UNIVERSITI TEKNOLOGI MARA

$AgNO_3$ DEPENDENT MODULATION OF GLUCOSE MEDIATED RESPIRATION KINETICS IN *Escherichia coli* AT DIFFERENT pH AND TEMPERATURE

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Thesis submitted in fulfilment
of the requirements for the degree of
Master of Science
(Microbiology)

Faculty of Pharmacy

September 2019

ABSTRACT

Silver nitrate ($AgNO_3$) has been widely used as an antimicrobial agent. However, there is a lack of information on its microbial anti-physiologic role. Although it is known that $AgNO_3$ interferes with the microbial respiration, its action at various glucose concentration, pH and temperature has not been elucidated. Therefore, this study aimed to investigate the time dependent modulation of glucose mediated respiration of *E. coli* at different pH, temperature and various concentration of silver nitrate; concentration dependent impact of glucose upon the respiration of *E. coli*; and preferential binding of $AgNO_3$ upon the respiratory enzymes by computational methods. Clark type electrode was used to measure *E. coli* oxygen consumption. The physical state of the microbe was assessed using environmental scanning electron microscope. For the computational work, the academic version of MODELLER9v6 was employed. In the given concentration of bacterial suspension (1×10^8 CFU/mL), *E. coli* showed an increasing non-linear trend of tetra-phasic respiration between 1 to 133 μM glucose concentration within 20 minutes. Glucose concentrations above 133 μM did not result in linear increment in respiration, rather showed a partial inhibition at higher glucose concentrations (266-1066 μM). In the presence of glucose, $AgNO_3$ caused a concentration dependent (47-1960 μM) inhibition of the respiration rate within four minutes of its addition. The respiration rate was the highest at pH 7 to 8 and then was decreased on either side of this pH range. The inhibitory action of $AgNO_3$ upon bacterial respiration was the highest at 37 °C. The observations of the respiration data were well supported by the altered bacterial morphology as observed in electron microscopic study. Docking study indicated the $AgNO_3$ binding to different amino acids of all respiratory complex enzymes in *E. coli* and thereby explaining its interference with the respiratory chain. In conclusion, this study provided a composite insight into the anti-respiratory activity of $AgNO_3$ on *E. coli* in the presence of glucose at difference pH and temperature. This may be beneficial in optimizing the effect of silver-based medication for treatment of microbial infection. Further elucidation of the site of interaction between silver nitrate and microbial respiratory chain may be useful in understanding of microbial resistance.

ACKNOWLEDGEMENT

First and foremost, thanks to Allah Almighty for giving me the opportunity to embark on my Master study and for completing this long and challenging journey successfully. My heartiest gratitude goes to my supervisor Dr Minaketan Tripathy for all the guidance and valuable knowledge he shared, the encouragement and the endless motivational support he gave me to complete the programme. I also thank my co-supervisor Professor Dato' Dr Abu Bakar Abdul Majeed for his support of my research.

I am so indebted towards my fellow collaborators from Odisha, India namely Dr Biswaranjan Paital of Department of Zoology, NC Govt. College, Jajpur and Dr Sunil Kumar of Institute of Life Sciences, Bhubaneswar for sharing their knowledge in this research journey. My appreciation also goes to the Dean and staff members of the Imaging Centre, Faculty of Pharmacy, UiTM Puncak Alam for the use of the facilities during sample preparation and observation.

Special thanks to colleagues and friends for helping me with this research especially those from Faculty of Pharmacy, UiTM Puncak Alam for their useful advice, reminders and support throughout this journey together.

Finally, this thesis is dedicated to my mother [redacted] and my father Mr Radin Abd Halim bin Radin Ahmad for the vision and determination to educate me; my loving husband, Mr Ahmad Muzakkir bin Ahmad Tajuddin for his time and financial support; my daughter, Putri Nur Humairah who is 4 years old this year; my in-laws as well as to all my family members for their unconditional love and support throughout my study. This piece of victory is dedicated to all of you. Alhamdulillah.

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