{1}$$

Where Δa_i is the concentration obtained by substitute the potential in interferent solution on the regression equation of the glucose solution, while a_i is the measured interferent concentration.

Furthermore, electrodes were applied to measure glucose levels in blood serum samples and compared with the results of the analysis using spectrophotometric methods as a commonly used method for the determination of blood glucose levels in the medical field. The influence of other components in the serum sample on the determination of glucose levels was tested with recovery values. Recovery (R) is determined by measuring the potential of standard glucose solution $10^{-3}M$ (C₁), diluted serum samples (C₂), and diluted serum samples containing standard glucose 10^{-3} M (C₃) by spiking technique. The potential obtained is then substituted into the linear regression equation of standard glucose. The recovery value is calculated using equation 2. D^{C1-C2} 100 0/ (2)

$$R = \frac{1}{C_3} \times 100 \%$$

RESULT AND DISCUSSION

Synthesis and Characterization of Zeolite

Synthesis of zeolite TS-1 was carried out from tetraethyl orthosilicate (TEOS) as a source of silica, tetrabutyl orthotitanate (TBOT) as a titania source, tertrapropylammonium hydroxide (TPAOH) as a mold structural director and provide the alkaline conditions needed for hydrolysis reactions, and water as a solvent. Glucose molecules are trapped in the zeolite pores and it is thought that the formation of hydrogen bonds between –OH functional groups on the glucose molecules with Ti-O-Si on zeolites. The hydrothermal process is intended to form a zeolite framework so that the size of the zeolite pores will conform to the size of the glucose molecule. Glucose was then extracted from the zeolite framework using hot water so that the side bonding is expected to be selective to glucose. An illustration of the synthesis process is shown in **Figure 1**.



FIGURE 1. Illustration of the bonding process between zeolite and glucose

Based on the XRD pattern of **Figure 2** (a), the formation of TS-1 zeolite was marked by the peak at 2θ of 7.95°; 8.83°; 23.14°; 23.25°; 23.72°; and 23.94°. The crystalline peaks are the mobile five I (MFI) framework structures. The MFI framework structure on the TS-1 zeolite was compared with the standard ZSM-5 pattern taken from the Collection of Simulated XRD Powder Patterns for the Zeolites, International Zeolite Association [21] which has an MFI framework structure. The standard structural pattern shows the peaks at 2θ 7.95°; 8.83°; 23.18°; 23.23°; 23.74°; and 23.99°.



FIGURE 2. (a) The XRD pattern of zeolite TS-1 (ZSM-5, inset) and (b) FTIR spectra of glucose, zeolite, NIZ, and IZ

Figure 2(b) shows the typical spectra of zeolite TS-1, namely the band at wave numbers around 451, 545, 796, 1100, and 1220 cm⁻¹. The peaks at the wave numbers 451 and 1220 cm⁻¹ indicate Si-O-Si asymmetry stretching vibrations. The peak at wave number 796 shows the stretching vibration of the Si-O-Si symmetry. The MFI structure in zeolites is shown by bands at wave numbers 451, 545 and 1222 cm⁻¹. At wave numbers 545 and 451 cm⁻¹ are the peaks that indicate rocking vibrations [22]; 1099 cm⁻¹ is the asymmetric stretching vibrations of Si-O-Ti and at 1600 cm⁻¹ is the peak of the bend -OH vibrations of Si-OH, Ti-OH, TPAOH, and H₂O [23].

Optimization of research parameter

Carbon paste-IZ electrodes are prepared from a mixture of activated carbon powder, paraffin granule and IZ powder. The activated carbon used has a surface area of 984.330 m^2/g . The pore size of the carbon is 3.835 nm, this shows that the carbon is mesoporous in size [24]). IZ serves to increase the electrode selectivity to glucose.

In accordance with the composition in **Table 1**, the electrodes showed the optimum performance, namely E6 which was fabricated with a mass ratio of carbon, paraffin and IZ of 9:7:4. The indicator used to determine the electrode performance is the Nernst factor value which approaches the theoretical value (59.2/n mV) [25]. The E6 showed a Nernst factor of 24.83 mV/decade. **Table 2** shows Nernst factor and measurement range of electrode and linearity of the calibration curve of glucose solution.

TABLE 2. Data of electrode measuring range, Nernst factor, and linearity of calibration curve of glucose solution at pH 7

Electrode	Linear dynamic range (M)	Nernst Factor (mV/decade)	Linearity (r)
E1	10-5-10-2	21.11	0.998
E2	10-5-10-2	16.57	0.865
E3	10-5-10-2	17.28	0.858
E4	10-5-10-2	22.21	0.947
E5	10-5-10-2	21.65	0.919
E6	10-5-10-2	24.83	0.986
E7	10-5-10-2	23.71	0.957

In this study, the pH optimization of the solution was carried out to determine the effect of acid and base conditions on the measurement of glucose solution. In an alkaline media, glucose is present as an open chain carboxylic ion whereas in an acidic media glucose turns into lactone. The pH optimization was carried out by measuring the potential of a 10^{-8} - 10^{-2} M glucose solution with a pH of 5, 6, 7, and 8 using the E6 electrode (**Figure 3**). The measurement of glucose solution using E6 at a pH 7 produced the Nernst factor of 28.6 mV/decade. The value most close to the theoretical value. Glucose is a divalent molecule, so that theoretically it will produce a Nernst factor of 29.6 mV/decade [26].



FIGURE 3. Plot electrode potential and log[Glucose] at varying pH

In order to know the effect of the mold on the performance of the IZ modified electrodes, zeolite (EZ) and NIZ (ENIZ) modified electrodes with the same composition as the E6 electrodes were fabricated and applied to measure glucose standard solution. Data of the electrodes potential the E1, E6, EZ, and ENIZ on measurements of standard glucose solutions and the Nernst factor are shown in **Table 3**.

[Clussea] (M)	Potential (mV) of the electrode						
	E1	E6	ENIZ	EZ			
10-5	102.5	793	976	977			
10-4	103.8	833	985	988			
10-3	127.7	852	1083	935			
10-2	146.5	882	1035	1028			
Nernst factor (mV/decade)	15.6	28.6	27.5	10.0			

TABLE 3 Data of electrode potential and Nernst factor using E1, E6, EZ, and ENIZ

Performance of the electrode and method validity

The results of glucose analysis using E6 at pH 7 provide a measurement range of 10^{-5} - 10^{-2} M with a Nernst factor value of 28.6 m/ decade and a response time of 8.9-21.5 s. The response time of E6 is faster than that of non-enzymatic sensor based on the poly (o-phenylenediamine) [27] and previously developed imprinted zeolite-based electrode [7].

The electrode detection limit is the lowest or highest concentration that can be responded by electrode. The detection limit is determined from the intersection of linear curve with non-linear curve on the plot of log [glucose] and electrode potential. In this study, the linear equation obtained is y = 18.6x + 940.1 and the nonlinear equation is $y = 14.66x^2 + 172x + 12866$. From the both equations obtained the lower detection limit is $4.79x10^{-5}$ M. The value of the measurement range and detection limit explains that the potentiometric method using imprinted zeolite modified carbon paste electrodes in this study can be used for glucose analysis with a normal concentration to glucose concentrations of diabetics [16].

In this study, precision is expressed by the coefficient of variation (CV). At concentrations of 10^{-5} - 10^{-2} M, the CV value is 0.92%-4.89%. The CV value is better than the limit set by AOAC [28].

Electrode selectivity tests are carried out through the application of electrodes for measurement of urea, uric acid, and creatine solutions. Electrode selectivity is expressed by the coefficient of selectivity ($K_{i,j}^{pot}$) which is calculated using matched potential methods (MPM). The coefficient of selectivity value in **Table 4** shows that zeolite modified electrodes have a higher selectivity to glucose (i) than uric acid, urea and creatine (j).

Solution	Concentration (M)	$\mathbf{K}_{\mathrm{i},\mathrm{j}}^{\mathrm{pot}}$			
Solution	Concentration (M)	Bare carbon paste	Carbon paste-IZ		
	10-5	0.96	2.35x10 ⁻⁶		
Unio opid	10-4	0.99	4.04x10 ⁻⁶		
Une acid	10-3	1.12	4.67x10 ⁻⁶		
	10-2	1.31	4.75x10 ⁻⁶		
	10-5	1.39	9.77x10 ⁻⁷		
Linco	10-4	2.14	2.37x10 ⁻⁷		
Ulea	10-3	2.29	1.24x10 ⁻⁶		
	10-2	2.45	1.46x10 ⁻⁶		
	10-5	1.18	6.49x10 ⁻⁷		
Creating	10-4	1.23	7.87x10 ⁻⁷		
Creatine	10-3	1.34	1.08x10 ⁻⁶		
	10-2	1.39	1.24×10^{-6}		

TABLE 4. Selectivity coefficient (K_{i,j}^{pot}) of electrode on uric acid, urea and creatine solution

Accuracy test is used to determine whether the potentiometric using developed electrode is as good as spectrophotometric, the commonly used method for determining blood glucose levels in the medical field, while the recovery test is intended to see whether there is interference caused by the sample matrices. The accuracy value obtained from the analysis of five blood samples in this study was $90.58\pm4.65\%$ (**Table 5**). This value is slightly lower than the accuracy range accepted for an analysis method according to the Association of Official Analytical Chemist (AOAC) [28]. Recovery of potentiometric methods using carbon paste-IZ electrodes was (91.73 ± 3.48)% (n=5). This value satisfies the criteria of a chemical analysis method according to AOAC [28]. Based on the recovery value and accuracy, it is suspected that there are several components in blood samples that have the

potential to interfere with glucose analysis such as fructose, sucrose, maltose [29] and ions (Na⁺, Cl⁻, K⁺, PO₄³⁻, SO_4^{2-} , NH_4^+) [30].

Samula	Glucose	concentration (M)	Accaracy	Recovery
Sample	Potentiometry Spectrophotometry		(%)	(%)
Glucose 10 ⁻³ M	9.28x10 ⁻⁴	-	-	-
Serum sample 1	4.86x10 ⁻³	5.62x10 ⁻³	86.53	-
Serum sample 1 + Glucose 10 ⁻³ M	5.71x10 ⁻³	-	-	91.59
Serum sample 2	4.94x10 ⁻³	5.44x10 ⁻³	90.79	-
Serum sample2 + Glucose 10 ⁻³ M	5.84x10 ⁻³	-	-	96.98
Serum sample 3	4.63x10 ⁻³	4.76x10 ⁻³	97.27	-
Serum sample 3 + Glucose 10 ⁻³ M	5.44x10 ⁻³	-	-	87.28
Serum sample 4	9.07x10 ⁻³	9.81x10 ⁻³	92.40	
Serum sample 4 + Glucose 10 ⁻³ M	9.92 x10 ⁻³			92.10
Serum sample 5	10.57x10 ⁻³	12.40x10 ⁻³	85.90	
Serum sample 5 + Glucose 10 ⁻³ M	11.41x10 ⁻³			90.70

TABLE 5. Data accuracy and recovery potentiometry method to analyse blood glucose

Electrode life time is investigated to know the stability of the electrodes. The life time of electrodes depends on the mechanical properties of an electrode material. This mechanical property is influenced by the flexibility of the material, the pH and the level of solubility of the material. Imprinted zeolite modified carbon paste electrodes still show a good performance up to 9 weeks (130 times usage). This life time is longer than the electrodes developed previously [7,13].

CONCLUSION

Imprinted zeolite modified carbon paste electrode show a wide measurement range, low detection limit, fast response time and long life time. The developed electrode recognizes selectively the presence of glucose compared to urea, uric acid and creatine in solution. Comparison of potentiometry with spectrophotometry as a commonly used method for blood glucose analysis in medical field shows an accuracy of $90.58\pm4.65\%$ (n=5). Based on the electrode performance, potentiometry using the carbon paste-IZ electrode is recommended as an alternative method for routine analysis of blood glucose in the medical field.

ACKNOWLEDGEMENT

The authors thank to the Ministry of Research, Technology and Higher Education, Indonesia for the financial support of this study through PDUPT Grant No. 713/UN3.14/LT/2019 Universitas Airlangga and the Chemistry Department Universitas Airlangga for the laboratory facilities provided.

