

INTISARI

Uji *In Vitro* Pengaruh Pemberian Nanoemulsi Daun Jati (*Tectona grandis* Linn) terhadap Karakteristik Fermentasi Rumen Sapi

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Daun jati (*Tectona grandis* Linn) memiliki kandungan senyawa metabolit sekunder tanaman. Efektivitas produksi ternak terhambat akibat degradasi nutrisi pakan pada proses pencernaan fermentatif rumen. Produksi ternak juga memiliki dampak emisi gas metana akibat aktivitas bakteri metanogenik di dalam rumen yang berpengaruh terhadap produktivitas ternak. Penelitian ini bertujuan mengkaji potensi nanoemulsi ekstrak daun jati sebagai agen proteksi protein, antimetanogenik, dan pengaruhnya terhadap karakteristik fermentasi rumen melalui uji *in vitro*. Penelitian ini menggunakan daun jati yang diekstraksi dan diproses menjadi bentuk sediaan nanoemulsi dengan konsentrasi 3%, 5%, dan 7%, serta dilakukan pada media cairan rumen sapi. Metode penelitian mengacu kepada teknik *in vitro* Theodorou *et al.* (1994), dengan masing-masing kelompok terdiri atas 5 ulangan. Karakteristik fermentasi rumen yang dianalisis meliputi parameter pH, ammonia (NH₃), *Volatile fatty acid* (VFA), protein mikrobia, jumlah protozoa, serta tingkat pencernaan bahan kering (KcBK) dan bahan organik (KcBO). Analisis produksi gas fermentasi rumen meliputi parameter laju kinetika produksi gas, konsentrasi gas metana (CH₄), karbondioksida (CO₂) dan dinitrogen monoksida (N₂O). Data yang diperoleh dianalisis statistik dengan metode *one way* ANOVA dan dilanjutkan dengan *Duncan's multiple range test* (DMRT). Hasil penelitian menunjukkan penambahan nanoemulsi ekstrak daun jati dengan konsentrasi 3%, 5% dan 7% tidak berpengaruh secara nyata ($P>0,05$) terhadap perubahan pH rumen, konsentrasi NH₃, protozoa, VFA yang meliputi asetat, propionat dan butirat, tingkat pencernaan bahan kering (KcBK) dan bahan organik (KcBO), produksi gas N₂O, serta laju produksi gas fraksi pakan mudah terdegradasi (fraksi a) dan laju produksi gas terhadap satuan waktu (fraksi c). Pemberian nanoemulsi ekstrak daun jati konsentrasi 7% berpengaruh secara signifikan ($P<0,05$) terhadap penurunan produksi gas metana (CH₄) dan karbondioksida (CO₂). Pemberian nanoemulsi ekstrak daun jati konsentrasi 3%, 5% dan 7% berpengaruh secara nyata ($P<0,05$) terhadap peningkatan sintesis protein mikrobia. Kesimpulan yang diperoleh adalah pemberian nanoemulsi ekstrak daun jati konsentrasi 7% dinilai efektif untuk meningkatkan efisiensi fermentasi rumen dan menurunkan produksi gas metana.

Kata kunci: daun jati, degradasi protein, gas metana, metabolit sekunder, nanoemulsi.

ABSTRACT

In Vitro Evaluation of the Effect of Teak Leaf (*Tectona grandis* Linn) Nanoemulsion on the Characteristic of Rumen Fermentation in Cattle

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Teak leaves (*Tectona grandis* Linn) contain secondary plant metabolite compounds. Degradation of feed components during the fermentative digestion process in the rumen limits the efficiency of livestock output. Livestock production also contributes to methane gas emissions due to the activity of methanogenic bacteria in the rumen, which results in global warming. This study aims to evaluate the potential of teak leaf nanoemulsion as a protein protection agent, an anti-methanogenic agent, and their effects on rumen fermentation characteristics through in vitro testing. This study utilized teak leaves that were extracted and processed into nanoemulsion formulations with concentration level of 3%, 5%, and 7%, and tested on cattle's rumen fluid media to determine the features of rumen fermentation. The research method follows the in vitro technique described by Theodorou *et al.* (1994), with each group consisting of five replicates. The rumen fermentation characteristics assessed include parameters such as pH, ammonia (NH₃), volatile fatty acids (VFA), microbial protein, protozoa population, as well as the digestibility of dry matter (DM) and organic matter (OM). The analysis of rumen fermentation gas production encompasses parameters such as the kinetics of gas production, concentrations of methane (CH₄), carbon dioxide (CO₂), and nitrous oxide (N₂O). The data obtained were statistically analyzed using one-way ANOVA, followed by Duncan's multiple range test (DMRT). The results indicated that the addition of teak leaf nanoemulsion at concentrations of 3%, 5%, and 7% had no significant effect ($P > 0,05$) on changes in rumen pH, NH₃ concentration, protozoa levels, VFA production including acetate, propionate and butyrate, dry matter digestibility (DMD), organic matter digestibility (OMD), N₂O gas production, the gas production rate of soluble fraction (fraction a) and the reaction rate of gas formation (fraction c). However, the application of 7% teak leaf nanoemulsion significantly affected ($P < 0.5$) the reduction of methane (CH₄) and carbon dioxide (CO₂) gas production. Furthermore, the application of teak leaf nanoemulsion at concentrations of 3%, 5%, and 7% significantly influenced ($P < 0.05$) the increase in microbial protein synthesis. Based on these findings, it can be concluded that administering 7% teak leaf nanoemulsion is effective in enhancing rumen fermentation efficiency and reducing methane gas production.

Keywords: methane gas, nanoemulsion, protein degradation, secondary metabolites, teak leaves.