UNIVERSITI TEKNOLOGI MARA

AgNO₃ DEPENDENT MODULATION OF GLUCOSE MEDIATED RESPIRATION KINETICS IN Escherichia coli AT DIFFERENT pH AND TEMPERATURE

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ABSTRACT

Silver nitrate (AgNO₃) 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 AgNO₃ 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 AgNO₃ 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 x 10⁸ 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 μ M). In the presence of glucose, AgNO₃ 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 AgNO₃ 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 AgNO₃ 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 antirespiratory activity of AgNO₃ 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.

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