REFERENCES

- 1. G.G. Mohamed, T.A. Ali, M.F. El-Shahat, M.A. Migahed, and A.M. Al-Sabagh, Drug Test. Anal. 4,1009–1013 (2012).
- 2. Z. Heidari and M. Masrournia 2018. J.Anal. Chem. 78(8), 824–831 (2018)
- 3. T.A. Ali, G.G. Mohamed, and G.A. Yahya, Iran. J. of Pharm. Res. 16 (2), 498–512 (2017)
- 4. I. Svancara, A. Walcarius, K. Kalcher, K. Vytras, Cent. Eur. J. Chem. 7, 598-656 (2009)
- 5. D.M. Kim, J.M. Moon, W.C. Lee, J.H. Yoon, C.S. Choi, and Y.B. Shim, Biosens. Bioelectron. **91**, 276–283 (2017)

- 6. L.M. Muresan, Pure App. Chem. 83(2), 325–343 (2011)
- 7. M. Khasanah, U.S. Handajani, A.A. Widati, A. Abdulloh, and R.R. Rindarti, Anal. Bioanal. Electrochem. **10(4)**, 429–438 (2018)
- 8. Q. Wu, H. Wang, and C. Yi., J. Photochem. Photobiol. A: Chemistry 356, 138–149 (2018)
- 9. D. Serrano, S. Rau'l, P. Patricia, and M. Ine's, 2009, RSC Adv. 11, 1407–1409 (2009)
- 10. A. Wroblewska, E. Makuch, and P. Miadlicki, Catal. Today 268, 121–129 (2016)
- 11. P. Yuan, D. Liu, W.B. Yu, M.W. Laipan, L.L. Deng, and F.R. Chen, J. Colloid Interface Sci. 462, 191–199 (2016)
- 12. M. Khasanah, M. Harsini, A.A. Widati, Indones. J. Chem. 13(2), 108-113 (2013)
- A. Athiroh, T. Fadillah, D.F. Damayanti, A. Abdulloh, A.A. Widati, and M. Khasanah, Carbon Paste Electrode Modified Imprinted Zeolite as a Selective Sensor for Creatine Analysis by Potentiometry, IOP Proceeding Conference series: Earth and Environmental 217(1), (2019)
- 14. S. Rahmadhani, H. Setiyanto, and M.A. Zulfikar, Mater. Sci. Forum 936, 71-76 (2018)
- 15. L.C. Jiang and W.D. Zhang, Biosens. Bioelectron. 25, 1402–1407 (2010)
- J.L. Kee, E.R. Hayes, and L.E. McCuistion, A Patient Centered Nursing Process Approach, Ed 8, Elsevier Inc., Saunders (2015)
- 17. K. Tonyushkina and J.H. Nichols, J. Diabetes Sci. Technol. 4(3), 971–980 (2009)
- G.A. Eimer, I. Diaz, E. Sastre, G.S. Casuscelli, M.E. Crivello, E.R. Herrero, and J.P. Pariente, Appl. Catal. A Gen. 343, 77–86 (2008)
- 19. C. Qin, Y. Chen, J.M. Gao, Mater. 135, 123-126 (2014)
- 20. K. Tohda, D. Dragoe, M. Shibata, and Y. Umezawa, Anal. Sci. 17, 733-743 (2001)
- 21. M.M.J. Treacy, J.B. and Higgins, Collection of Simulated XRD Powder Patterns for Zeolites, Published on behalf of the Structure Commision of the International Zeolite Association (2001)
- 22. W. Nuni, E. Ratna, E., F. Hamzah and D. Prasetyoko, Makara Sains 15(2), 135-147 (2011)
- 23. C.A. Rios, C.D. Wiliams, and M.A. Fulen, Appl. Clay Sci. 42, 446–454 (2009)
- 24. T. Ariyanto, I. Prasetyo, I., and Rochmadi, Jurnal Penelitian 14(1), 25-32 (2012)
- 25. D.A. Skoog, D.M. West, F.J. Holer, and S.R. Crouch, Fundamental of Analytical Chemistry, 9th Edition Brooke/Cole, Cengange Learning Inc. (2014)
- 26. S. Park, H. Boo, and T.D. Chung, Anal. Chim. Acta 556(1), 46–57 (2006)
- 27. J. Wang, M. Wang, J. Guan, C. Wang, and G. Wang, Mat. Sci. Eng. C 71, 844-851 (2016)
- 28. I. Taverniers, M.D. Loose, and E.V. Bockstaele, Trends Anal. Chem. 23, 535-552 (2004)
- 29. Z. Amani-Beni, and A. Nezamzadeh-Ejhieh, J. Colloid Interface Sci. 504, 186-196 (2017)
- 30. J.E. Hall, Textbook of Medical Phisiology Ed 13. Elsevier Inc., Philadelphia (2016)



miratul khasanah <miratul-k@fst.unair.ac.id>

[AIP] Email Clarification

F Rahmawati <fitria@mipa.uns.ac.id>

To: miratul khasanah <miratul-k@fst.unair.ac.id>

Tue, Dec 17, 2019 at 12:12 PM

Waalaikumsalam,

Benar status artikel saudara adalah Copyediting. Artikel tsb saat ini msh dalam proses layouting dan proof reading.



Email telah dikirimkan pada 13 Desember 2019, dg record sbb:

	Siakad	Lunsac.id	x M Re: [AP] Email Clarification - fitri x 🚾 #35258 Review x +	· · · ×
50	$\leftarrow \ \rightarrow$	X 🔒 jurnal.uns.ac.i	d/pcc/editor/submissionReview/35258	🖈 🎱 E
RAHI	🚺 Apps	Editor/Author Correspo	ndence - Google Chrome — 🗌 🗙 Title suggestion for 🚱 Send Email	
6		iurnal.uns.ac.id/pcc	z/editor/viewEditorDecisionComments/35258#11332	- K. (1) - 1
- 13	- C .	Editor 2019-12-13 03:36 PM	Subject: IPCC1IAIP1Editor Decision - Acceptance AIP Publication The following message is being delivered on behalf of proceeding of chemistry conferences.	
Ľ			Dear Miratul Khasanah:	
Ne	Trans		We have reached a decision regarding your submission to AIP Proceeding, "Imprinted	1557
	26.8		Zeolite Modified Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood	Sama E
e			Glucose".	
Rang			Our decision is to: Accept Submission	
٦			Later, we will send your article proof.	36 -
	146		Dr Fitria Rahmawati	
Com			Chemistry Department 19-12-13	
6	133		Sebelas Maret University	
	0.04		Indonesia,	636
	Constant 1		fitria@mipa.uns.ac.id	Carlos Carlos
Rea	27.5		Fitria Rahmawati	Steel a
Col	2000 M		Chief Editor	- 1000 - California -
	pdf2		Proceeding of Chemistry Conferences	Show all X
	, Р тур	pe here to search	🛱 🤮 📻 🚳 🧑	12:11 PM 12/17/2019

salam, Fitria Rahmawati scientific committee === Dr. Fitria Rahmawati Research Group of Solid State Chemistry & Catalysis Chemistry Department Sebelas Maret University JI,Ir. Sutami 36 A Kentingan Surakarta 57126 email: fitria@mipa.uns.ac.id http://www.researchgate.net/profile/Fitria_Rahmawati/publications/ Chief Editor Alchemy:https://jurnal.uns.ac.id/index.php?journal=alchemy ORCID ID 0000-0002-3145-9063 Scopus ID 36053591500

[Quoted text hidden]



[PCC] [AIP] Proofreading Request (Author)

Teguh Endah Saraswati <jurnal@mail.uns.ac.id> Reply-To: Dr Fitria Rahmawati <fitria@mipa.uns.ac.id> To: Miratul Khasanah <miratul-k@fst.unair.ac.id>

The following message is being delivered on behalf of proceeding of chemistry conferences.

Miratul Khasanah:

Your submission "Imprinted Zeolite Modified Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood Glucose" to Proceeding of Chemistry Conferences now needs to be proofread by following these steps.

- 1. Click on the Submission URL below.
- 2. Log into the journal and view PROOFING INSTRUCTIONS
- 3. Click on VIEW PROOF in Layout and proof the galley in the one or more formats used.
- 4. Enter corrections (typographical and format) in Proofreading Corrections.
- 5. Save and email corrections to Layout Editor and Proofreader.
- 6. Send the COMPLETE email to the editor.

The proofreading itself is due December 21th 2019.

Submission URL: https://jurnal.uns.ac.id/pcc/author/submissionEditing/35258 Username: mkhasanah

Scientific Committee The 14th Joint Conference on Chemistry UNIVERSITAS SEBELAS MARET

Proceeding of Chemistry Conferences https://jurnal.uns.ac.id/index.php/pcc Fri, Dec 20, 2019 at 7:41 PM

CHANGE-TO

1. CHANGE

Zeolite used in this study was TS-1 synthetic zeolite.

In this study, the type of used zeolite was TS-1.

2. CHANGE

The electrode was able to respond to glucose molecules ... TO

The electrode was able to respond the glucose molecules ...

3. CHANGE

In this study, an imprinted zeolite modified carbon paste electrode has been developed to the detection ...

TO

. . .

In this study, an imprinted zeolite modified carbon paste electrode has been developed to detect

4. CHANGE

Need to develop methods of glucose detection in the blood because diabetes mellitus has become a threat to human health in the world.

ТО

The development of glucose detection method still interesting to be studied because the glucose level act as indicator a diabetes mellitus disease. As we know, diabetes mellitus has become a threat to human health in the world.

5. CHANGE

... and TPAOH according to the procedure developed previously.

- TO ... and TPAOH according to the previous research.
- 6. CHANGE

Then 9.0 mL of TEOS was added dropwise and stirred for 30 minutes at room temperature. Then was added dropwised with 4.8 g TPAOH and stirred for 15 hours.

TO

A 9.0 mL of TEOS was added dropwise and stirred for 30 minutes at room temperature; 4.8 g TPAOH was added dropwised and stirred for 15 hours.

7. CHANGE

Next 12.2 mL of water ...

TO Finally, 12.2 mL of water...

Finally, 12.2 mL of wa

8. CHANGE

 \dots by centrifugation and oven it until dry (IZ).

TO

... by centrifugation and dried. The dried powder was named imprinting zeolite (IZ)

9. CHANGE

... (TPAOH) as a mold structural director and ...

TO

... (TPAOH) as a structure directing agent and ...

10. CHANGE

Based on the XRD pattern of **Figure 2** (**a**), the formation of TS-1 zeolite was marked by the peak at 2θ of 7.95°; 8.83°; 23.14°; 23.25°; 23.72°; and 23.94°.

ТО

Based on the XRD pattern of **Figure 2** (a), the formation of TS-1 zeolite was marked by the peak at 2θ of 7.95; 8.83; 23.14; 23.25; 23.72; and 23.94°.

11. CHANGE

The crystalline peaks are the mobile five I (MFI) framework structures.

TO

The diffractogram was corresponded to the MFI structures.

12. CHANGE

... International Zeolite Association [21] which has an MFI framework structure. TO

10

... International Zeolite Association [21] which also has an MFI framework structure.

13. CHANGE

The standard structural pattern shows the peaks at 207.95° ; 8.83° ; 23.18° ; 23.23° ; 23.74° ; and 23.99° .

ТО

- (none)
- 14. CHANGE

Figure 2(b) shows the typical spectra of zeolite TS-1, namely the band at wave numbers around 451, 545, 796, 1100, and 1220 cm⁻¹.

ТО

Figure 2(b) showed the typical spectra of zeolite TS-1, namely the band at wavenumbers around 451, 545, 796, 1100, and 1220 cm⁻¹.

15. CHANGE

The peaks at the wave numbers 451 and 1220 cm⁻¹ indicate Si-O-Si asymmetry stretching vibrations.

ТО

The peaks at 451 and 1220 cm⁻¹ indicated Si-O-Si asymmetry stretching vibrations.

16. CHANGE

The peak at wave number 796 shows the stretching vibration of the Si-O-Si symmetry. TO

The stretching vibration of the Si-O-Si symmetry was confirmed by characteristic band at 796 cm⁻¹.

17. CHANGE

The MFI structure in zeolites is shown by bands at wave numbers 451, 545 and 1222 cm⁻¹. TO

The MFI structure in zeolites were revealed at 451, 545 and 1222 cm⁻¹.

18. CHANGE

At wave numbers 545 and 451 cm⁻¹ are the peaks that indicate rocking vibrations [22]; 1099 cm⁻¹ is the asymmetric stretching vibrations of Si-O-Ti and at 1600 cm⁻¹ is the peak of the bend -OH vibrations of Si-OH, Ti-OH, TPAOH, and H₂O [23].

ТО

The characteristic bands at 545 and 451 cm⁻¹ were corresponded to the rocking vibrations [22]. The absorption band at 1099 cm⁻¹ were the asymmetric stretching vibrations of Si-O-Ti and the band at 1600 cm⁻¹ was the peak of the –OH vibrations from Si-OH, Ti-OH, TPAOH, and H₂O [23].

19. CHANGE

Carbon paste-IZ electrodes are prepared from ...

ТО

Carbon paste-IZ electrodes were prepared from ...

20. CHANGE

The activated carbon used has a surface area of 984.330 m²/g. TO

The activated carbon used had a surface area of $984.330 \text{ m}^2/\text{g}$.

