Review of: "Critical Review on Carbon Nanomaterial Based Electrochemical Sensing of Dopamine the Vital Neurotransmitter"

Gilbert Ringgit[1]

1 Biotechnology Research Institute, Universiti Malaysia Sabah, Malaysia

Potential competing interests: No potential competing interests to declare.

Comment to Author Manuscript (Qeios)

Dear Author(s)

Thank you for opportunity given for reviewing manuscript,**Critical Review on Carbon Nanomaterial Based Electrochemical Sensing of Dopamine the Vital Neurotransmitter**. I appreciate the work you have put into this study and am pleased to offer feedback that I hope will help refine and improve the manuscript.

Positive Aspects:

- Your research addresses an important topic within electrochemical sensing of dopamine.
- The structure of the manuscript is coherent, and the argument is generally well developed.
- The data you present offers valuable insights into application of carbon nanomaterials.

Suggestions for Improvement:

- The research should focusing on carbon nanomaterial based electrochemical sensing of dopamine. Provide less general information.
- Please provide reference for the respective statements.
- Provide a comparative study of this research and previous findings.

These suggestions are intended to be constructive, and I hope you take consideration on comments given.

Page	Line	Comment
Abstract		
		First 1-2 sentences should introduce on your main review. Suggestion: Significance review on electrochemical sensor of dopamine based on carbon nanomaterials. Then relate it with dopamine. Discussion on dopamine should lesser since author focusing on electrochemical sensor of dopamine and carbon nanomaterials.
		What is the limitation of available diagnostic methods?
		How authors collecting data? What data/information authors want to discuss?

		"While studies related to electrochemical sensing of dopamine have shown promising advancements in terms of simplicity, speed, and sensitivity, there remains a notable gap in their application for clinical studies." The review strength or purpose should put after introduction on electrochemical sensor of dopamine and carbon nanomaterials.
1. Introduction		
		Introduction on dopamine is well covered but there is no introduction on electrochemical sensor of dopamine and carbon nanomaterials or related. Suggestion: Added 1-2 paragraph on electrochemical sensor of dopamine and carbon nanomaterials or related.
		Discuss on the limitation of available diagnostic methods.
		Add one paragraph on purpose review and who get benefits on reading this review and future direction.
2. Dopamine diagnosis and clinical significance		
		"The existing methods for dopamine detection are complex, requiring rigorous sample preparation, including blood-plasma separation, specialized laboratory equipment, skilled workers, and high reagent costs." Provide citation.
		"…detection methods. While these analytical sensing procedures offer various advantages, such as sensitivity and specificity, many are expensive, time-consuming, involve complex pre-treatment steps, use hazardous substances, and do not provide continuous analysis." Provide citation.
		ELISA diagnostic kits should be put together with other advances in techniques since manuscript discussing on electrochemical sensor. Put disadvantages on available method and advantages on electrochemical method.
		Tally advantages on electrochemical method with the application of carbonaceous nanomaterials (CNs).
3. Outline of electrochemical sensing methods		
		First paragraph should focus on electrochemical sensor with carbonaceous nanomaterials of dopamine or related.
		List all the electrode involved and different among them.
		What sample been detected?
		Discuss each of factor influences the sensor process. How many electrode been used for one complete running system?
		What fabrication method? How many element or modification involved? Give example of modified electrode, performance, or LOD for specific dopamine sensor.
		"The potential advantages of electrochemical sensing over other detection techniques include susceptibility to miniaturization, cost-effectiveness, delivery of both quantitative and qualitative results, low detection limits, an extensive

		linear response range, reliability, and reproducibility” Numerous studies on this research. Add 2-3 recent references focusing on advantages.
		What difference between those electroanalytical techniques?
		“Among these techniques, cyclic voltammetry, fast-scan cyclic voltammetry (FSCV), and differential pulse voltammetry are particularly prevalent in dopamine sensing approaches.” Provide citation.
		“…optimized to achieve the best electrochemical response..” What parameters involved among techniques?
		“…molecule adsorbed onto an electrode..” What mechanism adsorption and briefly explain the process.
		“..measurement of rapid changes in electroactive biomolecules..” Briefly explain changing process.
		“..lower detection limits, and its capability to differentiate between analytes.” Explain limit of detection and interfering study?
3.1. Electrochemical sensing of dopamine		
		“Biosensors utilize enzymes as recognition..” List all the receptor that been performed including enzymes in biosensor.
		“…enzyme tyrosinase (Tyr), also known as polyphenol oxidase (PPO)..” Provide research finding to claim these.
		“..non-biologically active elements as..”

