

## ABSTRAK

### Uji Antibakteri dan Antibiofilm Ekstrak *Streptomyces* InaCC A758 Terhadap Mono-Spesies dan Dual-Spesies *Escherichia coli* ATCC 700928 dan *Enterococcus faecalis* ATCC 29212

**Latar Belakang:** Infeksi saluran kemih (ISK) umumnya disebabkan oleh *E. coli* dan *E. faecalis* yang mampu membentuk biofilm sehingga meningkatkan resistensi antibiotik dan risiko infeksi berulang. Biofilm melindungi bakteri dari respon imun inang serta terapi antimikroba, sehingga diperlukan agen antibakteri dan antibiofilm alternatif. Metabolit sekunder *Streptomyces* berpotensi sebagai sumber senyawa antimikroba baru. Penelitian ini bertujuan mengevaluasi aktivitas antibakteri dan antibiofilm ekstrak etil asetat *Streptomyces* InaCC A758 terhadap *E. coli* ATCC 700928 dan *E. faecalis* ATCC 29212 pada kondisi mono dan dual-spesies. **Metode:** Aktivitas antibakteri terhadap sel planktonik diuji menggunakan metode mikrodilusi cair untuk menentukan MIC dan MBC. Aktivitas antibiofilm dianalisis menggunakan metode *crystal violet* untuk menentukan nilai MBIC<sub>50</sub> dan MBRC<sub>50</sub> pada rentang konsentrasi ekstrak 50–800µg/mL dibandingkan kontrol. Fosfomycin trometamol 0,04% digunakan sebagai kontrol positif. Analisis perubahan morfologi dan struktur biofilm dilakukan menggunakan SEM. **Hasil:** Ekstrak etil asetat *Streptomyces* InaCC A758 mampu menghambat dan membunuh pertumbuhan sel planktonik *E. coli* dan *E. faecalis* pada kondisi mono dan dual-spesies. Uji MBIC<sub>50</sub>, ekstrak menghambat pembentukan biofilm pada *E. coli* (50µL; 92,18%), *E. faecalis* (50µL; 61,06%) dan dual-spesies (100µL; 57,48%). Uji MBRC<sub>50</sub>, ekstrak mereduksi biofilm pada *E. coli* (100µL; 65,24%), *E. faecalis* (100µL; 50,07%) dan dual-spesies (200µL; 54,75%). Efektivitas antibakteri dan antibiofilm ekstrak lebih rendah dibandingkan kontrol positif, terutama pada kondisi dual-spesies. Pengamatan SEM menunjukkan kerusakan struktur sel dan disrupti matriks biofilm. **Kesimpulan:** Ekstrak etil asetat *Streptomyces* InaCC A758 memiliki potensi sebagai agen antibakteri dan antibiofilm terhadap *E. coli* ATCC 700928 dan *E. faecalis* ATCC 29212 serta berpotensi dikembangkan sebagai terapi alternatif.

**Kata Kunci:** Biofilm, *Enterococcus faecalis*, *Escherichia coli*, Infeksi saluran kemih, *Streptomyces* InaCC A758.

## ABSTRACT

### **Antibacterial and Antibiofilm Activity of *Streptomyces* InaCC A758 Extract Against Mono-Species and Dual-Species *Escherichia coli* ATCC 700928 and *Enterococcus faecalis* ATCC 29212**

**Background:** Urinary tract infections (UTI) are commonly caused by *E. coli* and *E. faecalis*, which are capable of forming biofilms, thereby increasing antibiotic resistance and the risk of recurrent infections. Biofilms protect bacteria from host immune responses and antimicrobial therapy, highlighting the need for alternative antibacterial and antibiofilm agents. Secondary metabolites produced by *Streptomyces* species have considerable potential as sources of novel antimicrobial compounds. This study aimed to evaluate the antibacterial and antibiofilm activities of the ethyl acetate extract of *Streptomyces* InaCC A758 against *E. coli* ATCC 700928 and *E. faecalis* ATCC 29212 under mono and dual-species conditions. **Methods:** Antibacterial activity against planktonic cells was assessed using the broth microdilution method to determine the MIC and MBC. Antibiofilm activity was evaluated using the *crystal violet* assay to determine the MBIC<sub>50</sub> and MBRC<sub>50</sub> values at extract concentrations ranging from 50–800 µg/mL, compared with controls. Fosfomycin trometamol 0.04% was used as a positive control. Changes in cell morphology and biofilm structure were analyzed using SEM. **Results:** The ethyl acetate extract of *Streptomyces* InaCC A758 inhibited and killed planktonic cells of *E. coli* and *E. faecalis* under both mono and dual-species conditions. The MBIC<sub>50</sub> assay, the extract inhibited biofilm formation in *E. coli* (50 µg/mL; 92.18%), *E. faecalis* (50 µg/mL; 61.06%), and dual-species biofilms (100 µg/mL; 57.48%). The MBRC<sub>50</sub> assay, the extract reduced established biofilms of *E. coli* (100 µg/mL; 65.24%), *E. faecalis* (100 µg/mL; 50.07%), and dual-species biofilms (200 µg/mL; 54.75%). The antibacterial and antibiofilm activities of the extract were lower than those of the positive control, particularly under dual-species conditions. SEM observations revealed cellular damage and disruption of the biofilm matrix. **Conclusion:** The ethyl acetate extract of *Streptomyces* InaCC A758 demonstrates potential as an antibacterial and antibiofilm agent against *E. coli* ATCC 700928 and *E. faecalis* ATCC 29212 and may be further developed as an alternative therapeutic approach.

**Keywords:** Biofilm, *Enterococcus faecalis*, *Escherichia coli*, Urinary tract infection, *Streptomyces* InaCC A758.