21. CHANGE

The pore size of the carbon is 3.835 nm, this shows that the carbon is mesoporous in size [24]. TO The pore size of the carbon was 3.835 nm, this shows that the carbon was classified as mesoporous material [24]. 22. CHANGE **Table 2** shows Nernst factor and ... то
 Table 2 presented the Nernst factor and ...
 23. CHANGE ... and the Nernst factor are shown in Table 3. TO ... and the Nernst factor were shown in **Table 3**. 24. CHANGE The results of glucose analysis using E6 at pH 7 provide ... TO The results of glucose analysis using E6 at pH 7 provided ... 25. CHANGE The response time of E6 is faster than ... TO The response time of E6 was faster than 26. CHANGE ...the poly (o-phenylenediamine) [27] and previously developed imprinted zeolite-based electrode TO ... the poly (o-phenylenediamine) [27] and previous research of imprinted zeolite-based electrode 27. CHANGE ... the linear equation obtained is y = 18.6x + 940.1 and ... TO ... the linear equation obtained was y = 18.6x + 940.1 and ... 28. CHANGE ... the lower detection limit is 4.79×10^{-5} M. TO ... the lower detection limit was 4.79×10^{-5} M. 29. CHANGE ... and detection limit explains that ... TO ... and detection limit explained that ... 30. CHANGE At concentrations of 10⁻⁵-10⁻² M, the CV value is ... TO At concentrations of 10^{-5} - 10^{-2} M, the CV values were ... 31. CHANGE The CV value is better than ... TO The CV value was better than ... 32. CHANGE ... in **Table 4** shows that zeolite modified electrodes have a higher selectivity to glucose ... TO in **Table 4** showed that zeolite modified electrodes had a higher selectivity to glucose ... 33. CHANGE This value is slightly lower than ...

ТО

This value was slightly lower than ...

34. CHANGE

Recovery of potentiometric methods using carbon paste-IZ electrodes was $(91.73 \pm 3.48)\%$ (n=5). TO

The recovery of potentiometric methods using carbon paste-IZ electrodes was $91.73 \pm 3.48\%$ (n=5).

35. CHANGE

This value satisfies the criteria of ... TO

This value fulfilled the criteria of ...

36. CHANGE

Based on the recovery value and accuracy, it is suspected that ...

TO

Based on the recovery value and accuracy, it was assumed that ...

37. CHANGE

Accaracy (**Table 5, column 4**) TO

Accuracy

38. CHANGE

Imprinted zeolite modified carbon paste electrodes still show a good performance ... TO

Imprinted zeolite modified carbon paste electrodes presented a good performance ...

39. CHANGE

This life time is longer than the electrodes developed previously [7,13].

ТО

This life time was longer than the previous research [7,13].



miratul khasanah <miratul-k@fst.unair.ac.id>

The 14th Joint Conference on Chemistry 2019 - Complete your submission MS ID: AIPCP20-AR-JCC2019-00011

aipcp-edoffice@aip.org <aipcp-edoffice@aip.org> Reply-To: aipcp-edoffice@aip.org To: miratul-k@fst.unair.ac.id Tue, Feb 18, 2020 at 11:25 PM

Dear Dr. Khasanah,

Thank you for your contribution to the proceedings of The 14th Joint Conference on Chemistry 2019. The file that you have submitted to your conference organizer has been uploaded into the AIP Publishing Conference Proceedings submission site, and there are a few steps you need to take in order to complete the submission process and move your manuscript into production for publication. Please read this letter carefully and follow the instructions to complete your submission.

Your manuscript file has already been uploaded into the system. Click the following link to complete your submission:

https://aipcp.peerx-press.org/cgi-bin/main.plex?el=A5Cu4DJY3A3IcEu6J4A9ftdXWmkdRkCTTEhYrnOQ7WwY

The above link will take you to your Main Screen on the AIP Publishing Conference Proceedings submission site. Please note that you need to agree to AIP Publishing's Terms and Conditions in order to gain access to the site. If you are not able to agree to the Terms and Conditions, please contact your conference organizer. When you enter the site, please complete the following tasks:

- 1. Click on the "Modify Profile/Change Password" link under the "General Tasks" heading to verify and update your account information.
- 2. Return to your Main Screen. Click on your manuscript ID number (AIPCP20-AR-JCC2019-00011) under the "Author Tasks" heading. This will take you to the manuscript details screen where you will find a link to view your file. Scroll down to see the link for the task you need to complete (identified by a red arrow) labeled "Complete Partial Submission."
- 3. Click the "Complete Partial Submission" link and follow the on-screen instructions. You need to provide a response for anything marked with a red * in order to submit your manuscript.

PLEASE NOTE:

- You need to add the information for all co-authors listed in your manuscript. You need to also confirm that all listed authors are aware of and agree to the submission.
- You need to complete the electronic Copyright License Agreement form.
- 4. When you have correctly entered all the required information and completed the necessary forms, complete your submission by clicking "Submit MS."

If you experience any problems during the submission of your manuscript, click the "Help/Feedback" link at the top of the page, and someone will contact you to provide assistance. When you have successfully completed your manuscript submission, you will receive confirmation by email. You may be contacted by AIP Publishing during the production process if we identify any problems with your forms or submission.

Thank you again for your contribution to the proceedings of The 14th Joint Conference on Chemistry 2019.

Sincerely,

AIP Conference Proceedings

Editorial Office

AIP Publishing 1305 Walt Whitman Road Suite 300 Melville, NY 11747-4300 USA

E-mail: aipcp-edoffice@aip.org

This email message and any files transmitted with it contain confidential information. If you are not the intended recipient please notify the sender, delete this email and any attachments from your system, and destroy any copies you have made, electronic or otherwise.



miratul khasanah <miratul-k@fst.unair.ac.id>

AIPCP: Receipt of Manuscript MS #AIPCP20-AR-JCC2019-00011

aipcp-edoffice@aip.org <aipcp-edoffice@aip.org> Reply-To: aipcp-edoffice@aip.org To: miratul-k@fst.unair.ac.id Wed, Feb 19, 2020 at 10:03 AM

Dear Dr. Khasanah,

Your manuscript has been successfully submitted to the proceedings of The 14th Joint Conference on Chemistry 2019. This message is being sent to you as one of the authors of the following conference proceedings manuscript:

MS ID: AIPCP20-AR-JCC2019-00011

Title: "Imprinted Zeolite Modified Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood Glucose"

All co-authors are included on this message in order to provide notification of this submission. The order of the authors in your submitted manuscript is as follows: Miratul Khasanah, Alfa Widati, Usreg Handajani, Masfah Shofiyyah, Sabrina Rakhma, and Herwin Predianto.

Please note that if this order is changed or if there are any deletions or additions of authors, each author needs to provide approval for this change.

Your manuscript is being processed by the editorial office. You will receive another email soon if modifications are needed to your submission.

Open Researcher and Contributor Identifier (ORCID):

Our records show that your account in our journal's peer review system is not currently associated with an ORCID ID. Please use the link below to either register for a new ORCID ID or, if you already have one, to login into the ORCID system and retrieve it. Your account in the journal's peer review system will then be associated with your ORCID ID, helping to correctly identify you.

https://aipcp.peerx-press.org/cgi-bin/main.plex?el=A5Cu6GeEO3A5IcEu1Bh4B9ftdL6nFwwkEYfcYS336SbblAwY

The Open Researcher and Contributor Identifier (ORCID) connects research and researchers. ORCID provides a registry of unique identifiers that is open, non-proprietary, transparent, mobile, and community-based. To help the scientific community, we encourage all authors and reviewers to create and link an ORCID identifier to their account. For more information about ORCID, please visit http://orcid.org/content/about-orcid.

Thank you again for your contribution to the proceedings of The 14th Joint Conference on Chemistry 2019.

Sincerely,

AIP Conference Proceedings

Editorial Office

5/23/23, 10:19 AM

Airlangga University Mail - AIPCP: Receipt of Manuscript MS #AIPCP20-AR-JCC2019-00011

AIP Publishing 1305 Walt Whitman Road Suite 300 Melville, NY 11747-4300 USA

E-mail: aipcp-edoffice@aip.org

This email message and any files transmitted with it contain confidential information. If you are not the intended recipient please notify the sender, delete this email and any attachments from your system, and destroy any copies you have made, electronic or otherwise.



miratul khasanah <miratul-k@fst.unair.ac.id>

AIPCP: MS AIPCP20-AR-JCC2019-00011 ECopyright License Agreement Form -- AIP Publishing LLC

aipcp-edoffice@aip.org <aipcp-edoffice@aip.org> Reply-To: aipcp-edoffice@aip.org To: miratul-k@fst.unair.ac.id Wed, Feb 19, 2020 at 10:00 AM

Dear Dr. Khasanah,

You are receiving this email acknowledgment as a record of your agreement to the terms of the AIP Publishing LLC License to Publish Agreement Form. Please keep this document for your records. Thank you.

Sincerely,

AIP Conference Proceedings

Editorial Office

AIP Publishing 1305 Walt Whitman Road Suite 300 Melville, NY 11747-4300 USA

E-mail: aipcp-edoffice@aip.org

This email message and any files transmitted with it contain confidential information. If you are not the intended recipient please notify the sender, delete this email and any attachments from your system, and destroy any copies you have made, electronic or otherwise.

copyright_e_form_aipcp20-ar-jcc2019-00011_khasanah_eitlls.pdf



miratul khasanah <miratul-k@fst.unair.ac.id>

Tue, Nov 3, 2020 at 11:30 PM

AIPCP: Receipt of Manuscript MS #AIPCP20-AR-ICPIAM2019-00022

aipcp-edoffice@aip.org <aipcp-edoffice@aip.org> Reply-To: aipcp-edoffice@aip.org To: miratul-k@fst.unair.ac.id

Dear Dr. Khasanah,

Your manuscript has been successfully submitted to the proceedings of The 2nd International Conference on Physical Instrumentation and Advanced Materials 2019. This message is being sent to you as one of the authors of the following conference proceedings manuscript:

MS ID: AIPCP20-AR-ICPIAM2019-00022 Title: "Formaldehyde Sensing Using Micro-Loop Resonator"

All co-authors are included on this message in order to provide notification of this submission. The order of the authors in your submitted manuscript is as follows: Mohammad Yasin, Mohd Hafiz Jali, Hazli Abdul Rahim, Sana Hamid, Md Ashadi Johari, Haziezol Mohd Yusof, S. W. Harun, and Miratul Khasanah.

Please note that if this order is changed or if there are any deletions or additions of authors, each author needs to provide approval for this change.

Your manuscript is being processed by the editorial office. You will receive another email soon if modifications are needed to your submission.

Open Researcher and Contributor Identifier (ORCID):

Our records show that your account in our journal's peer review system is not currently associated with an ORCID ID. Please use the link below to either register for a new ORCID ID or, if you already have one, to login into the ORCID system and retrieve it. Your account in the journal's peer review system will then be associated with your ORCID ID, helping to correctly identify you.

https://aipcp.peerx-press.org/cgi-bin/main.plex?el=A4Cu1HKHD2A6IcEu3Bh5B9ftdcYuUCkryw66rkBwL1GvWDAY

The Open Researcher and Contributor Identifier (ORCID) connects research and researchers. ORCID provides a registry of unique identifiers that is open, non-proprietary, transparent, mobile, and community-based. To help the scientific community, we encourage all authors and reviewers to create and link an ORCID identifier to their account. For more information about ORCID, please visit http://orcid.org/content/about-orcid.

Thank you again for your contribution to the proceedings of The 2nd International Conference on Physical Instrumentation and Advanced Materials 2019.

Sincerely,

AIP Conference Proceedings

Editorial Office

5/23/23, 10:19 AM

Airlangga University Mail - AIPCP: Receipt of Manuscript MS #AIPCP20-AR-ICPIAM2019-00022

AIP Publishing 1305 Walt Whitman Road Suite 300 Melville, NY 11747-4300 USA

E-mail: aipcp-edoffice@aip.org

This email message and any files transmitted with it contain confidential information. If you are not the intended recipient please notify the sender, delete this email and any attachments from your system, and destroy any copies you have made, electronic or otherwise.

