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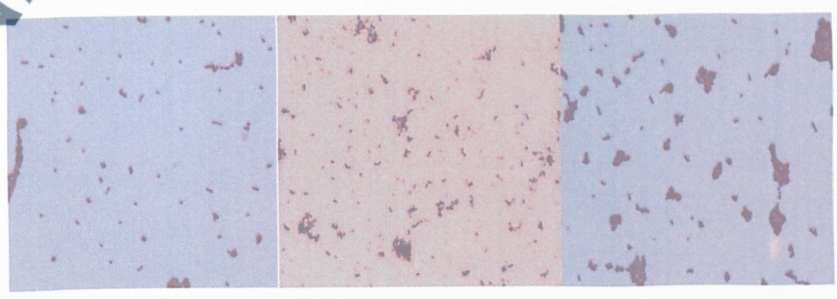
APPENDIX A

Figure 1: Honey samples which were used in this study

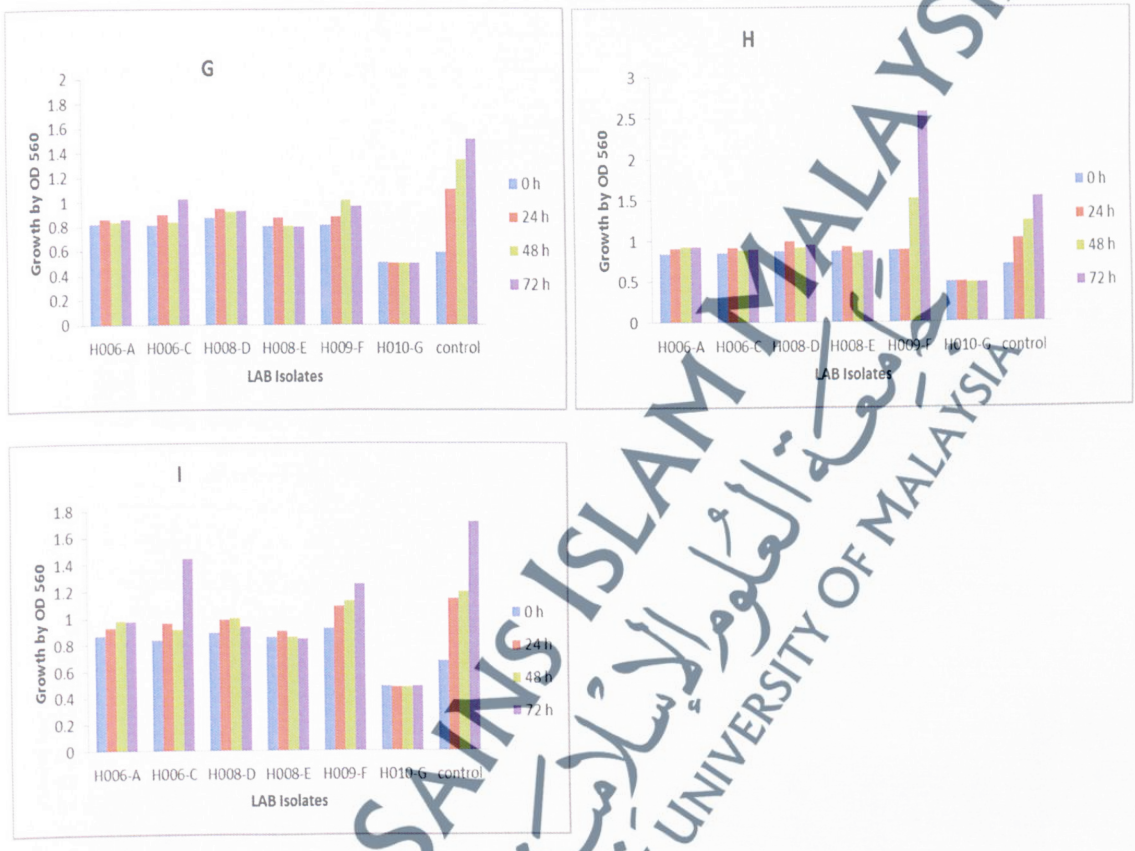
Figure 2: Lactic acid bacteria isolates form honey



APPENDIX B

Figure 1: Growth of pathogenic bacteria after inoculation with LAB supernatants monitored using biophotometer at OD 560 nm within 72h. A: *Staphylococcus aureus*, B: *Staphylococcus epidermis*, C: *Salmonella typhimurium*, D: *Serratia marcescens*, E: *Klebsiella pneumoniae*, F: *Escherichia coli*.

Figure 2: Growth of pathogenic bacteria after inoculation LAB supernatants using bio photometer at optical density 560 nm within 72h. G: *Bacillus subtilus*, H: *Shigella sonnei*, I: *Enterobacter aerogenes*.



APPENDIX C

Figure 1: Growth of pathogenic bacteria after inoculation LAB supernatants after adjusting ph to 3 using bio photometer at optical density 560 nm within 72h. A: *Staphylococcus aureus*, B: *Staphylococcus epidermis*, C: *Salmonella typhimurium*, D: *Serratia marcescens*, E: *Klebsiella pneumoniae*, F: *Escherichia coli*.