		Give example chemical been used.
		“Recently, non-enzymatic sensors have been perceived to overcome the limitations of enzymatic sensors, such as high cost, complex production procedures, and short shelf lives. Provide citation.
		“…widely employed as selective sensing platforms for dopamine and other neurotransmitters.’ Provide citation.
		“A variety of inorganic or organic materials..” Give example.
		“…particularly those based on carbon nanomaterials.” Add one paragraph on carbon nanomaterials for detecting dopamine or related.
		“…catalytic affinity, expand reaction space, and mitigate the influence of interferences.” Provide citation.
		“..numerous studies focusing on the..” Authors wrote numerous studies but one reference only.
4. Carbonaceous nanomaterials in electrochemical sensing		
		“Carbon exhibits a diverse array of properties owing to its various allotropes and structures, characterized by sp, sp2, or sp3 hybridization. The ability of carbon orbitals to hybridize in these configurations gives rise to numerous natural (such as diamond, amorphous carbon, and graphite) and synthetic allotropes (including graphene, carbon nanotubes, fullerenes, etc.)” Provide citation.
		“…by enhancing electron transfer kinetics.” Any advantage than electron transfer kinetics?

		"..including single-walled carbon nanotubes (SWCNTs), double-walled carbon nanotubes (DWCNTs), and multi-walled carbon nanotubes (MWCNTs)," Provide references.
		"…its remarkable electrical conductivity stemming from its sp2 hybridization energy and its delicate atomic structure (0.345 nm)." Provide references.
		"..electrochemical sensors to improve the electrochemical detection of Neurotransmitters." Provide mechanism graphene with modification.
		"For example, doping graphene or CNTs with heteroatoms such as N, P, B, S, Cl, and Si can introduce defects in the ends and sidewalls, thereby tuning their electrocatalytic activity and enhancing their ability to sense dopamine." Provide mechanism.
		"…of carbonaceous materials, surface modification, electrode attachment method, and the incorporation of electron Mediators." Provide procedure detection.
		"…physicochemical properties and microstructural features.." What differences between those techniques?
4.1. Graphene & CNTs based electrochemical sensors for dopamine		
		"Comprehensive data.." Add spiking analysis or reproducibility study in percentage. And agreement with conventional method.
		Provide data on method, type of sample and LOD for respective findings.
		Application of GO and MW should be in two paragraph.
		"..detection of AA, DA, and UA.."

		How these inferring the system.
		"…pulse voltammetry (DPV) demonstrated excellent linearity over a wide concentration range for each analyte, with low detection limits of 0.70 μM for DA, 22.20 μM for AA, and 0.36 μM for UA." Provide citation.
		"…negligible interference from various inorganic compounds." What the sample?
		"…low detection limits of 30 nM for DA and 40 nM for UA." Why Da lower than UA?
		"…novel nanohybrid material composed.." Provide clear introduction on this material related to dopamine before discuss on previous findings.
		"…relative standard deviation (RSD) under optimized working condition." What is RSD in this research?
		"…good dopamine electrocatalytic oxidation," What is sample test?
		"Graphene quantum dots (GQDs), recognized for their distinctive structural.." What are LOD and sample test? Similar comment on other electrodes. Each electrode discuss in one paragraph.
		Add one paragraph focusing on the improvement of graphene among others.
		Add one section for biosensor (aptamer-based) and one section for chemical sensor.
		"..neutral buffer solution." What is buffer?

		"…while nanoholes on the pGO plane supported electron transfer to GNP surfaces, enhancing electrochemical-redox signals." What are sample test and LOD?
4.2. Carbon nanotube-based electrochemical sensors for dopamine with interferences		
		Give justification on interferences discussion on this section. Since interference is part of performance. Suggestion: Discuss in performance section.
5. Future challenges and perspective		
		Discussion should focus on the main point of manuscript. Suggestion: Discuss on monitoring dopamine with electrochemical sensors with difference performance of nanomaterial. How dopamine as a target react with any modification? Any change on synergistic effect or mechanical challenge among receptor and target?
6. Summary		
		The summary is well presented.
Table		
		Include Recovery (%) for all sensors.