Rekaman sistem AIPCP20_JCC2019

a apopteer-presenges universe growth with a band manual part of the second se	Appropries Appropries Appropries Appropries Appropries Approx Appro		00011 × 🎭 AIPCP20-AR-JCC2019-00011 × 🔇 Indonesian Journal of Chemistry × +	- 0	
Adde the Sourced Programming Your Manuacce, UK Contact Editional Office Ammessicipit # APP Conference Proceedings The Submission Date III Herbs 2000 22:0.222 Bayes to Render Final Decision: 1 Contrant Stages Hamescript You Article IIII Herbs 2000 22:0.222 Bayes to Render Final Decision: 1 Contrant Stages Hamescript You Article IIII Herbs 2000 20:0.22 Bayes to Render Final Decision: 1 Tele Imported Zoelle Modeling Carbon Partse Electrode as A Selective Potentionnetric Sensor for Blood Glucose Manuscript You Article # III IIII Herbs 10 Manuality (Dartsen and Contraintone on Chamistry 2019 Section Article # IIIII Herbs 10 Manuality (Dartsen and Chamistry 2019 Section IIIII Herbs 10 Manuality (Dartsen and Chamistry 2019 Section IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	About the Journal APP200-40-JCC2019-00011 Journal APP200-40-JCC2019-00011 APP200-40-JCC2019-00011 Journal APP200-40-JCC2019-20012 Days to Render Final Decision: 1: Contrest Case Analoxic Status Modified Carbon Plate Electrode an A Selective Potentiometric Sensor for Blood Glucose Analuscip Status Modified Carbon Plate Electrode an A Selective Potentiometric Sensor for Blood Glucose Analuscip Status Modified Carbon Plate Electrode an A Selective Potentiometric Sensor for Blood Glucose Analuscip Status Modified Carbon Plate Electrode an A Selective Potentiometric Sensor for Blood Glucose Analuscip Status Modified Carbon Plate Electrode an A Selective Potentiometric Sensor for Blood Glucose Analuscip Status Modified Carbon Plate Electrode an A Selective Potentiometric Sensor for Blood Glucose Analuscip Status Modified Carbon Plate Electrode an A Selective Potentiometric Sensor for Blood Glucose Analuscip Status Potentiometric Sensor for Blood Glucose Analuscip Status Modified Carbon Plate Electrode Sensor Sensor For Blood Glucose Analuscip Status Modified Carbon Plate Plate Modified		lex?form_type=e_forms_chasers_display_ms&j_id=150&ms_id=924990&ms_rev_no=0&ms_id_key=ftdMBk4xfggpUU AIP Conference Proceedings	10 ☆	M
Autorspin # AIPC2094R-022019-00011 Summary Ends Bit Processings Current Evaluation Date 194-82-2002 20:022 Days to Render Final Decision 3. Current Stage Hanaccript Set Production To Days in Folder 960 Tide Improved Set Production To Days in Folder 960 Tides Improved Set Production To Days in Folder 960 Conference Name 1 Conference Name 1 Conference Name 1 Autors Stages Autors Name Section ATTLES Autors Stages 1 Autors Stages	All Conference Proceedings All Conference Proceedings Current Revision B Bit Rev 2002 2003:2 Days to Reder Final Decision: : Current Stage Hensecript State In Production Days in Police: 90 The Important Content State Content State Content State Content State Content State Content State	Abo	ut the Journal Preparing Your Manuscript Contact Editorial Office		
Journal APP Conference Proceedings Current Revision Date 19 Feb 2002 20:322 Day to Render Final Decision 1. Current Stage Handwardt Secker to Poduction Day to Render Final Decision 1. Current Stage Handwardt Secker to Poduction Day to Render Final Decision 1. Title Impatch decision Mate Conference on Cleminity 2019 Section Atticle Atticle Atticle 1 Matabact Section Pode Section Po	autoral AP Conference Proceedings Sectors Existion Date 19 4764 2020 22:03:2 Current Stage Harracetty Stage To Poduction Date Sectors Existion 11 4764 2020 22:03:2 The Important Zoules Modified Carbon Paste Electrods as A Selective Potentionmetric Sensor for Elocid Gucuse Manuscript Type Aride Conference Name 11 47644 Monands (Conruch) Section Attification Author 2. Min Advanta Wedan Section Attification Author 9. Mind Monands (Conruch) Section Attification Author Reviewer Suggestions to Exclude NA Author Reviewer Suggestinton to Include NA <td>Manuscript #</td> <td>AIPCP20-AR-JCC2019-00011</td> <td>-</td> <td></td>	Manuscript #	AIPCP20-AR-JCC2019-00011	-	
Current Revision # 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Current Revision # 0	Journal	AIP Conference Proceedings		
Submission Date IP-69-2002 22-0322 Days to Render Final Dacision: 1 Contrant. Stage Manuscript Type Aricle Province Stage Tele Iprovince Stage Arite A Arite A Arite A IP IPROVINCE Arite A IP IPROVINCE Arite A IP IPROVINCE IPROVI	Submission Date 1945-b-2020 22:03:22 Days to Render Final Decision: 1 The Imported Zackite Molfind Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood Glucose Manuacity Type Aricle Aricle 4 11 Conference Name 1 18 Conference Name 1 18 Section ARTICLES Article 4 11 Authors 4 Modarita Molannia (corresult) 4 Modarita Readman 5 How Potention Conference on Chemistry 2019 Section ARTICLES Article 4 11 Authors 4 Modarita Molannia (corresult) 5 How Potention Conference and Chemistry 2019 Section ARTICLES Article 4 How Potention Corresult) 5 How Potention Corresult 5 How Potention C	Current Revision #	0		
Current Stage Menacipt Sent to Production Dyse in Folder: 98 Title Imprinted ZealeRe Modified Carbon Paste Electronic de as A Selective Patteritometric Sensor for Blood Glucose Manuscript Type Aricle Article 4 The Aricle Article Article Article Article Conference on Chemistry 2019 Section ARTICLES Arthors ARTICLES Arthors ARTICLES Arthors ARTICLES Arthors Article	Currents Stage Manuacipt, Serie Production Days in Folder: 98 The Imprinted Scalenk Modified Carlon Paste Electrode as A Solective Potentiometric Sensor for Blood Glucose Article # 11 Conference Name The Manuacipt, Sensor for Blood Glucose Article # 11 Conference Name The Manuacipt, Sensor for Blood Glucose Authors 1 Author Reviewer Suggestions to Enclude NA	Submission Date	18-Feb-2020 22:03:22 Days to Render Final Decision: 1		
Title Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potentiometric Sensor for Blood Glucos Manuscript Type Aride Conference Name I Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potentiometric Sensor for Blood Glucos Conference Name Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potentiometric Sensor for Blood Glucos Authors Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potentiometric Sensor for Blood Glucos Authors Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potentiometric Sensor for Blood Glucos Authors Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potentiometric Sensor for Blood Glucos Authors Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potention Electricite as A Selective Potention Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potention Authors Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potention Imprinted Zealte Medified Carbon Paste Electricite as A Selective Potention Author Reviewer Suggestions to Electricite N/A Author Reviewer Suggestions to Electricite N/A Imprinted Zealte Associate Editor	The Imprinted Zakile Moldied Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood Glucose Memauscript Spreis Article 4 Authors 1 Conferences Name 1: Authors 2: Authors 1: Author Reviewer Suggestions to Exclude N/A Author Re	Current Stage	Manuscript Sent to Production Days in Folder: 98		
Manuscript Type Article Article Article Article Article Article Biology 2019 Section Article 4 11 Conference Name The 14th Joint Conference on Chemistry 2019 Section Article 5 1 Users of Handigeria Article 4 1 Mindle Maaanah (corn-auth) 2 Min Adusta Widei 3 Users of Handigeria Authors & Article Articl	Menuscript Type Article Article # 11 Conference Name The 14h Joint Conference on Chemistry 2019 Section A United Maxima Vedain Authors 2 Authors 3 Using Sit Handshalpini 4 Authors 4 Authors 6 Author Reviewer Suggestions to Enclude N/A Au	Title	Imprinted Zeolite Modified Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood Glucose		
Article s ⁴ 11 Conference Mame Section ARTICLES ART	Article # 11 Conference Name The 14th John Conference on Chemistry 2019 Section ARTICLES ARTI	Manuscript Type	Article		
Conference on C The 14th Joint Conference on Chemistry 2019 Section Attricts Attriors Attricts Attriors Attricts Attriors Attricts Attriors Attricts Attric	Conference Name The 14th John Conference on Chemistry 2019 Section Attract Authors 1 Authors 1	Article #	11		
Section A HUTCLES Authors A HUTCLES Authors A HUTCLES Authors A HUTCLES Authors A HUTCLES Author Reviewer Suggestion to Schulde N/A Author Reviewer Suggestion to Include N/A Author Reviewer Suggestion to Include N/A Conference on CI X A AUCREA HUTCLES Author Reviewer Suggestion to Include Author Relations Abstract Abstract Abstract Author Reviewer Suggestion to Include N/A Author Reviewer Suggestion to Include Author Relations Abstract Abstract Abstract Abstract Author Reviewer Suggestion to Include Author Relations Abstract Author Reviewer Suggestion to Include Authal Authal Author Reviewer Suggestion to	Section ATTRCE ATTRCE Atthors ATTRCE Atthors Attract Advances Marked Research (corresult) 3. Abbract Marked Readman (corresult) 3. Sebira Advances Marked Readman (corresult) 4. M	Conference Name	The 14th Joint Conference on Chemistry 2019		
Authors	1 Midraid (Basanah) (corr-sult) 3 Userg SH Handajani 3 Userg SH Handajani 3 Authors 2 Handajani 3 Extra Midraid Madanau 3 Extra Midraid Midraid Midraid Midraid Midraid Midraid Midraid Midraid Midraid Midraid Midraid	Section	ARTICLES		
Authors	Authors		1 Miratul Khasanah (corr-auth) 2 Alfa Akustia Widati		
Bastan Audia Rohma Bastan Audia Rohma Bastan Bast	Product Machine Adding Machine Addine Machine Addine Machine Addine Machine Addine Machine A	Authors	3 Usreg Sri Handajani		
Bernard Hawards B			4 Mastah Raudiotus Shotiyyah		
Astract Associate Editor Assigned Atthor Reviewer Suggestions to Exclude MA author Reviewer Suggestions to Exclude MA Conference on Cl X APCP20-AR-JCC2019-0011 X APCP20-AR-JCC2019-00-10-10-10-10-10-10-10-10-10-10-10-10-	Abstract Associate Editor Assigned Author Reviewer Suggestions to Exclude WA Decision View Decision Letter / 19-feb-2020 a aloca perce-press.org/cgi-bin/main.plex/form.type-status_detailedgi_id=150&ms_id=224990&ms_rev_ne=0&ms_id_key=ftd0701ZxuJMOyrTR6ceUUW Conference on Conference on Confer		5 Sabrina Aulia Kakhma		
Abstract Associate Editor Assigned Author Reviewer Suggestions to Include NA Decision Conference on Cl X A NFCP20-AR-ICC2019-0011 X A Inclonesian Journal of Chemistry X + - Conference on Cl X A NFCP20-AR-ICC2019-0011 X A Inclonesian Journal of Chemistry X + - - - - - - - - - -	Abstract Associate Editors Associate Editors Associate Editors To Construct Associate Editors Associate		6 Herwin Predianto		
Associate Editor Assigned Active Reviewer Suggestions to Exclude NA Author Reviewer Suggestions to Exclude NA Decision Interfere on Cl X APCP20-AR-ICC2019-0011 X Interfere AR-ICC2019-0011 X Interf	Adverte Reviewer Suggestions to Exclude V/A Author Reviewer Suggestions to Exclude V/A Decision Vew Decision Latter / 19-Feb-2020 C Conference on Ci X ALCP20-ARE-ICC2019-0001 X ALCP20-ARE-ICC2019-0001 X Indexes and a log on the first of	Abstract			
Author Reviewer Suggestions to Exclude V/A Author Reviewer Suggestions to Exclude V/A Decision Exclude V/A Conference on Cl X A REPERO-AR-JCC2019-0001 X A REPERO-AR-JCC2019-0001 X O Indonesian Journal of Chemistry X + O a tipcp perv-press.org/cgi-bin/main.plex/form_type=status_details8j.id=1508cms_id=9249908cms_rev_no=08cms_id_key=ftdo7012suJMOyrTR6ceUJJW O a tipcp perv-press.org/cgi-bin/main.plex/form_type=status_details8j.id=1508cms_id=9249908cms_rev_no=08cms_id_key=ftdo7012suJMOyrTR6ceUJJW O Author Reviewer Suggestions to Include N/A Author Reviewer Suggestions to Include N/A Author Reviewer Suggestions to Include N/A Decision Exclude 10 / Feb-2020 Electronic Forms Hintly Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form)	Author Reviewer Suggestions to Exclude V/A Autor Reviewer Suggestions to Exclude V/A Decision Vew Decision Letter / 19-Feb-2020 at Conference on Cl X ALC220-AR-JCC2019-0001 X ALC2204-R-JCC2019-0001 X C Indonesian Journal of Chemistry X + C at Journal of Chemistry X + C a Journal of Chemistry X + C Alc220-AR-JCC2019-0001 X ALC2204-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-0001 X ALC2204-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-0001 X ALC220-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-0001 X ALC220-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-0001 X ALC220-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC201-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-AR-JCC2019-0001 X C Indonesian Journal of Chemistry X + C Alc220-AR-JCC2019-AR-JCC2000 X JOURD Submission Check Vy Editorial Office Completed IF4-b-2020 11:35:20 Submission Check Vy Editorial Office Completed IF4-b-2020 11:35:20 Submission Check Vy Editorial Office Completed IF4-b-2020 12:20:51:71 Manuscript Sandt to Editorial Office Completed IF4-b-2020 12:20:21:72 Manuscript Sandtra to Editorial Office Completed IF4-b-2020 12:20:21:72 Manuscript Sandtra to Editorial Office Completed IF4-b-2020 12:20:21:72 Manuscript Sandtra to Editorial Office Completed IF4-b-2020 22:20:22:72 Manuscript Sandtra to Editorial Office Completed IF4-b-2020 22:20:22:7	Associate Editor	Assigned		
Author Reviewer Suggestions to Exclude MA User Decision Letter / 19-Feb-2020 Conference on Ci X AIRCR20-ARJCC2019-00011 X AIRCR20-ARJCC2019-00011 X Indenesian Journal of Chemistry X +	Author Reviewer Suggestions to Exclude WA Recision View Decision Letter / 19-5tb-2021 A Conference on C X A REC20-ARJCCC019-00011 X A REC2019-00011 X C Indonesian Journal of Chemistry X + C a ajcep peerx-press.org/cgi-bin/main plex/form_type=status_details&j.jd=1508cms_jd=9249908cms_rev_no=08cms_jd_key=ftdo7012suMOyrTR6ceUW A stract Astract Astract Astract Astract A Stract Bectronic Forms Electronic Forms Minauscrpt Ready for Production 19-5fb-2020 Author Reviewer Suggestions to Enclude WA Author Reviewer Suggestions to Enclude WA Becision Letter First Production 19-5fb-2020 [12:55:17] Manuscrpt Ready for Production 19-5fb-	Author Reviewer Suggestions to Include	e N/A		
Decision View Decision 1254 Conference on Cl: X A RPCP20-AR-JCC2019-00011 X A RPCP20-AR-JCC2019-00011 X Indonesian Journal of Chemistry X + - 0 a sipcp peerce-press.org/cgi-bin/main plex/Horm_type=status_details&j.jd=150&ms_id=924990&ms_rev_no=0&ms_id_key=Htdo7012suJMOyrTR6ceUJW Image: Conference on Cl: X + - 0 Abstract Associate Editor - Associate Information - - 0 Image: Conference on Cl: X + - 0 Abstract - - - - - - 0 Image: Conference on Cl: X + - 0 Autor Reviewer Suggestions to Include - - - - - 0 Image: Conference on Cl: X + - 0 Image: Conference on Cl: X + - 0 Image: Conference on Cl: X + + - 0 0 - 0 Image: Conference on Cl: X + + - 0 0 0 - 0 - 0 - 0 0 - 0 0 - 0 0	Decision View Decision (Litter / 19-Ch2020) Ind Conference on Clix Image: Conference on Clix A DECED AR. JCC2019-00011 Ind Conference on Clix Image: Conference on Clix A DECED AR. JCC2019-00011 Ind Conference on Clix Image: Conference on Clix A DECED AR. JCC2019-00011 Ind Conference on Clix Image: Conference on Clix A DECED AR. JCC2019-00011 Ind Conference on Clix Image: Conference on Clix A DECED AR. JCC2019-00011 Ind Conference on Clix Image: Conference on Clix A DECED AR. JCC2019-00011 Ind Conference on Clix Image: Conference on Clix A DECED AR. JCC2019-00011 Ind Conference on Clix Image: Conference on Clix A DECED AR. JCC2019-00011 Ind Conference on Clix Image: Conference on Clix A DECED AR. JCC2019-00011 Ind Conference on Clix Image: Conference on Clix A Decision Ind Conference on Clix A Decision Ind Conference on Clix View Decision Letter / 19-Feb-2020 Ind Conference Forms Ind 1 forms completed on 18-Feb-2020 (AIPP Standard LTP Form) Image: Conference on Clix Image: Decision View Decision Conference on Clix Image: Decision Conference On Conference on Clix If Feb-2020 12:05:17 Image: Decision Conference On Clix If Feb-2020 12:05:17 Image: Decision Conference On Conference On Feb-2020 12:05:02 Image: Conference On Feb-2020 12:02:02 Image: Decision Conference On Feb-2020 12:05:02<	Author Reviewer Suggestions to Exclude	e N/A		
Conference on Cl X APCP20-AR-ICC2019-00011 X APCP20-AR-ICC2019-00011 X Indonesian Journal of Chemistry X +	APCR20ABL/CC2019-0001 A approprint Constrained APCR20ABL/CC2019-0001 APCR20ABL/CC2019-0011 APCR20ABL/CC2019-0012-05170 APCR20ABL/CC2019-00	Decision	View Decision Letter / 19-Feb-2020	12:54	