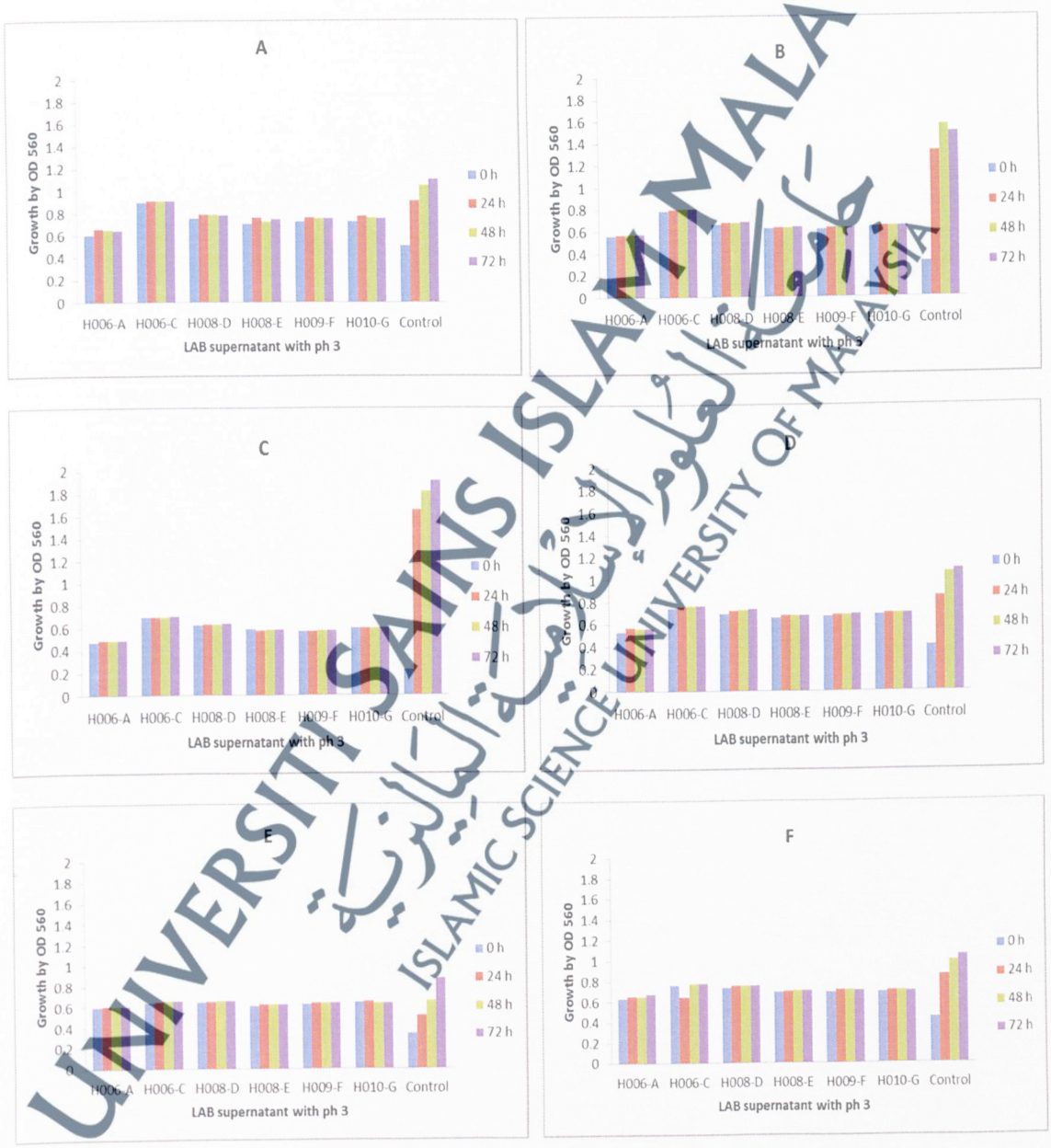


Figure 2: Growth of pathogenic bacteria after inoculation LAB supernatants after adjusting ph to 3 using bio photometer at optical density 560 nm within 72h. G: *Bacillus subtilus*, H: *Shigella sonnei*, I: *Enterobacter aerogenes*.

APPENDIX D

Figure 1: Growth of pathogenic bacteria after inoculation LAB supernatants after adjusting ph to 5 using bio photometer at optical density 560 nm within 72h. A: *Staphylococcus aureus*, B: *Staphylococcus epidermis*, C: *Salmonella typhimurium*, D: *Serratia marcescens*, E: *Klebsiella pneumoniae*, F: *Escherichia coli*.

