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Madan Rajbanshi

Madan Rajbanshi

Declaration

I hereby declare that his thesis entitled **"Understanding the Target Analyte Interaction for the Design and Development of Efficient Optical Sensor: A Combined Photophysical and Theoretical Analysis"** embodies my original research work, conducted under the supervision of Dr. Sudhir Kumar Das, at the Department of Chemistry, University of North Bengal.

The work presented in this thesis results from my independent investigation and reflects my efforts and understanding of the subject matter. All the data, results, and conclusions presented in this document are based on genuine research findings and have not been previously submitted for any other degree or qualification at this or any other institution.

I affirm that the content of this thesis is the result of my research work and is presented with the utmost honesty and integrity.

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समानो मन्त्रः समितिः समानी

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Certificate

It is certified that the work contained in the thesis titled "**Understanding the Target Analyte Interaction for the Design and Development of Efficient Optical Sensor: A Combined Photophysical and Theoretical Analysis**," by "**MADAN RAJBANSHI**," has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

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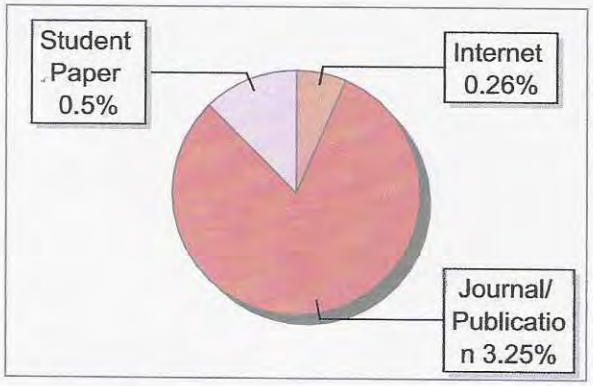
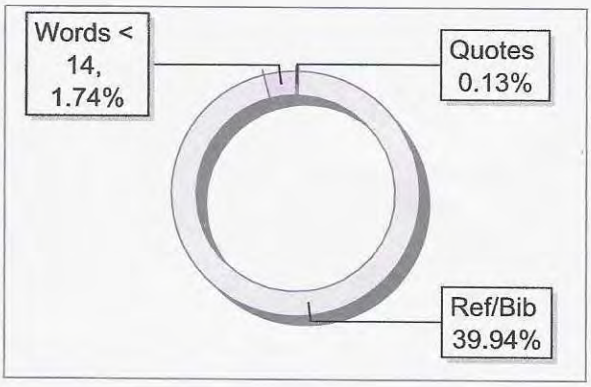
Author Name	Madan Rajbanshi
Title	Understanding the Target Analyte Interaction for the Design and Development of Efficient Optical Sensor: A Combined Photophysical and Theoretical Analysis
Paper/Submission ID	1454083
Submitted by	nbuplg@nbu.ac.in
Submission Date	2024-02-21 14:22:24
Total Pages	112
Document type	Thesis

Result Information

Similarity **4 %**





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Preface

I set off my journey for research work regarding to Doctor of Philosophy (Ph.D.) degree under the supervision of Dr. Sudhir kumar Das in 2019 in the Department of Chemistry, University of North Bengal (NBU). The thesis, entitled **"Understanding the Target Analyte Interaction for the Design and Development of Efficient Optical Sensor: A Combined Photophysical and Theoretical Analysis"** represents the termination of the journey to obtain the desired degree and the outcomes of several years of diligent study and investigation are gathered in this thesis. The date of registration for my Ph.D. program at NBU is 02/01/2019, vide letter no. Ph.D/Chem. (1722)/623/R-2023.

Here some optical sensors have been designed and developed and the whole thesis is an attempt to understand the interaction between the target analyte and sensor by measuring the change of some photophysical properties experimentally in the spectroscopic method. Further, these experimental results obtained from photophysical analysis have been correlated with theoretical calculations applying DFT.

Acknowledgment

I am incredibly grateful to my supervisor, **Dr. Sudhir Kumar Das**, for his important advice and mentorship throughout my research work. His vast knowledge and enthusiasm for science have motivated me to work well in the laboratory. I want to convey my sincere thanks to **Prof. Bhaskar Biswas**, Head of the Department of Chemistry, University of North Bengal for giving necessary resources, advice, and administrative help during my research. I am thankful to all my lab mates, especially **Manas Mahato, Ziaur Rahaman, Pallobi Sarkar, Tuhina Sultana, Najmin Tohora, Sabbir Ahamed,** and **Jyoti Chourasia**. I am also thankful to all other scholars of the department for their constant support and companionship. I want to convey thanks to my family members for their constant support during this challenging endeavor. I am also grateful to my friends **Somnath Karmakar, Litan Bhakta,** and **Kishalay Sharma** who helped, and my brother, **Bappa Debnath** supported me in various matters related to Research work. Without the collective assistance/ help and encouragement of these people and organizations, this thesis would not have been feasible.

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List of figures

T2CP, (5) TMP, (6) TIMEP, (7) TEP, (8)$POCl_3$, (9) Na_2HPO_4, (10) Na_3PO_4, (11) DCNP, (12) NaH_2PO_4, (13) TA, (14) TEA, (15) HCl, (16) BA, (17) MCE, (18) CH_3COOH, (19) BB, (20) 2CES, (21) 2CPS. **(b)** Change in fluorescence intensity of **MATC** in various concentrations (10^{-9} to 10^{-3} M) of DCP under a 365 nm UV light. **(c)** Photoluminescence response of **MATC** solution in conical flask test **(1)** in the absence and **(2)** presence of DCP vapor under 365 nm UV light radiations.

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