6 Herwin Predianto Abstract Associate Editor Assigned Author Reviewer Suggestions to Include N/A Author Reviewer Suggestions to Exclude N/A Decision View Decision Letter / 19-Feb-2020 Electronic Forms 1 of 1 forms complete - View Electronic Forms Status Electronic Forms Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Total Reviewer Suggestion Completed 19-Feb-2020 11:36:20 Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office Appleted Files 18-Feb-2020 22:03:22 Avaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office Appleted Files 18-Feb-2020 22:03:22 Terms of Use Manuscript Submitted to Editorial Office Appleted Files 18-Feb-2020 22:03:22 Terms of Use Marking Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Terms of Use Mare All All Probletang Marking Mathema Read,	Abstract Associate Editor Assigned Author Reviewer Suggestions to Enclude N/A Author Reviewer Suggestions to Exclude N/A Decision Wew Decision Letter / 19-Feb-2020 Electronic Forms Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Stage Stage Minuscript Sent to Production 19-Feb-2020 11:36:20 Associate Editor Stage 19-Feb-2020 11:36:20 Securing Ready for Production 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 21:03:21 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Avaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Avaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Mainscript Seady for Value 100 19-Feb-2020 22:03:22 Mainscript Submitted to Editorial Office 19-Feb-2020 22:03:22 Mainter Submitted to Editoria		plex?form_type=status_details8ij.id=150&ms_id=924990&ms_rev_no=0&ms_id_key=ftdo701ZsuJMOyrTR6ceUIJw אין אין אין אין אין אין אין אין אין אין	Image: A marked block in the second seco	
Astract Associate Editor Assigned Author Reviewer Suggestions to Include N/A Author Reviewer Suggestions to Exclude N/A Decision View Decision Letter / 19-Feb-2020 Electronic Forms 1 of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form)	Abstract Assigned Author Reviewer Suggestions to Include N/A Author Reviewer Suggestions to Exclude N/A Decision Vew Decision Letter / 19-Feb-2020 Electronic Forms Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP Form) Intrul Khasanah (Corr): completed on 19-Feb-2020 (AIPP Standard LTP		6 Herwin Predianto		
Associate Editor Assigned Author Reviewer Suggestions to Include N/A Author Reviewer Suggestions to Exclude N/A Decision View Decision Letter / 19-Feb-2020 I of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Electronic Forms Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Manuscript Sent to Production 19-Feb-2020 11:36:20 19-Feb-2020 11:36:20 Securing Associate Editor Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 19-Feb-2020 11:36:20 Securing Associate Editor Submission Check by Editorial Office Started 19-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Visit AIPCP Online Privacy Policy Terms of Use	Associate Editor Assigned Author Reviewer Suggestions to Include N/A Decision View Decision Letter / 19-Feb-2020 Electronic Forms 1 of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Nanuscript Sent to Production 19-Feb-2020 11:36:20 Assigned 19-Feb-2020 11:36:20 Securing Associate Editor 19-Feb-2020 11:36:20 Securing Gator 19-Feb-2020 11:36:20 Securing Gator 19-Feb-2020 11:36:20 Securing Gator 19-Feb-2020 11:36:20 Austor Ready for Columnal office Started 19-Feb-2020 21:03:21 Submission Check by Editorial Office Started 19-Feb-2020 21:03:22 Manuscript Submitted to Editorial Office Started 19-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office Started 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office Started 19-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office Started 09-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office Started 09-Feb-2020 22:03:22 Miret Withman Read, Suite 200, Heddell, M11747-400 US	Abstract			
Author Reviewer Suggestions to Include N/A Author Reviewer Suggestions to Exclude N/A Decision View Decision Letter / 19-Feb-2020 Electronic Forms 1 of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Imauscript Sent to Production 19-Feb-2020 12:05:17 Manuscript Ready for Production 19-Feb-2020 11:36:20 Decision Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Associate Editor 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office IB-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Terms of Use	Author Reviewer Suggestions to Include N/A Author Reviewer Suggestions to Exclue N/A Decision View Decision Letter / 19-Feb-2020 I of 1 forms complete - View Electronic Forms Status Electronic Forms Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form)	Associate Editor	Assigned		
Author Reviewer Suggestions to Exclude N/A Decision View Decision Letter / 19-Feb-2020 Electronic Forms 1 of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Stage Stat Date Manuscript Sent to Production 19-Feb-2020 11:36:20 Decision Letter Being Prepared 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Scuring Associate Editor 19-Feb-2020 11:36:20 Scuring Litor 18-Feb-2020 11:36:20 Scuring Editor 18-Feb-2020 21:03:22 Manuscript Submitted to Editorial Office Started 18-Feb-2020 21:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 21:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22	Author Reviewer Suggestions to Exclude N/A Decision View Decision Letter / 19-Feb-2020 I of 1 forms complete - View Electronic Forms Status Electronic Forms Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Imanuscript Sent to Production 19-Feb-2020 11:36:20 View Decision Completed 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22	Author Reviewer Suggestions to In-	clude N/A		
Decision View Decision Letter / 19-Feb-2020 1 of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) <u>Stage </u>	Decision View Decision Letter / 19-Feb-2020 Electronic Forms 1 of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Manuscript Sent to Production 19-Feb-2020 11:36:20 Decision Letter Being Prepared 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Securing Associate Editor 19-Feb-2020 11:36:20 Securing Editoria Office Completed 19-Feb-2020 11:36:20 Securing Editoria 19-Feb-2020 11:36:20 Securing Editoria 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 19-Feb-2020 11:36:20 Marki	Author Reviewer Suggestions to Ex	cclude N/A		
I of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Stage Manuscript Sent to Production 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Securing Editor Securing Editor <td>Electronic Forms I of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Imauscript Sent to Production 19-Feb-2020 11:36:20 Anuscript Ready for Production 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Securing Editor Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 19-Feb-2020 11:36:20 Submission Check by Editorial Office 18-Feb-2020 21:36:20 Submission Check by Editorial Office 18-Feb-2020 21:36:20 Manuscript Submitted to Editorial Office 18-Feb-2020 21:36:20 Manuscript Submitted to Editorial Office 18-Feb-2020 21:36:20 Manuscript Submitted to Editorial Office 18-Feb-2020 22:02:20:70</td> <td>Decision</td> <td>View Decision Letter / 19-Feb-2020</td> <td></td> <td></td>	Electronic Forms I of 1 forms complete - View Electronic Forms Status Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Imauscript Sent to Production 19-Feb-2020 11:36:20 Anuscript Ready for Production 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Securing Editor Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 19-Feb-2020 11:36:20 Submission Check by Editorial Office 18-Feb-2020 21:36:20 Submission Check by Editorial Office 18-Feb-2020 21:36:20 Manuscript Submitted to Editorial Office 18-Feb-2020 21:36:20 Manuscript Submitted to Editorial Office 18-Feb-2020 21:36:20 Manuscript Submitted to Editorial Office 18-Feb-2020 22:02:20:70	Decision	View Decision Letter / 19-Feb-2020		
Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Manuscript Sent to Production 19-Feb-2020 12:05:17 Manuscript Ready for Production 19-Feb-2020 11:36:20 Decision Letter Being Prepared 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 20:322 Submission Check by Editorial Office 18-Feb-2020 20:322 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 12:05:07 Visit AIPCP Online Privacy Policy Terms of Use Operation of Use	Ideat with Fromis Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form) Stage Start Date Manuscript Sent to Production 19-Feb-2020 12:05:17 Manuscript Ready for Production 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 21:36:20 Submission Check by Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Market Withman Road, Subt 300, Medder, NY 11747-4300 USA Image: Constraint Constraints	Electronic Forme	1 of 1 forms complete - View Electronic Forms Status		
Stage Start Date Manuscript Sent to Production 19-Feb-2020 12:05:17 Decision Letter Being Prepared 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 21:03:22 Submission Check by Editorial Office 18-Feb-2020 22:03:22 Securing Editor 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Terms of Use	Stage Start Date Manuscript Sent to Production 19-Feb-2020 12:05:17 Decision Letter Being Prepared 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Sciencing Associate Editor Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office	Electronic Forms	Miratul Khasanah (Corr): completed on 18-Feb-2020 (AIPP Standard LTP Form)		
Manuscript Sent to Production 19-Feb-2020 12:05:17 Manuscript Ready for Production 19-Feb-2020 11:36:20 Decision Letter Being Prepared 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Securing Editor 18-Feb-2020 22:03:22 Securing Editor 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Terms of Use Colspan="2">Colspan="2"Colspan="2">Colspan="2"Colspan="2"Colspan="2"C	Manuscript Sent to Production 19-Feb-2020 12:05:17 Manuscript Ready for Production 19-Feb-2020 11:36:20 Decision Letter Being Prepared 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:02:07 Visit AIPCP Online Privacy Policy Terms of Use Ings	Stage	Start Date		
Manuscript Ready for Production 19-Feb-2020 11:36:20 Decision Letter Being Prepared 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Securing Editor 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Visit AIPCP Online Privacy Policy Terms of Use	Manuscript Ready for Production 19-Feb-2020 11:36:20 Decision Letter Being Prepared 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Associate Editor 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Submission Check by Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Terms of Use	Manuscript Sent to Production	19-Feb-2020 12:05:17		
Decision Letter Being Prepared 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Submission Check by Editorial Office 18-Feb-2020 22:03:22 Securing Editor 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Visit AIPCP Online Privacy Policy Terms of Use	Decision Letter Being Prepared 19-Feb-2020 11:36:20 Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Terms of Use Visit AIPCP Online Privacy Policy Terms of Use	Manuscript Ready for Production	19-Feb-2020 11:36:20		
Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Associate Editor 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 21:36:20 Securing Editor 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Securing Editor 19-Feb-2020 11:36:20 Securing Editor 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Securing Author Adjustment Adju	Associate Editor Decision Completed 19-Feb-2020 11:36:20 Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Associate Editor 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 20:03:22 Manuscript Submitted to Editorial Office	Decision Letter Being Prepared	19-Feb-2020 11:36:20		
Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Lotitor 19-Feb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Visit AIPCP Online Privacy Policy Terms of Use gs	Submission Check by Editorial Office Completed 19-Feb-2020 11:36:20 Securing Associate Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Securing Editor 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:02:07 Visit AIPCP Online Privacy Policy Terms of Use	Associate Editor Decision Completed	19-Feb-2020 11:36:20		
Securing Editor 19-Freb-2020 11:36:20 Securing Editor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:02:07 Visit AIPCP Online Privacy Policy Terms of Use gs ge 2020 AIP Publishing LLC 1305 Walt Whitman Road, Suite 300, MeWille, NY 11747-4300 USA	Securing Leitor 19-Feb-2020 11:36:20 Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Securing Editor 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:02:07 Visit AIPCP Online Privacy Policy Terms of Use ings © 2020 AIP Publishing LLC 1305 Wait Whitman Road, Suite 300, Metville, NY 11747-4300 USA © 2020 AIP Publishing LLC 1305 Wait Whitman Road, Suite 300, Metville, NY 11747-4300 USA	Submission Check by Editorial Office Con	mpleted 19-Feb-2020 11:36:20		
Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Securing Editor 18-Feb-2020 22:03:22 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Terms of Use Visit AIPCP Online Privacy Policy Terms of Use Securing Editor (0: 2020 AIP Publishing LLC 1305 Walt Whitman Road, Suite 300, MeWille, NY 11747-4300 USA	Submission Check by Editorial Office Started 18-Feb-2020 22:03:22 Securing Editor 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:02:07 Terms of Use Visit AIPCP Online Privacy Policy Terms of Use 0 2020 AIP Publishing LLC 1305 Walt Writtman Road, Suite 300, Metville, NY 11747-4300 USA CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	Securing Associate Editor	19-Feb-2020 11:36:20		
Securing Editor 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:02:07 Visit AIPCP Online Privacy Policy Terms of Use gs COLOR OF Converted Files 0:2020 AIP Publishing LLC 1305 Walt Whitman Road, Suite 300, MeWille, NY 11747-4300 USA	Securing Editor 18-Feb-2020 22:03:22 Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:02:07 Visit AIPCP Online Privacy Policy Terms of Use Ings 0 2020 AIP Publishing LLC 1305 Walt: Whitman Road, Suite 300, Melville, NY 11747-4300 USA CCCCCC C C 0 2020 AIP Publishing LLC 1305 Walt: Whitman Road, Suite 300, Melville, NY 11747-4300 USA CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	Submission Check by Editorial Office Sta	arted 18-Feb-2020 22:03:22		
Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:03:22 Terms of Use gs Colspan="2">Colspan="2" gs Colspan="2">Colspan="2" Colspan="2">Colspan="2" Colspan="2" Colspan="2	Manuscript Submitted to Editorial Office 18-Feb-2020 22:03:22 Awaiting Author Adjustment/Approval of Converted Files 18-Feb-2020 22:02:07 Visit AIPCP Online Privacy Policy Terms of Use ings © 2020 AIP Publishing LLC 1305 Wait Whitman Road, Suite 300, Met/Ille, NY 11747-4300 USA © 2020 AIP Publishing LLC 2025 Converted Files 200 Met/Ille, NY 11747-4300 USA	Securing Editor	18-Feb-2020 22:03:22		
Awaiting Author Adjustment/Approval of Converted Files [18-reb-2020 22:02:07 Visit AIPCP Online Privacy Policy Terms of Use gs	Awaiting Author Adjustment/Approval of Converted Files [18-Feb-2020 22:02:07 Visit AIPCP Online Privacy Policy Terms of Use ings	Manuscript Submitted to Editorial Office	18-Feb-2020 22:03:22		
gs @ 2020 AIP Publishing LLC 1305 Walt Whitman Road, Suite 300, Melville, NY 11747-4300 USA	Visit AIPCP Online Privacy Policy Terms of Use	Awaiting Author Adjustment/Approval of	f Converted Hiles 18-heb-2020 22:02:07		
© 2020 AIP Publishing LLC 1305 Walt Whitman Road, Suite 300, Melville, NY 11747-4300 USA	• ② 2020 AIP Publishing LLC 1305 Walt Whitman Road, Suite 300, Melville, NY 11747-4300 USA • ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○		Visit AIPCP Online Privacy Policy Terms of Use		
Openational © 2020 AIP Publishing LLC Description 1305 Walt Whitman Road, Suite 300, Melville, NY 11747-4300 USA Checkee	[©] 2020 AIP Publishing LC [©] 2020 AIP Publishing LC ¹³⁰⁵ Walt Whitman Road, Suite 300, Melville, NY 11747-4300 USA [©] Check® [©] = ¹ = [©] = ^{12:56} ^{22:56} ²²	attings			
		rttings	Cross		
	🗧 📑 💼 🗾 🚾	ttings	20 AIP Publishing LLC Will Willman Road, Suite 300, Mekille, NY 11247-4300 USA		