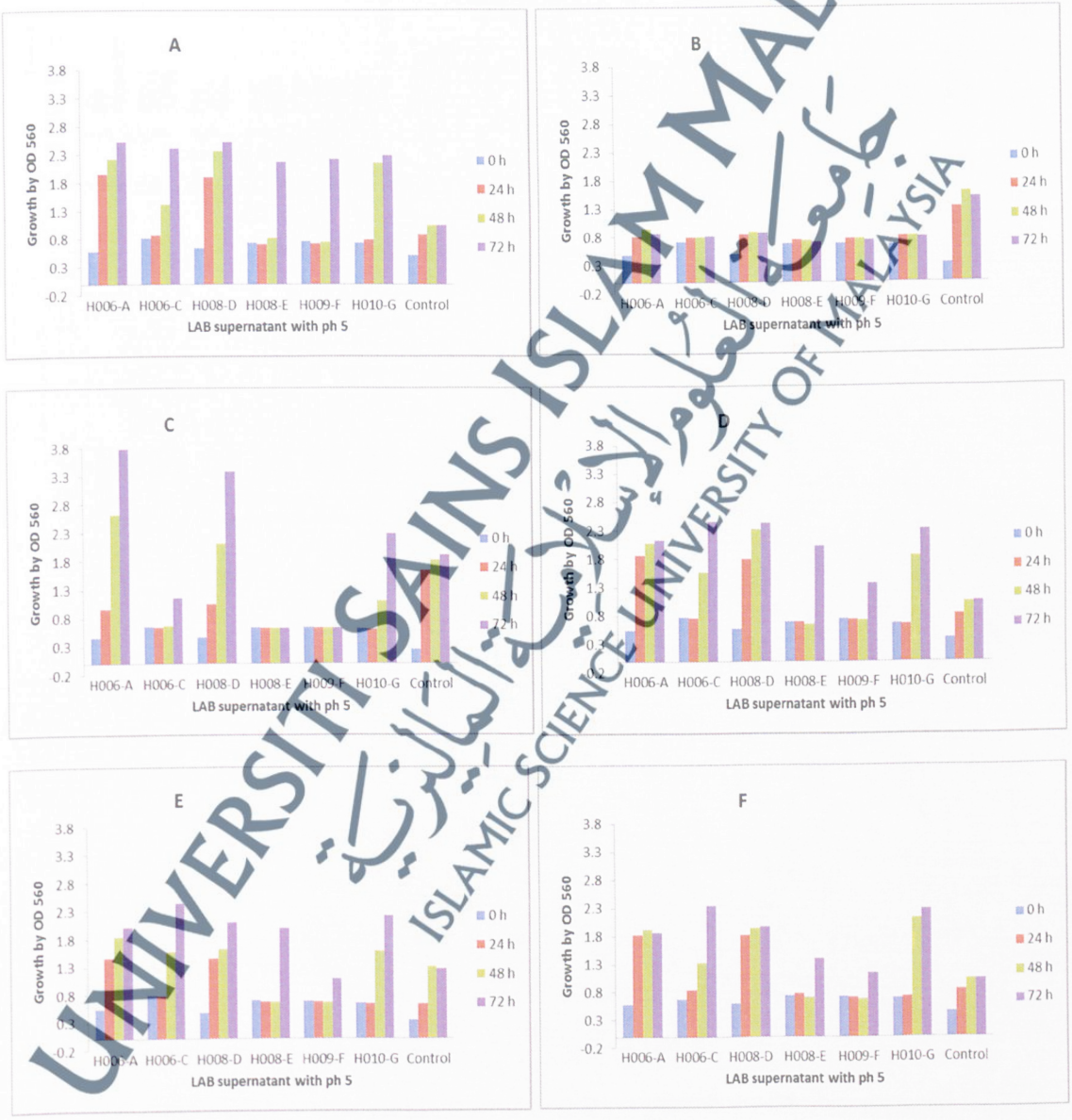
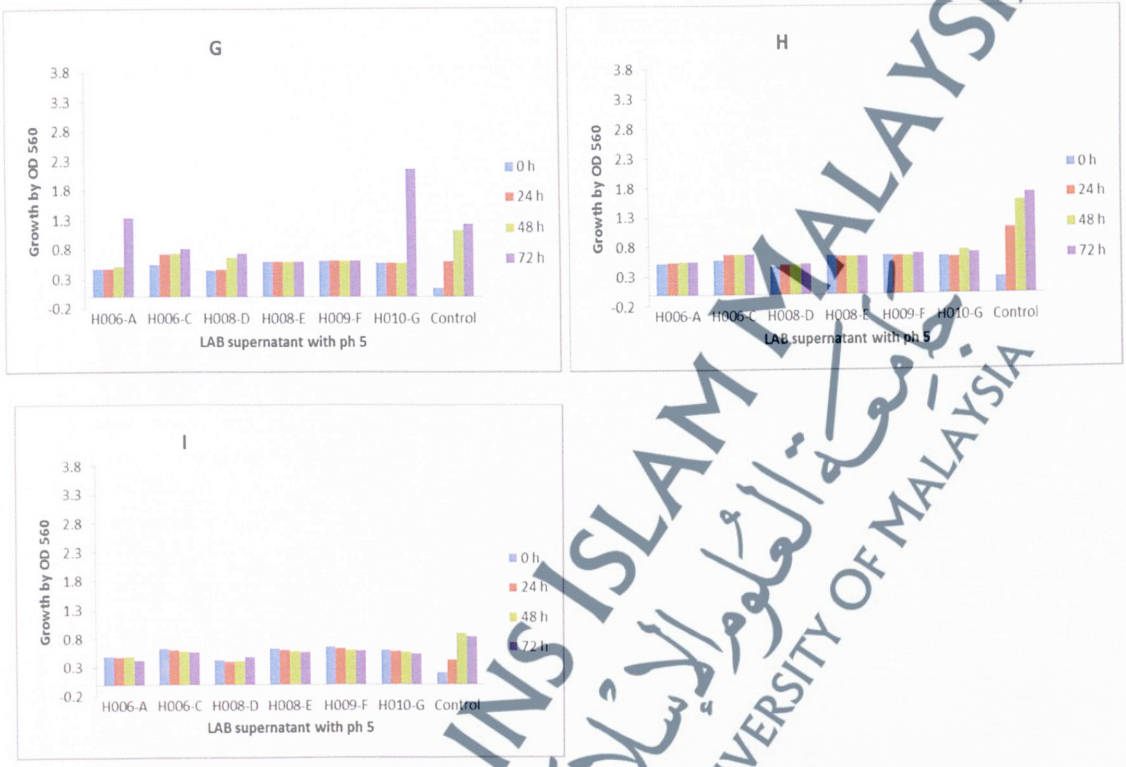


Figure 2: Growth of pathogenic bacteria after inoculation LAB supernatants after adjusting ph to 5 using bio photometer at optical density 560 nm within 72h. G: *Bacillus subtilus*, H: *Shigella sonnei*, I: *Enterobacter aerogenes*.



APPENDIX E

Figure 1: Growth of pathogenic bacteria after inoculation LAB supernatants after enzymatic treatment with proteinase K using bio photometer at optical density 560 nm within 72h. A: *Staphylococcus aureus*, B: *Staphylococcus epidermis*, C: *Salmonella typhimurium*, D: *Serratia marcescens*, E: *Klebsiella pneumoniae*, F: *Escherichia coli*.

