

ABSTRAK

Mastitis adalah penyakit peradangan kelenjar susu (ambing) pada sapi perah yang umumnya disebabkan oleh infeksi bakteri, seperti *Staphylococcus aureus* dan *Escherichia coli*. Ekstrak daun sirih hijau memiliki aktivitas antibakteri yang dapat digunakan dalam penanganan mastitis. Formulasi nanopartikel mampu meningkatkan sistem penghantaran obat dan kestabilan zat aktif dalam ekstrak daun sirih. Penelitian ini bertujuan untuk memformulasikan dan mengetahui aktivitas antibakteri nanopolimer ekstrak daun sirih hijau (*Piper betle L.*) terhadap pertumbuhan *Staphylococcus aureus* dan *Escherichia coli*, serta mengevaluasi sediaan *spray* nanopolimer ekstrak daun sirih hijau.

Ekstrak daun sirih hijau diperoleh dengan metode maserasi etanol 96% dan preparasi nanopolimer menggunakan metode gelasi ionik dengan kitosan dan natrium tripolifosfat. Penetapan formula terbaik berdasarkan karakterisasi nanopolimer, meliputi ukuran partikel, keseragaman distribusi ukuran partikel (PdI), dan *entrapment efficiency*. Formula terbaik dievaluasi nilai pH, viskositas, bobot penghantaran sediaan, serta uji aktivitas antibakteri dengan metode difusi sumuran. Analisis data dilakukan dengan uji statistik *T-independent* dan *One-Way ANOVA* pada taraf kepercayaan 95%.

Formula dengan konsentrasi ekstrak 1%, kitosan 0,4%, dan NaTPP 0,01% merupakan sediaan nanopolimer terbaik dengan ukuran partikel $392,7 \pm 4,05$ nm, nilai PdI $0,334 \pm 0,05$, dan *entrapment efficiency* $14,58 \pm 0,23\%$. Hasil diameter zona hambat sediaan nanopolimer terhadap bakteri *Staphylococcus aureus* dan *Escherichia coli* sebesar $8,71 \pm 0,54$ mm dan $7,69 \pm 0,14$ mm lebih baik daripada ekstrak yang tidak diformulasikan sebesar $6,98 \pm 0,13$ mm dan $6,82 \pm 0,07$ mm. Sediaan *spray* nanopolimer memiliki rata-rata pH $4,90 \pm 0,04$; viskositas $21,11 \pm 0,50$ mPa.s; dan bobot semprot rata-rata penghantaran sediaan sebesar $0,110 \pm 0,0006$ g. Optimasi perlu dilakukan untuk mendapatkan formula optimum, serta pengujian antibakteri lebih lanjut agar memperoleh kadar hambat minimum dan kadar bunuh minimum.

Kata kunci : Antibakteri, daun sirih hijau (*Piper betle L.*), gelasi ionik, nanopolimer, mastitis.

ABSTRACT

Mastitis is an inflammatory disease of the mammary gland in cows which is should be generally caused by bacterial infections, such as *Staphylococcus aureus* and *Escherichia coli*. Green betle leaf extract had antibacterial activities can be used to treatment of mastitis. The nanoparticle formulation was able to improved the drug delivery system and stability of the active substance in betle leaf extract. This study aims to formulate and find out the activity as an antibacterial agent to *Staphylococcus aureus* and *Escherichia coli* of the green betel leaf (*Piper betle L.*) into nanopolymer preparations. Spray nanopolymer green betel leaf extract evaluated.

Green betel leaf extract was obtained by 96% ethanol maceration method, while nanopolymer preparations was made by ionic gelation method with chitosan and Sodium Tripoliphospat. Characterization of nanopolymer were analyzed by measurement of particle size, uniformity of particle size distribution, and entrapment efficiency. Moreover, the antibacterial activities were conducted by well diffusion method. Data analysis were performed by the T-independent and One-Way ANOVA test at the 95% confidence level.

Formula with 1% extract concentration, 0,4% chitosan, and 0.01% NaTPP was the best nanopolymer preparations which a particle size of $392.7 \pm 4,05$ nm, uniformity of particle size distribution $0.334 \pm 0,05$, and entrapment efficiency $14.58 \pm 0,23\%$. The results of the inhibition zone diameter of nanopolymer on *Staphylococcus aureus* and *Escherichia coli* bacteria were 8.71 ± 0.54 mm and $7,69 \pm 0,14$ mm gave a better than the unformulated extract were $6.98 \pm 0,13$ mm and 6.82 ± 0.07 mm. The nanopolymer spray has pH $4,90 \pm 0,04$; viscosity $21,11 \pm 0,50$; and weight of drug delivery $0,110 \pm 0,0006$ g. Optimization needed to get the optimum formula, and antibacterial activity further to get minimum inhibition concentration and minimum kill concentration

Keywords : Antibacterial, green betel leaf (*Piper betle L.*), ionic gelation nanopolymers, mastitis.