RESEARCH ARTICLE | JUNE 02 2020

Imprinted zeolite modified carbon paste electrode as a selective potentiometric sensor for blood glucose \;

Miratul Khasanah , Alfa Akustia Widati; Usreg Sri Handajani; Masfah Raudlotus Shofiyyah; Sabrina Aulia Rakhma; Herwin Predianto

Check for updates

+ Author & Article Information *AIP Conference Proceedings* 2237, 020011 (2020) https://doi.org/10.1063/5.0005231

Imprinted zeolite modified carbon paste electrode as a potentiometric sensor for glucose analysis in blood serum sample has been developed. In this study, the type of used zeolite was TS-1. Imprinted zeolite (IZ) was synthesized with mole ratio of glucose/Si of 0.0306. The modified electrode prepared by mixing activated carbon, imprinted zeolite, and paraffin granule with mass ratio 9:4:7 from the measurement in range of $10^{-5} - 10^{-2}$ M is with Nernst factor of 28.6 mV/decade, and the detection limit of 4.79×10^{-5} M. The electrode was able to respond the glucose molecules in solution quickly (<30 s), stable for more than 9 weeks (130 times usage) and selective to glucose molecules. The urea, uric acid, and creatine with various concentrations did not interfere to glucose analysis by potentiometry using the electrode. Applying of the electrode for glucose analysis in spiked blood serum samples showed that it had recovery of 91.73±3.48% (n=5), while its accuracy against spectrophotometry method as commonly used method in medical field was 90.58±4.65% (n=5). Based on its performance, potentiometry using the imprinted zeolite modified carbon paste electrode is recommended as an alternative method for routine blood glucose analysis in the medical field.

Topics

Sensors, Electrodes, Zeolites, Potentiometry, Carbon based materials, Spectrophotometry, Medical

fields, Biofluids, Carbohydrates

This content is only available via PDF.

© 2020 Author(s).

You do not currently have access to this content.

Sign in

Don't already have an account? Register

Sign In

Username

Password



Sign in via your Institution

Sign in via your Institution

Reset password Register

Pay-Per-View Access \$40.00

₩ BUY THIS ARTICLE

Imprinted zeolite modified carbon paste electrode as a selective potentiometric sensor for blood glucose

Cite as: AIP Conference Proceedings **2237**, 020011 (2020); https://doi.org/10.1063/5.0005231 Published Online: 02 June 2020

Miratul Khasanah, Alfa Akustia Widati, Usreg Sri Handajani, Masfah Raudlotus Shofiyyah, Sabrina Aulia Rakhma, and Herwin Predianto



ARTICLES YOU MAY BE INTERESTED IN

Synthesis of hydroxylated azomethine compounds and the antioxidant activity AIP Conference Proceedings **2237**, 020023 (2020); https://doi.org/10.1063/5.0005806

Nanoparticles Fe₃O₄ modified chitosan and its antibacterial applications AIP Conference Proceedings **2237**, 020022 (2020); https://doi.org/10.1063/5.0005693

Synthesis of N'-(3-trimethoxysilylpropyl)diethylentriamine modified silica (SiO_{2(RHA)}-TMPDT) for adsorption of gold(III)

AIP Conference Proceedings 2237, 020047 (2020); https://doi.org/10.1063/5.0008267





AIP Conference Proceedings **2237**, 020011 (2020); https://doi.org/10.1063/5.0005231 © 2020 Author(s).

Imprinted Zeolite Modified Carbon Paste Electrode as A Selective Potentiometric Sensor for Blood Glucose

Miratul Khasanah^{1, a)}, Alfa Akustia Widati^{1, b)}, Usreg Sri Handajani^{1, c)}, Masfah Raudlotus Shofiyyah^{1, d)}, Sabrina Aulia Rakhma^{1, e)}, Herwin Predianto^{1, f)}

¹Chemistry Department, Faculty of Sciences and Technology, Airlangga University Kampus C Unair, Mulyorejo, Surabaya, 60115, Indonesia

> ^{a)}Corresponding author: miratul-k@fst.unair.ac.id ^{b)}alfaakustia@fst.unair.ac.id ^{c)}usreg-s-h@fst.unair.ac.id ^{d)}masfahrs@gmail.com ^{e)}sabrinaaulia63@gmail.com ^{f)}herwinpredianto@yahoo.com

Abstract. Imprinted zeolite modified carbon paste electrode as a potentiometric sensor for glucose analysis in blood serum sample has been developed. In this study, the type of used zeolite was TS-1. Imprinted zeolite (IZ) was synthesized with mole ratio of glucose/Si of 0.0306. The modified electrode prepared by mixing activated carbon, imprinted zeolite, and paraffin granule with mass ratio 9:4:7 from the measurement in range of $10^{-5} - 10^{-2}$ M is with Nernst factor of 28.6 mV/decade, and the detection limit of 4.79×10^{-5} M. The electrode was able to respond the glucose molecules in solution quickly (<30 s), stable for more than 9 weeks (130 times usage) and selective to glucose molecules. The urea, uric acid, and creatine with various concentrations did not interfere to glucose analysis by potentiometry using the electrode. Applying of the electrode for glucose analysis in spiked blood serum samples showed that it had recovery of 91.73±3.48% (n=5), while its accuracy against spectrophotometry method as commonly used method in medical field was 90.58±4.65% (n=5). Based on its performance, potentiometry using the imprinted zeolite modified carbon paste electrode is recommended as an alternative method for routine blood glucose analysis in the medical field.

INTRODUCTION

Carbon paste electrodes are the type of carbon electrode most widely used in electrochemical studies because of its inertness, low manufacturing costs, and suitability for various applications [1]. Carbon paste electrodes are easily renewed, porous, easy to miniaturized [2] and the response is fast [3]. Carbon paste electrodes can chemically modified to improve their performance in detecting samples at very small levels by mixing the modifier as one of the electrodes (bulk modified) or by coating the surface of the electrode with a thin film of the modifier (surface modified).