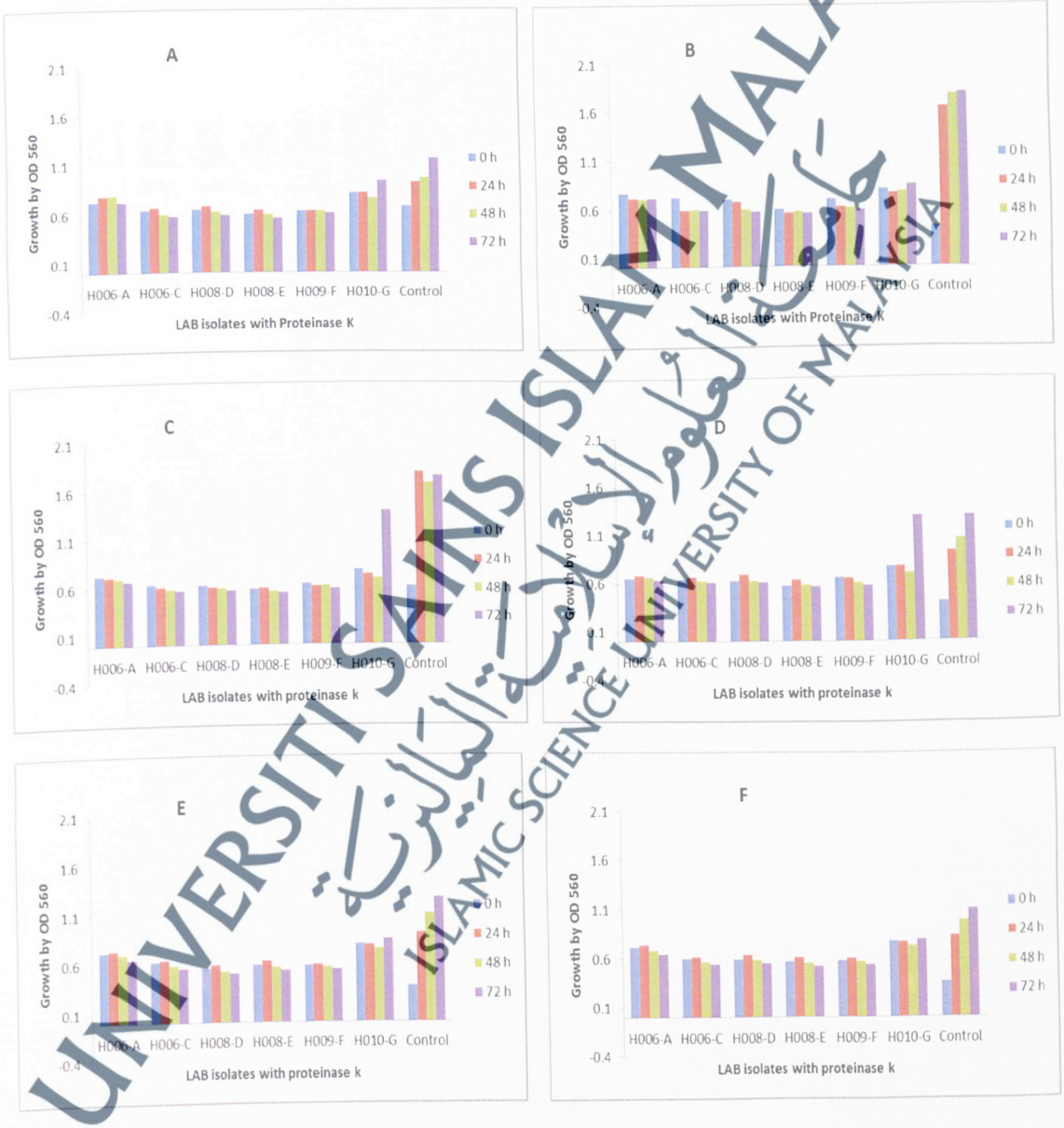
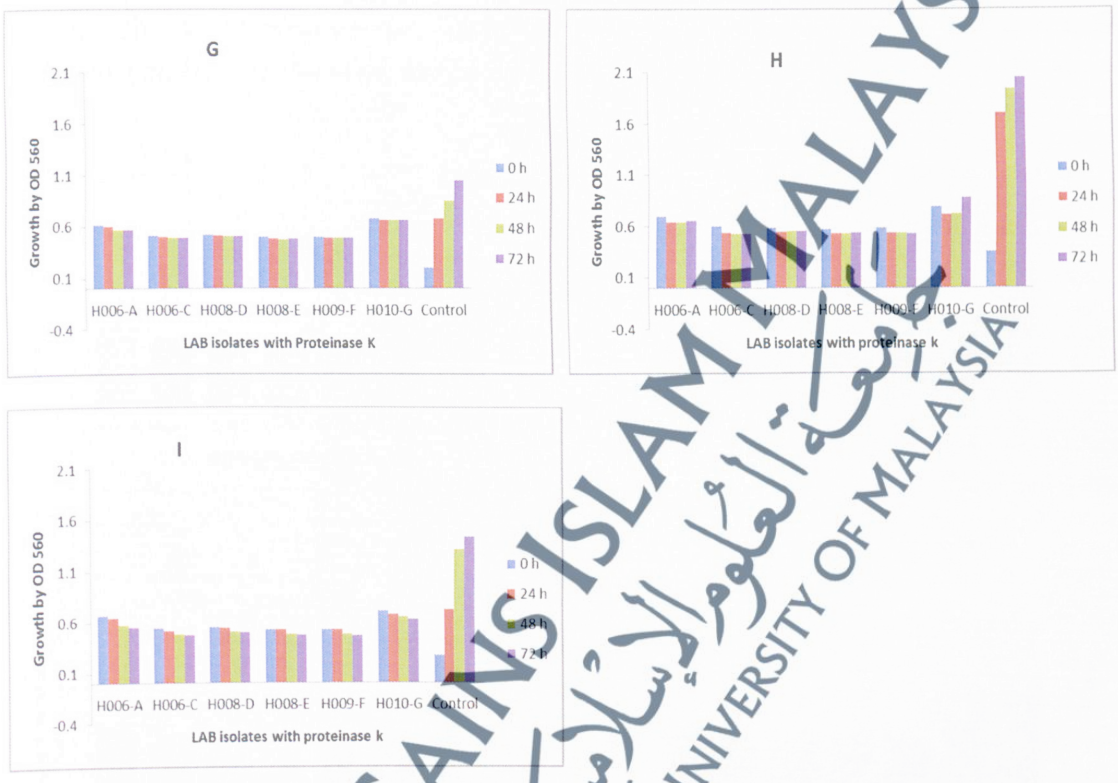


Figure 2: Growth of pathogenic bacteria after inoculation LAB supernatants after enzymatic treatment with proteinase K using bio photometer at optical density 560 nm within 72h. G: *Bacillus subtilus*, H: *Shigella sonnei*, I: *Enterobacter aerogenes*.



APPENDIX F

Figure 1: Growth of pathogenic bacteria after inoculation LAB supernatants after enzymatic treatment with proteinase K using bio photometer at optical density 560 nm within 72h. A: *Staphylococcus aureus*, B: *Staphylococcus epidermis*, C: *Salmonella typhimurium*, D: *Serratia marcescens*, E: *Klebsiella pneumoniae*, F: *Escherichia coli*.

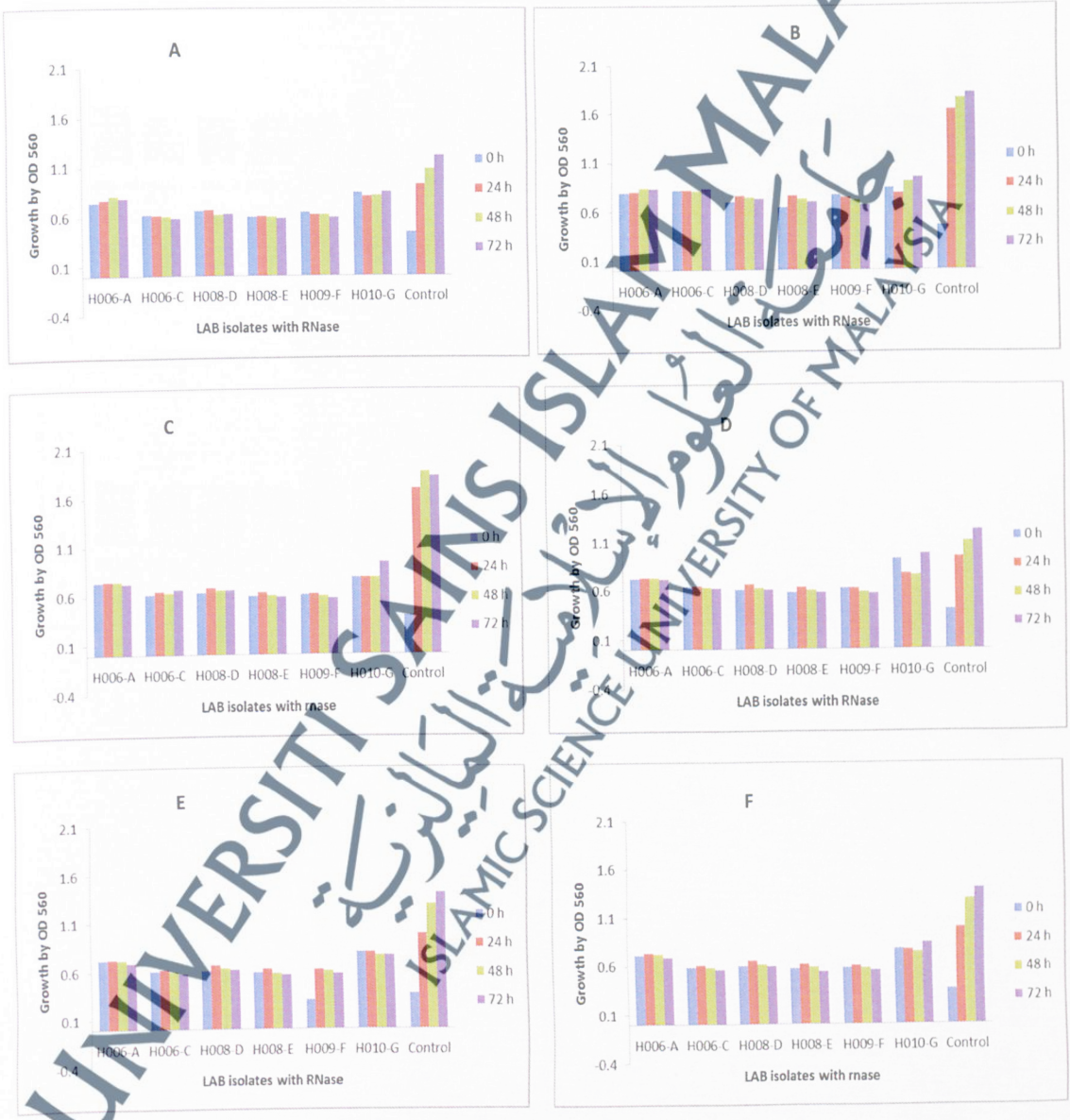
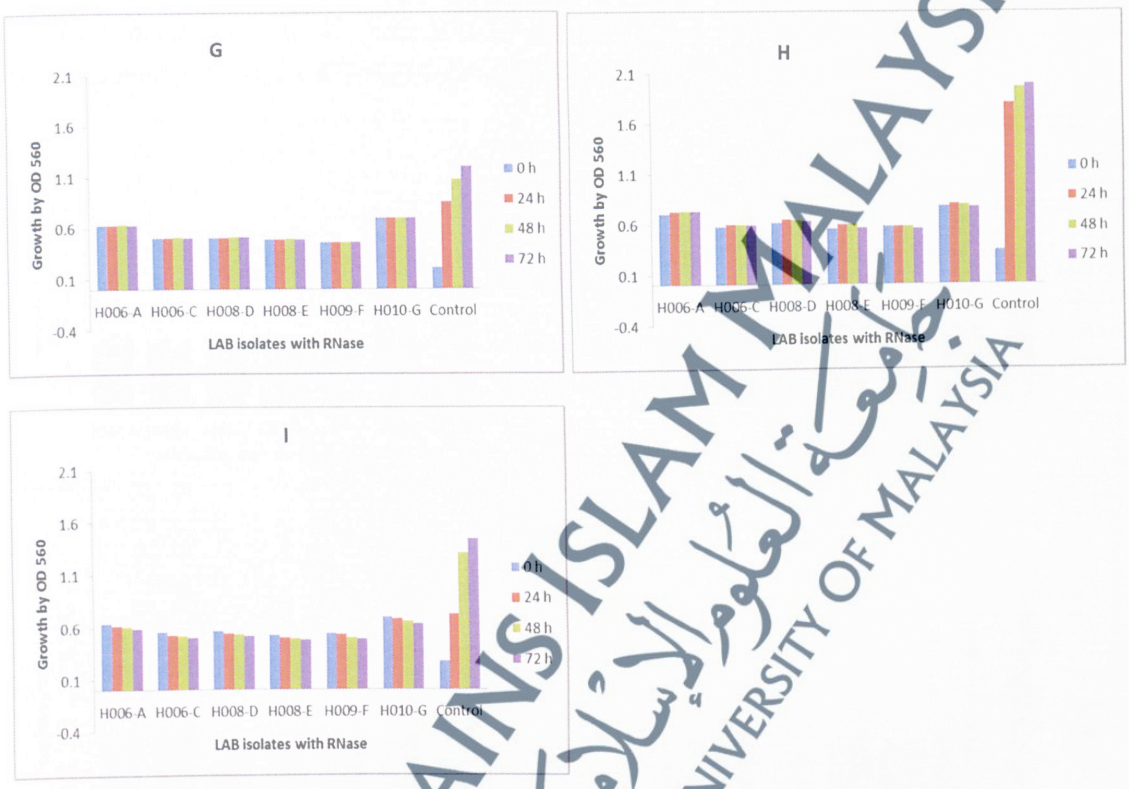