Among inorganic materials, zeolite has been widely used to modify carbon electrodes to form zeolite modified electrode (ZME) due to its unique porosity size, selectivity, high ion exchange ability, high thermal stability, adsorption capacity and resistance to extreme conditions [4]. The carbon-based electrodes including glassy carbon electrodes, graphite electrodes, diamond electrodes modified with boron-doped (BDE), screen printed electrodes, polymer [5] and zeolites modified electrode (ZME) [6, 7] have been widely developed.

Zeolites are crystalline aluminosilicates which have pores in molecular dimensions, unique micro pore structure, catalytic activity and good hydrothermal stability [8]. Titanium silicate-1 (TS-1) is a zeolite with MF-1 structure, usually used for selective oxidation reactions under mild conditions using hydrogen peroxide as an oxidant [9]. TS-1 type zeolites are superior types of zeolites due to nanoscale pores [10], excellent adsorption properties [11] and photocatalytic activity. The inherent activity of Ti atoms in TS-1 is higher than photocatalytic TiO₂.

The 14th Joint Conference on Chemistry 2019 AIP Conf. Proc. 2237, 020011-1–020011-8; https://doi.org/10.1063/5.0005231 Published by AIP Publishing. 978-0-7354-1996-4/\$30.00 Modified electrodes as sensors for electrometric analysis of organic or inorganic compound have been developed including zeolite modified electrodes for the analysis of uric acid [12], Cr^{3+} ions [2], creatinine [7], creatine [13]; and polymer-based electrodes for phenol analysis [14]. Nanoparticle material has also been used to increase the selectivity and sensitivity of electrodes [15].

In this study, an imprinted zeolite modified carbon paste electrode has been developed to detect glucose in blood serum. The development of glucose detection method still interesting to be studied because the glucose level act as indicator a diabetes mellitus disease. As we know, diabetes mellitus has become a threat to human health in the world. World Health Organization (WHO) predicted an increase in the number of people with diabetes mellitus in Indonesia from 8.4 million in 2000 to around 21.3 million in 2030. Increasing the blood glucose levels (> 200 mg/dL or equivalent to 2×10^{-2} M) is a major cause of diabetes mellitus. In the body, normal blood glucose levels are 60-100 mg/dL ($6 \times 10^{-3} - 1 \times 10^{-3}$ M) while serum glucose is 70–110 mg/dL ($3.88 \times 10^{-3} - 6.1 \times 10^{-3}$ M) [16]. Determination of blood glucose levels in the medical field is generally done using a spectrophotometer or glucometer. Spectrophotometers use venous blood sample, while glucometers use capillary blood sample [17].

The electrodes were fabricated from a paste made by combining activated carbon, paraffin granule and imprinted zeolite with varying compositions. Zeolites were synthesized by the mole ratio of TEOS, TBOT, TPAOH, H_2O namely 1:0.017:0.24:21.2 [18]. The parameters studied in this study were the optimization of the ratio of activated carbon, paraffin and IZ as electrodes material and the optimum pH of glucose solution. Electrode performance was expressed from the measurement range (linear dynamic range), Nernst factor value, detection limit, selectivity, accuracy, response time and electrode life time (stability). Furthermore, the sensor was applied for the analysis of glucose levels in blood serum samples and compared with the spectrophotometric method as a commonly method used in the medical field.

EXPERIMENTAL

Materials

The chemicals used in this study were glucose (Sigma Aldrich, 99.5%), creatine (Sigma Aldrich 98%), urea (Sigma Aldrich, 99.5%), and uric acid (Fluka, 99%), tetraethyl orthosilicate (Merck, 99%), tetra butyl ortho titanate (TBOT; *Merck*, 98%), tetra propyl ammonium hydroxide (TPAH; *Merck*, 40%), isopropanol (Merck, 98%), paraffin granule (Merck, 99%). Creatine and urea solution were prepared using distilled water, while the 10^{-2} M uric acid solution was prepared by dissolving uric acid powder in 1: 1 NaOH (w/w). Acetate buffer was prepared from glacial acetic acid (Merck 100%) and sodium acetate trihydrate (Merck, 99.5%) while phosphate buffers are prepared from sodium dihydrogen phosphate dihydrate (Merck, 98.5%) and sodium hydrogen phosphate (Merck, 99%) in distilled water. Carbon powder was chemically activated by immersing it in 0.01M H₃PO₄ and n-hexane, respectively. Furthermore, the carbon powder was heated at a temperature of 300 °C for 2 hours [19]. Ag wire was used as connector of carbon paste and potentiometer.

The equipments used in this study were a Cyberscan 510 potentiometers with Ag/AgCl as reference electrode, fourier transform infrared (FTIR) spectrophotometer (Shimadzu), X-ray diffraction (Shimadzu), Gas Sorption Quantachrome ASIQwin, Analytical balance Mettler AE 200, hotplateTermolyne S46410-2, pH meter Cyberscan Eutech instruments pH 510, HITTECH EBA 20 centrifuge, Vacuum Oven Model 5851, magnetic stirrer, polypropylene bottle, agate mortar, 1000 µL micropipette tip and glassware commonly used in laboratories.

Procedure

Synthesis and Characterization of Zeolite

Synthesis of zeolite TS-1 was carried out by mixing TEOS, TBOT and TPAOH according to the previous research [18]. Amount of 5.0 mL of isopropanol was mixed with 0.2361 g of TBOT in a polypropylene bottle. Then, a 9.0 mL of TEOS was added dropwise and stirred for 30 minutes at room temperature; 4.8 g TPAOH was added dropwised and stirred for 15 hours. Finally, 12.2 mL of water was added to the mixture. Furthermore, the mixture formed was heated hydrothermally at 80 °C for 4 days. As much as ¹/₃ of the mixture was neutralized by washing using distilled water, then it was dried at 80 °C. As much as ²/₃ part of the mixture was added by 0.2205 g of glucose in 1 mL of distilled water. Then the mixture was allowed to stand for 3 hours. As much as ¹/₂ part of this mixture was

dried (NIZ) and the other was extracted using hot water (80 °C) by centrifugation and dried. The dried powder was named imprinting zeolite (IZ).

Fabrication of Carbon Paste-Imprinted Zeolite Electrode

Fabrication of carbon paste-IZ electrodes was initiated by filling $\frac{3}{4}$ of the micropipette tip with melting paraffin. Silver wire (Ag) used as a connector between the electrodes and the potentiometer was first inserted into the micropipette tip. The remaining part of the micropipette tip was filled with a paste made from mixture of solid paraffin, carbon, and IZ (the composition in Table 1). The electrode surface was rubbed using HVS paper, and immersed in a 10^{-3} M glucose solution for 24 hours for conditioning.

Electrode code	Composition (% weight)				
Electione code	Activated carbon	ΙZ	Paraffin		
E1	65	0	35		
E2	60	5	35		
E3	58	7	35		
E4	55	10	35		
E5	50	15	35		
E6	45	20	35		
E7	40	25	35		

TABLE 1. The composition of activated carbon, IZ, and paraffin in the fabrication of carbon paste-IZ electrodes

Determination of Electrode Performance

The carbon paste-IZ electrode was used to measure the glucose solution $10^{-8}-10^{-2}$ M and determined for its performance including the measurement range, the Nernst factor, the limit of detection, precision, accuracy, response time and life time. Electrode selectivity which was expressed by the coefficient of selectivity ($K_{i,j}^{pot}$) was studied by applying the electrodes to measure a series of standard solutions of urea, uric acid, and creatine (compounds that coexist with glucose in serum samples) and calculated using matched potential methods (MPM). The potential obtained was substituted into the linear regression equation of standard glucose. $K_{i,j}^{pot}$ values were calculated using equation (1) [20].

$$(K_{i,j}^{\text{pot}} = \frac{\Delta a_i}{a_j}) \tag{1}$$

Where Δa_i is the concentration obtained by substitute the potential in interferent solution on the regression equation of the glucose solution, while a_i is the measured interferent concentration.

Furthermore, electrodes were applied to measure glucose levels in blood serum samples and compared with the results of the analysis using spectrophotometric methods as a commonly used method for the determination of blood glucose levels in the medical field. The influence of other components in the serum sample on the determination of glucose levels was tested with recovery values. Recovery (R) was determined by measuring the potential of standard glucose solution 10^{-3} M (C₁), diluted serum samples (C₂), and diluted serum samples containing standard glucose 10⁻³ M (C₃) by spiking technique. The potential obtained was then substituted into the linear regression equation of standard glucose. The recovery value was calculated using equation (2).

$$R = \frac{C1 - C2}{C3} \times 100 \%$$
 (2)

RESULTS AND DISCUSSION

Synthesis and Characterization of Zeolite

Synthesis of zeolite TS-1 was carried out from tetraethyl orthosilicate (TEOS) as a source of silica, tetrabutyl orthotitanate (TBOT) as a titania source, tertrapropylammonium hydroxide (TPAOH) as structure directing agent and provide the alkaline conditions needed for hydrolysis reactions, and water as a solvent. Glucose molecules are

trapped in the zeolite pores and it is thought that the formation of hydrogen bonds between –OH functional groups on the glucose molecules with Ti-O-Si on zeolites. on the glucose molecules with Ti-O-Si on zeolites. The hydrothermal process was intended to form a zeolite framework so that the size of the zeolite pores will conform to the size of the glucose molecule. Glucose was then extracted from the zeolite framework using hot water so that the side bonding was expected to be selective to glucose. An illustration of the synthesis process is shown in Fig. 1.



FIGURE 1. Illustration of the bonding process between zeolite and glucose

Based on the XRD pattern of Fig. 2a, the formation of TS-1 zeolite was marked by the peak at 20 of 7.95; 8.83; 23.14; 23.25; 23.72; and 23.94°. The diffractogram was corresponded to the MFI structures. The MFI framework structure on the TS-1 zeolite was compared with the standard ZSM-5 pattern taken from the Collection of Simulated XRD Powder Patterns for the Zeolites, International Zeolite Association [21] which also has an MFI framework structure. The standard structural pattern shows the peaks at 20 7.95°; 8.83°; 23.18°; 23.23°; 23.74°; and 23.99°.



FIGURE 2. (a) The XRD pattern of zeolite TS-1 (ZSM-5, inset) and (b) FTIR spectra of glucose, zeolite, NIZ, and IZ

Figure 2b showed the typical spectra of zeolite TS-1, namely the band at wavenumbers around 451, 545, 796, 1100, and 1220 cm⁻¹. The peaks at 451 and 1220 cm⁻¹ indicated Si-O-Si asymmetry stretching vibrations. The stretching vibration of the Si-O-Si symmetry was confirmed by characteristic band at 796 cm⁻¹. The MFI structure in zeolites were revealed at 451, 545 and 1222 cm⁻¹. The characteristic bands at 545 and 451 cm⁻¹ were corresponded

to the rocking vibrations [22]. The absorption band at 1099 cm⁻¹ were the asymmetric stretching vibrations of Si-O-Ti and the band at 1600 cm⁻¹ was the peak of the –OH vibrations from Si-OH, Ti-OH, TPAOH, and H₂O [23].

Optimization of Research Parameter

Carbon paste-IZ electrodes were prepared from a mixture of activated carbon powder, paraffin granule and IZ powder. The activated carbon used had a surface area of 984.330 m^2/g . The pore size of the carbon was 3.835 nm, this showed that the carbon was classified as mesoporous material [24]. IZ served to increase the electrode selectivity to glucose.

In accordance with the composition in Table 1, the electrodes showed the optimum performance, namely E6 which was fabricated with a mass ratio of carbon, paraffin and IZ of 9:7:4. The indicator used to determine the electrode performance was the Nernst factor value which approached the theoretical value (59.2/n mV) [25]. The E6 showed a Nernst factor of 24.83 mV/decade. Table 2 presented Nernst factor and measurement range of electrode and linearity of the calibration curve of glucose solution.

TABLE 2. Data of electrode measuring range, Nernst factor, and linearity of calibration curve of glucose solution at pH 7

Electrode	Linear dynamic range	Nernst	Factor Linearity
	(M)	(mV/decade)	(r)
E1	$10^{-5} - 10^{-2}$	21.11	0.998
E2	$10^{-5} - 10^{-2}$	16.57	0.865
E3	$10^{-5} - 10^{-2}$	17.28	0.858
E4	$10^{-5} - 10^{-2}$	22.21	0.947
E5	$10^{-5} - 10^{-2}$	21.65	0.919
E6	$10^{-5} - 10^{-2}$	24.83	0.986
E7	$10^{-5} - 10^{-2}$	23.71	0.957

In this study, the pH optimization of the solution was carried out to determine the effect of acid and base conditions on the measurement of glucose solution. In an alkaline media, glucose was present as an open chain carboxylic ion whereas in an acidic media glucose turned into lactone. The pH optimization was carried out by measuring the potential of a 10^{-8} - 10^{-2} M glucose solution with a pH of 5, 6, 7, and 8 using the E6 electrode (Fig. 3). The measurement of glucose solution using E6 at a pH 7 obtained the Nernst factor 28.6 mV/decade. This value is closest to the theoretical value. Glucose is a divalent molecule, so that theoretically it will produce a Nernst factor of 29.6 mV/decade [26].