Figure 2: Growth of pathogenic bacteria after inoculation LAB supernatants after enzymatic treatment with proteinase K using bio photometer at optical density 560 nm within 72h. G: *Bacillus subtilus*, H: *Shigella sonnei*, I: *Enterobacter aerogenes*.



APPENDIX G

Figure 1: Growth of pathogenic bacteria after inoculation LAB supernatants after heat treatment at 90 °C for 1 h using bio photometer at optical density 560 nm within 72h. A: *Staphylococcus aureus*, B: *Staphylococcus epidermis*, C: *Salmonella typhimurium*, D: *Serratia marcescens*, E: *Klebsiella pneumoniae*, F: *Escherichia coli*.

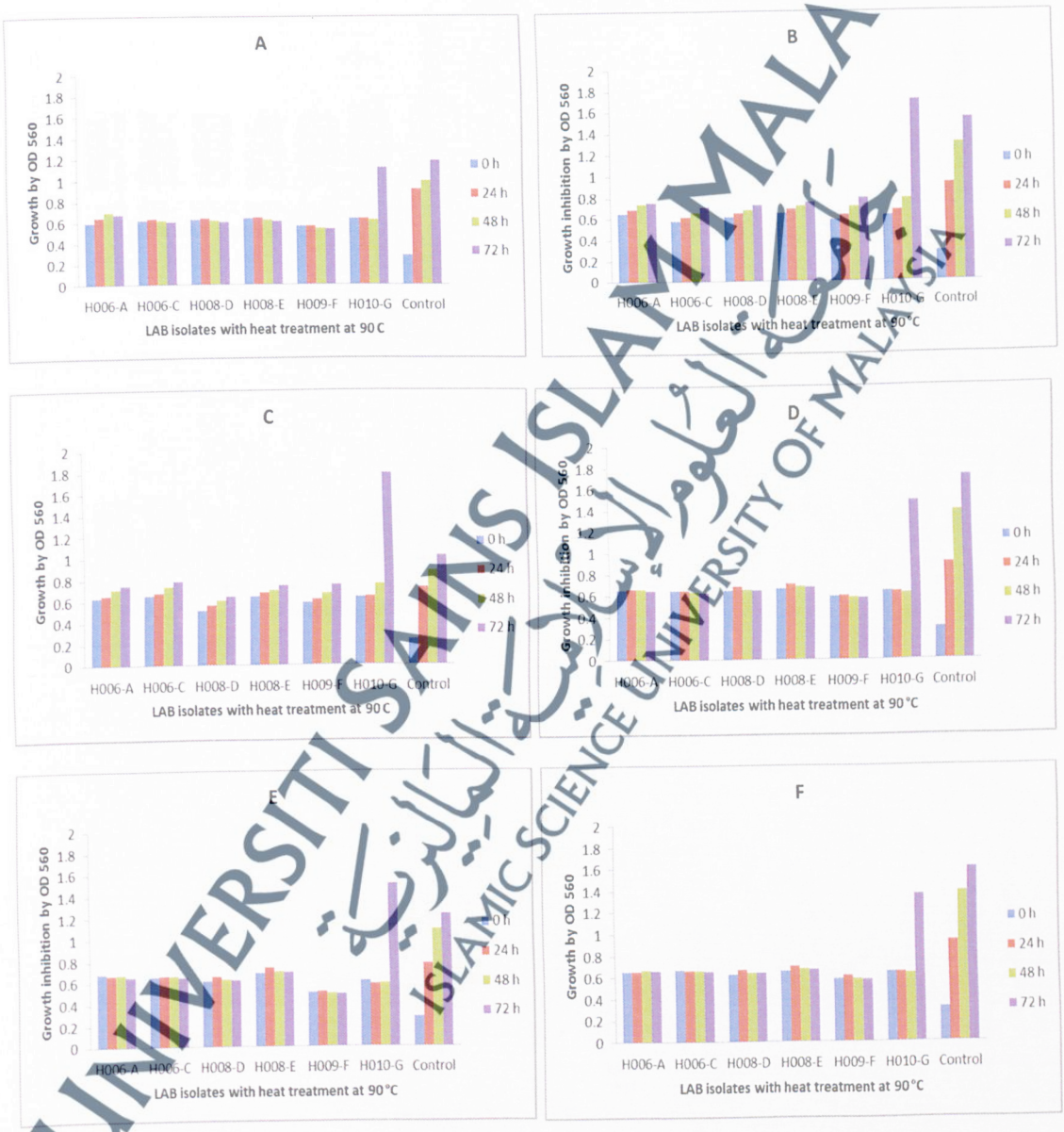
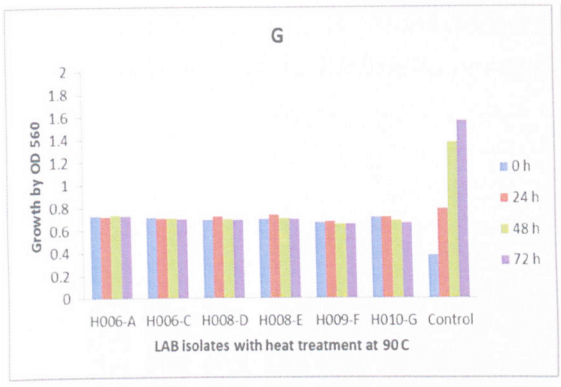
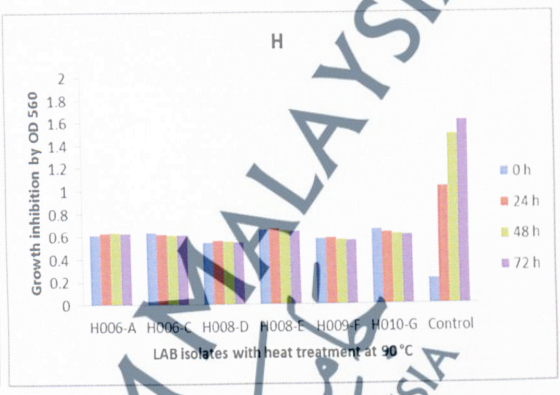
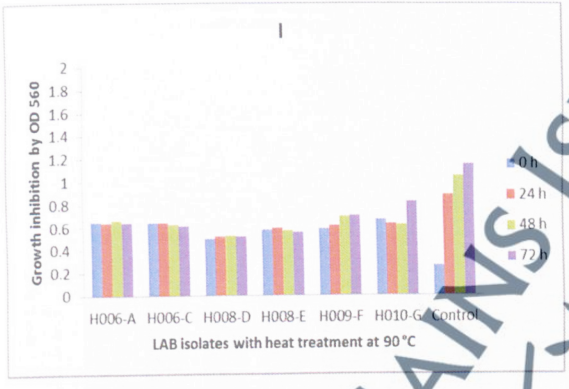