FIGURE 3. Plot electrode potential and log[Glucose] at varying pH

In order to know the effect of the mold on the performance of the IZ modified electrodes, zeolite (EZ) and NIZ (ENIZ) modified electrodes with the same composition as the E6 electrodes were fabricated and applied to measure glucose standard solution. Data of the electrodes potential the E1, E6, EZ, and ENIZ on measurements of standard glucose solutions and the Nernst factor were shown in Table 3.

	Potential (mV) of the electrode						
[Glucose] (M)	E1	E6	ENIZ	EZ			
10-5	102.5	793	976	977			
10^{-4}	103.8	833	985	988			
10 ⁻³	127.7	852	1083	935			
10-2	146.5	882	1035	1028			
Nernst factor	15.6	28 6	27.5	10.0			
(mV/decade)	13.0	28.0	27.3	10.0			

TABLE 3. Data of electrode potential and Nernst factor using E1, E6, EZ, and ENIZ

Performance of The Electrode and Method Validity

The results of glucose analysis using E6 at pH 7 provided a measurement range of 10^{-5} - 10^{-2} M with a Nernst factor value of 28.6 m/ decade and a response time of 8.9-21.5 s. The response time of E6 was faster than that of non-enzymatic sensor based on the poly (o-phenylenediamine) [27] and previous research of imprinted zeolite-based electrode [7].

The electrode detection limit was the lowest or highest concentration that could be responded by electrode. The detection limit was determined from the intersection of linear curve with non-linear curve on the plot of log [glucose] and electrode potential. In this study, the linear equation obtained was y = 18.6x + 940.1 and the nonlinear equation was $y = 14.66x^2 + 172x + 12866$. From the both equations obtained the lower detection limit was 4.79×10^{-5} M. The value of the measurement range and detection limit explained that the potentiometric method using imprinted zeolite modified carbon paste electrodes in this study could be used for glucose analysis with a normal concentration to glucose concentrations of diabetics [16].

In this study, precision was expressed by the coefficient of variation (CV). At concentrations of 10^{-5} - 10^{-2} M, the CV values were 0.92%-4.89%. The CV value was better than the limit set by AOAC [28].

Electrode selectivity tests were carried out through the application of electrodes for measurement of urea, uric acid, and creatine solutions. Electrode selectivity was expressed by the coefficient of selectivity ($K_{i,j}^{pot}$) which was calculated using matched potential methods (MPM). The coefficient of selectivity value in Table 4 showed that zeolite modified electrodes had a higher selectivity to glucose (i) than uric acid, urea and creatine (j).

Solution	Concentration (M)	$\mathbf{K}_{i,j}^{\text{pot}}$				
Solution	Concentration (MI)	Bare carbon paste	Carbon paste-IZ			
	10-5	0.96	2.35x10 ⁻⁶			
Uria agid	10 ⁻⁴	0.99	4.04×10^{-6}			
Une aciu	10 ⁻³	1.12	$4.67 \text{x} 10^{-6}$			
	10 ⁻²	1.31	4.75x10 ⁻⁶			
	10-5	1.39	9.77x10 ⁻⁷			
Linco	10^{-4}	2.14	2.37×10^{-7}			
Urea	10-3	2.29	1.24×10^{-6}			
	10-2	2.45	1.46×10^{-6}			
	10-5	1.18	6.49x10 ⁻⁷			
Creating	10 ⁻⁴	1.23	7.87x10 ⁻⁷			
Creatine	10 ⁻³	1.34	1.08×10^{-6}			
	10 ⁻²	1.39	1.24×10^{-6}			

TABLE 4. Selectivity coefficient $(K_{i,j}^{pot})$ of electrode on uric acid, urea and creatine solution

Accuracy test was used to determine whether the potentiometric using developed electrode is as good as spectrophotometric, the commonly used method for determining blood glucose levels in the medical field, while the recovery test was intended to see whether there is interference caused by the sample matrices. The accuracy value obtained from the analysis of five blood samples in this study was $90.58\pm4.65\%$ (Table 5). This value was slightly lower than the accuracy range accepted for an analysis method according to the Association of Official Analytical Chemist (AOAC) [28]. The recovery of potentiometric methods using carbon paste-IZ electrodes was (91.73 ± 3.48)% (n=5). This value fulfilled the criteria of a chemical analysis method according to AOAC [28]. Based on the recovery value and accuracy, it was assumed that there are several components in blood samples that have the

potential to interfere	e with glucose	analysis s	such as	fructose,	sucrose,	maltose	[29]	and	ions	$(Na^+,$	Cŀ,	Κ ⁺ ,	PO_4^{3-} ,
$SO_4^{2-}, NH_4^+)$ [30].													

IABLE 5. Data accuracy and <i>recovery</i> potentiometry method to analyse blood glucose				
Sample	Glucose concentration (M)		Accuracy	Recovery
	Potentiometry	Spectrophotometry	(%)	(%)
Glucose 10 ⁻³ M	9.28x10 ⁻⁴	-	-	-
Serum sample 1	4.86x10 ⁻³	5.62x10 ⁻³	86.53	-
Serum sample 1 + Glucose 10 ⁻³ M	5.71x10 ⁻³	-	-	91.59
Serum sample 2	4.94×10^{-3}	$5.44 \text{x} 10^{-3}$	90.79	-
Serum sample2 + Glucose 10 ⁻³ M	5.84x10 ⁻³	-	-	96.98
Serum sample 3	4.63x10 ⁻³	4.76x10 ⁻³	97.27	-
Serum sample 3 + Glucose 10 ⁻³ M	5.44x10 ⁻³	-	-	87.28
Serum sample 4	9.07x10 ⁻³	9.81x10 ⁻³	92.40	
Serum sample 4 + Glucose 10 ⁻³ M	9.92 x10 ⁻³			92.10
Serum sample 5	10.57x10 ⁻³	12.40x10 ⁻³	85.90	
Serum sample 5 + Glucose 10 ⁻³ M	11.41x10 ⁻³			90.70

TABLE 5. Data accuracy and recovery potentiometry method to analyse blood glucose

Electrode life time was investigated to know the stability of the electrodes. The life time of electrodes depended on the mechanical properties of an electrode material. This mechanical property was influenced by the flexibility of the material, the pH and the level of solubility of the material. Imprinted zeolite modified carbon paste electrodes presented a good performance up to 9 weeks (130 times usage). This life time was longer than the previous research [7, 13].

CONCLUSION

Imprinted zeolite modified carbon paste electrode showed a wide measurement range, low detection limit, fast response time and long life time. The developed electrode recognized selectively the presence of glucose compared to urea, uric acid and creatine in solution. Comparison of potentiometry with spectrophotometry as a commonly used method for blood glucose analysis in medical field, it showed an accuracy of 90.58±4.65% (n=5). Based on the electrode performance, potentiometry using the carbon paste-IZ electrode is recommended as an alternative method for routine analysis of blood glucose in the medical field.

ACKNOWLEDGEMENT

The authors thank to the Ministry of Research, Technology and Higher Education, Indonesia for the financial support of this study through PDUPT Grant No. 713/UN3.14/LT/2019 Universitas Airlangga and the Chemistry Department Universitas Airlangga for the laboratory facilities provided.

REFERENCES

- 1. G.G. Mohamed, T.A. Ali, M.F. El-Shahat, M.A. Migahed, and A.M. Al-Sabagh, Drug Test. Anal. 4,1009–1013 (2012).
- 2. Z. Heidari and M. Masrournia, J. Anal. Chem. 78(8), 824–831 (2018).
- 3. T.A. Ali, G.G. Mohamed, and G.A. Yahya, Iran. J. Pharm. Res. 16 (2), 498–512 (2017).
- 4. I. Svancara, A. Walcarius, K. Kalcher, K. Vytras, Cent. Eur. J. Chem. 7, 598-656 (2009).
- 5. D.M. Kim, J.M. Moon, W.C. Lee, J.H. Yoon, C.S. Choi, and Y.B. Shim, Biosens Bioelectron 91, 276–283 (2017).
- 6. L.M. Muresan, Pure Appl. Chem. 83(2), 325–343 (2011).

- 7. M. Khasanah, U.S. Handajani, A.A. Widati, A. Abdulloh, and R.R. Rindarti, Anal. Bioanal. Electrochem. **10(4)**, 429–438 (2018).
- 8. Q. Wu, H. Wang, and C. Yi, J. Photochem. Photobiol. A Chem. 356, 138–149 (2018).
- 9. D. Serrano, S. Rau'l, P. Patricia, and M. Ine's, RSC Adv. 11, 1407–1409 (2009).
- 10. A. Wroblewska, E. Makuch, and P. Miadlicki, Catal. Today 268, 121-129 (2016).
- 11. P. Yuan, D. Liu, W.B. Yu, M.W. Laipan, L.L. Deng, and F.R. Chen, J. Colloid Interface Sci. 462, 191–199 (2016).
- 12. M. Khasanah, M. Harsini, A.A. Widati, Indones. J. Chem. 13(2), 108–113 (2013).
- 13. A. Athiroh, T. Fadillah, D.F. Damayanti, A. Abdulloh, A.A. Widati, and M. Khasanah, "Carbon Paste Electrode Modified Imprinted Zeolite as a Selective Sensor for Creatine Analysis by Potentiometry" The 12th Congress of Indonesian Soc. for Biochemistry and Molecular Biology in Conjunction With The 2nd Int. Conf. "Collaboration Seminar of Chemistry and Industry (CoSCI)" and An Micro Workshop IOP Proceeding Conference series: Earth and Environmental 217(1), Ali Rohman, M.Si, Ph.D *et al* (IOP Proceeding Conference series: Earth and Environmental, (2019), 1-8.
- 14. S. Rahmadhani, H. Setiyanto, and M.A. Zulfikar, Mater. Sci. Forum 936, 71–76 (2018).
- 15. L.C. Jiang and W.D. Zhang, Biosens. Bioelectron 25, 1402–1407 (2010).
- 16. J.L. Kee, E.R. Hayes, and L.E. McCuistion, A Patient Centered Nursing Process Approach, Ed 8, Elsevier Inc., Saunders (2015).
- 17. K. Tonyushkina and J.H. Nichols, J. Diabetes Sci. Technol. 4(3), 971-980 (2009).
- G.A. Eimer, I. Diaz, E. Sastre, G.S. Casuscelli, M.E. Crivello, E.R. Herrero, and J.P. Pariente, Appl. Catal. A 343, 77–86 (2008).
- 19. C. Qin, Y. Chen, J.M. Gao, Mater. 135, 123-126 (2014).
- 20. K. Tohda, D. Dragoe, M. Shibata, and Y. Umezawa, Anal. Sci. 17, 733-743 (2001).
- 21. M.M.J. Treacy, J.B. and Higgins, Collection of Simulated XRD Powder Patterns for Zeolites, (Structure Commision of the International Zeolite Association, 2001).
- 22. W. Nuni, E. Ratna, E., F. Hamzah and and D. Prasetyoko, Makara Sains 15(2), 135-147 (2011).
- 23. C.A. Rios, C.D. Wiliams, and M.A. Fulen, Appl. Clay Sci. 42, 446–454 (2009).
- 24. T. Ariyanto, I. Prasetyo, I., and Rochmadi, Jurnal Penelitian 14(1), 25-32 (2012).
- 25. D.A. Skoog, D.M. West, F.J. Holer, and S.R. Crouch, Fundamental of Analytical Chemistry, 9th Edition (Brooke/Cole, Cengange Learning Inc. 2014).
- 26. S. Park, H. Boo, and T.D. Chung, Anal. Chim. Acta 556(1), 46-57 (2006).
- 27. J. Wang, M. Wang, J. Guan, C. Wang, and G. Wang, Mater. Sci. Eng. C. 71, 844-851 (2016).
- 28. I. Taverniers, M.D. Loose, and E.V. Bockstaele, Trends Anal. Chem. 23, 535-552 (2004).
- 29. Z. Amani-Beni, and A. Nezamzadeh-Ejhieh, J. Colloid Interface Sci. 504, 186-196 (2017).
- 30. J.E. Hall, Textbook of Medical Phisiology Ed 13. (Elsevier Inc., Philadelphia, 2016).