Figure 2: Growth of pathogenic bacteria after inoculation LAB supernatants after heat treatment at 90 °C for 1 h using bio photometer at optical density 560 nm within 72h. G: *Bacillus subtilus*, H: *Shigella sonnei*, I: *Enterobacter aerogenes*.

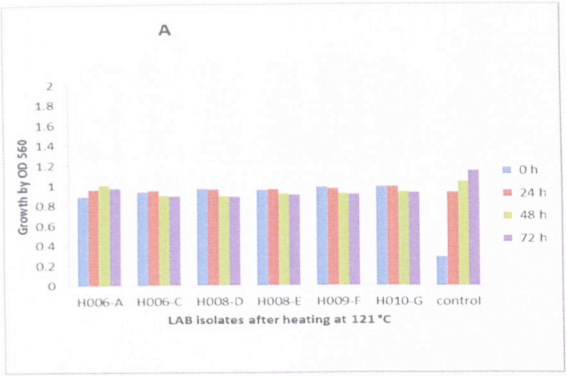


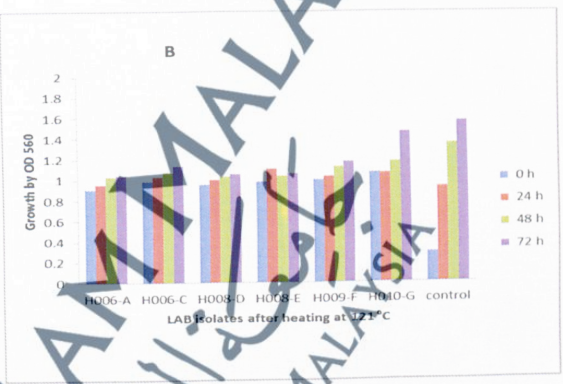


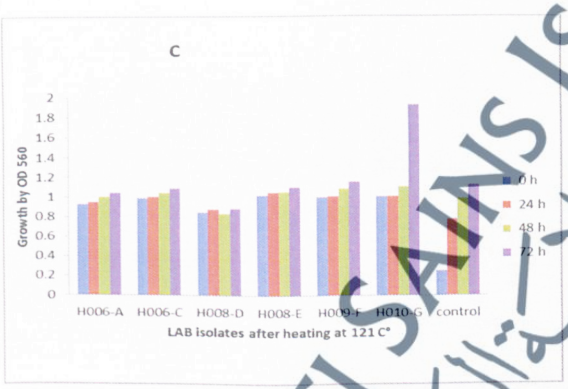


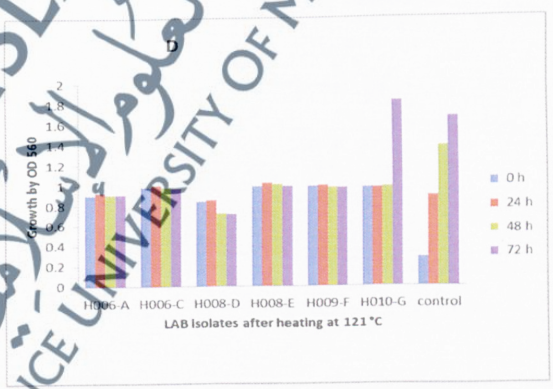
APPENDIX H

Figure 1: Growth of pathogenic bacteria after inoculation LAB supernatants after heat treatment at 121 °C for 1 h using bio photometer at optical density 560 nm within 72h. A: *Staphylococcus aureus*, B: *Staphylococcus epidermis*, C: *Salmonella typhimurium*, D: *Serratia marcescens*, E: *Klebsiella pneumoniae*, F: *Escherichia coli*.









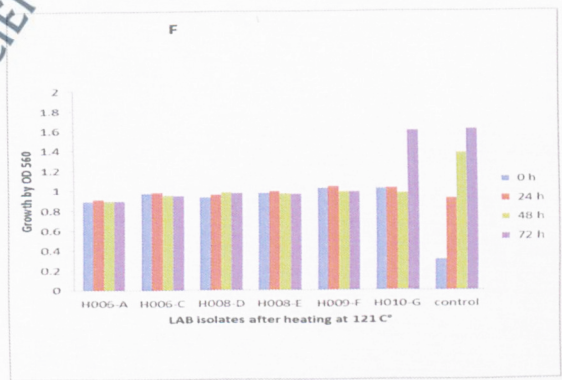
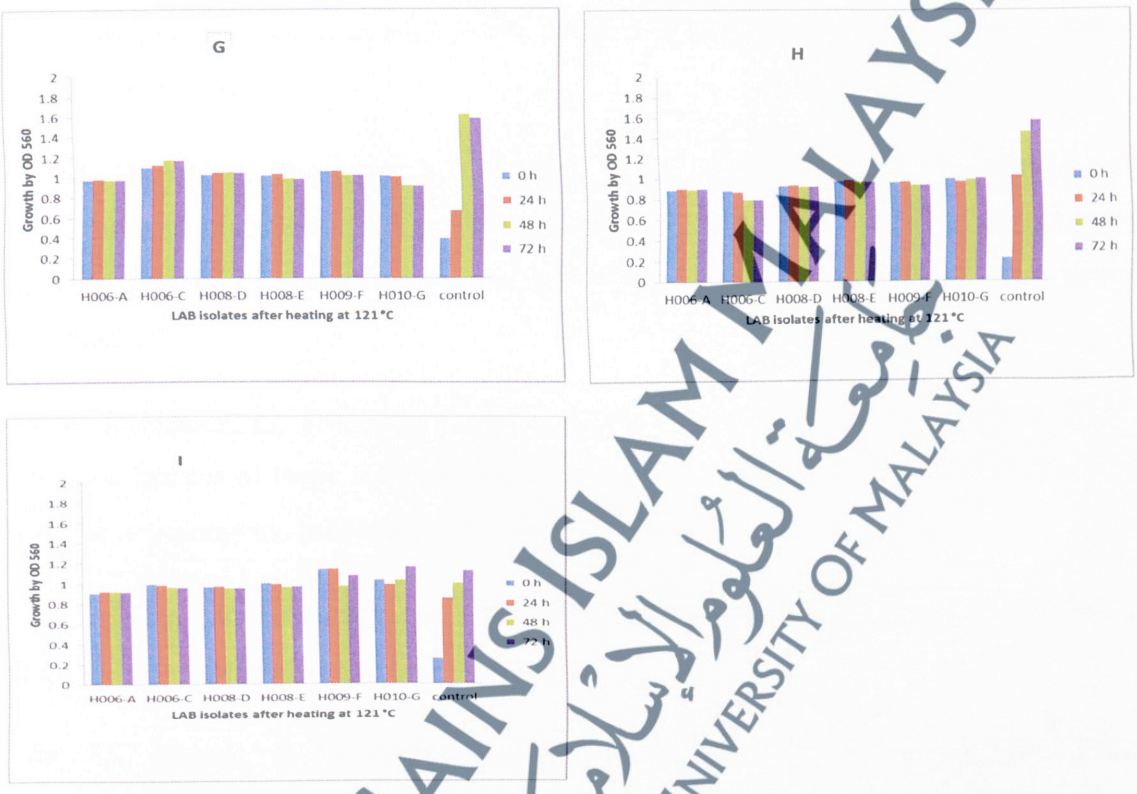


Figure 2: Growth of pathogenic bacteria after inoculation LAB supernatants after heat treatment at 121 °C for 1 h using bio photometer at optical density 560 nm within 72h. G: *Bacillus subtilus*, H: *Shigella sonnei*, I: *Enterobacter aerogenes*.



LIST OF PUBLICATIONS, CONFERENCES, SEMINARS AND OTHERS

Aween, M. M., Z. Hassan, B. J. Muhialdin, H. M. Noor and Eljamel, Y. A., 2012. Evaluation on antibacterial activity of Lactobacillus acidophilus strains isolated from honey. *American Journal Applied Science*, **9**: 807-817.

Aween, M. M., Hassan, Z., Muhialdin, B. J., Eljamel, Y. A., Asma Saleh W. Al-mabrok and Nizam Lani. 2012. Antimicrobial activity of Lactobacillus acidophilus strains isolated from honey marketed in Malaysia against gram positive bacteria. Accepted for publication in *Journal of Food Science*.

Muhialdin, B. J., Hassan, Z., Imdakim, M. M. A., Abdul-Kahar, F. K. S. and Aween, M. M. 2012. Malaysian isolates of lactic acid bacteria with antibacterial activity against gram-positive and gram-negative pathogenic bacteria. *Journal of Food Research*, **1**: 110-116.

Aween, M.M., Hassan, Z., Muhialdin, B. J. 2012. Health benefits and antimicrobial activity of honey, under review at *Microbiology Letters Journal*.

Aween, M. M., Hassan, Z., Muhialdin, B. J. and Asma Saleh W. Al-mabrok. 2012. Characterization of lactic acid bacteria isolated from honey, under review at *American Journal of Applied Science*.