

ABSTRAK

Performa Pertumbuhan dan Fisiologi Osmoregulasi Udang Vaname *Litopenaeus vannamei* (Bonne, 1931) pada Media Air Tawar dengan Konsentrasi Makromineral Kalium yang Berbeda

Oleh:

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Pemanfaatan perairan tawar untuk budi daya udang belum dilakukan secara maksimal. Tingkat pemanfaatan budi daya udang pada umumnya masih jauh lebih rendah dibandingkan dengan potensi produksi lestari, sehingga peluang peningkatan produksi dan produktivitas budi daya udang masih terbuka lebar.

Permasalahan utama dalam pemeliharaan udang vaname *Litopenaeus vannamei* (Boone, 1931) di media air tawar yang miskin mineral adalah sering terjadinya kram dan kegagalan molting, yang menyebabkan pertumbuhan lambat, stres, dan mortalitas tinggi. Kondisi tersebut disebabkan oleh meningkatnya kebutuhan energi untuk proses osmoregulasi akibat pertukaran ion, sehingga energi yang tersedia untuk pertumbuhan menjadi terbatas.

Penelitian ini bertujuan untuk menentukan konsentrasi kalium optimal pada media air tawar terhadap performa pertumbuhan dan kelangsungan hidup udang vaname, mengevaluasi pengaruh penambahan kalium terhadap tingkat kerja osmotik, serta respon fisiologis udang vaname. Penelitian dilaksanakan selama enam bulan di Laboratorium Budi Daya Perikanan, Jurusan Perikanan dan Kelautan, Politeknik Negeri Lampung.

Bahan uji yang digunakan adalah benur udang vaname PL-21 dengan panjang rata-rata $2,1 \pm 0,01$ cm dan bobot rata-rata $0,05 \pm 0,05$ g/ekor. Makromineral yang digunakan meliputi NaCl, MgCl₂, CaCO₃, dan KCl. Penelitian menggunakan rancangan acak lengkap (RAL) dengan empat perlakuan dan tiga ulangan. Perlakuan berupa rekayasa air tawar yang disetarakan dengan salinitas 2 ppt menggunakan pengayaan makromineral Na, Mg, Ca, dan K. Konsentrasi kalium yang diuji adalah 22,02; 44,04; 66,06; dan 88,08 mg/L.

Penelitian menggunakan rancangan acak lengkap (RAL) yang terdiri dari 4 perlakuan dan 3 ulangan. Perlakuan tersebut adalah rekayasa air tawar yang disetarakan dengan salinitas 2 ppt menggunakan pengayaan makromineral; Na (natrium), Mg (magnesium), Ca (kalsium) dan K (kalium) yang setara dengan salinitas 2000 ppm yaitu; Na (608,7 mg/L), Mg (78,26 mg/L), Ca (23,18 mg/L). Adapun kalium merupakan perlakuan yang dibedakan dengan peningkatan

konsentrasi K yang berbeda yaitu; perlakuan A (22,02 mg/L) perlakuan B (44,04 mg/L), perlakuan C (66,06 mg/L) dan perlakuan D (88,08 mg/L).

Hasil penelitian menunjukkan penambahan makromineral K⁺ dalam rekayasa media air tawar berpengaruh nyata ($p < 0,05$) terhadap pertumbuhan, efisiensi pemanfaatan pakan, kelangsungan hidup, dan tingkat kanibalisme udang vaname. Konsentrasi kalium 66,06 mg/L menghasilkan bobot rata-rata tertinggi ($5,394 \pm 0,346$ g), laju pertumbuhan harian ($5,69 \pm 0,41\%$ /hari), kelangsungan hidup ($68,67 \pm 4,16\%$), dan efisiensi pakan ($72,69 \pm 1,85\%$).

Konsentrasi Kalium 66,06 mg/L mampu meningkatkan rata-rata bobot udang vaname ($5,39 \pm 0,35$ g), persentase pertumbuhan harian ($5,69 \pm 0,41\%$ /hari), kelangsungan hidup ($68,67 \pm 4,163\%$) dan efisiensi pakan ($72,69 \pm 1,85\%$). Penambahan kalium juga berpengaruh nyata terhadap respon fisiologis udang vaname, ditunjukkan dengan penurunan tingkat kanibalisme ($2,31 \pm 1,25\%$), kadar glukosa hemolimfa ($233,92 \pm 39,97$ μ g/g), serta tingkat konsumsi oksigen ($0,587 \pm 0,256$ mg O₂ g⁻¹ jam⁻¹).

Dari hasil penelitian dapat disimpulkan konsentrasi kalium 66,06 mg/L merupakan konsentrasi ideal untuk mendukung kehidupan dan performa udang vaname pada media air tawar.

Kata kunci: *Litopenaeus vannamei*, makromineral, osmoregulasi, kanibalisme, fisiologi.

ABSTRACT

Growth Performance and Osmoregulation Physiology of Vaname Shrimp *Litopenaeus vannamei* (Boone, 1931) in Freshwater Media with Different Concentrations of Potassium Macrominerals

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The utilization of freshwater for shrimp farming has not been maximized. The level of shrimp farming utilization is generally much lower than the potential for sustainable production. This indicates that there is still considerable room for improvement and productivity in shrimp farming.

Problems that arise in the maintenance of vaname shrimp in mineral-deficient freshwater are that shrimp are often found to be cramped and fail to molt, resulting in slow growth, stress, and high mortality. This is because shrimp undergo osmoregulation, which requires a large amount of energy for ion exchange, leaving no energy available for growth.

The purpose of this study was to determine the optimal potassium concentration in freshwater media for the growth performance and survival of vaname shrimp; to evaluate the addition of potassium concentration on the osmotic work rate of vaname shrimp; and the physiological response of vaname shrimp. The study was conducted for 6 months at the Aquaculture Laboratory, Department of Fisheries and Marine Sciences, Lampung State Polytechnic.

The test specimens used were *L. vannamei* post-larvae (PL 21) with an average length of 2.1 ± 0.01 cm and an average weight of 0.05 ± 0.05 g per individual. The macrominerals used in this study included NaCl, MgCl, CaCO₃, and KCl. The experimental setup consisted of 12 aquariums (each with a 50-liter water capacity) equipped with aeration and covered with black plastic.

The study employed a completely randomized design (CRD) with four treatments and three replications. This treatment is freshwater engineering that is equalized to a salinity of 2 ppt using macromineral enrichment; Na (sodium), Mg (magnesium), Ca (calcium) and K (potassium) equivalent to a salinity of 2000 ppm, namely; Na (608.7 mg/L), Mg (78.26 mg/L), Ca (23.18 mg/L). Potassium is treated differently with varying concentrations of K, namely: treatment A (22.02 mg/L), treatment B (44.04 mg/L), treatment C (66.06 mg/L), and treatment D (88.08 mg/L).

Based on the results of the study, it can be seen that the addition of K+ macromineral concentration in freshwater media engineering has a significant

effect on growth response, feed utilization efficiency, survival, and cannibalism rates in vaname shrimp (*Litopenaeus vannamei*, Boone, 1931) $p < 0,05$.

Potassium concentration of 66.06 mg/L was able to increase the average weight of vaname shrimp (5.394 ± 0.346 g), daily growth rate ($5.69 \pm 0.41\%$ /day), survival rate ($68.67 \pm 4.163\%$), and feed efficiency ($72.69 \pm 1.85\%$). Similarly, the addition of potassium concentration in freshwater engineering has a significant effect on the physiological system of vaname shrimp $p < 0,05$.

A potassium concentration of 66.06 mg/L was able to reduce the percentage of cannibalism by ($2.31 \pm 1.25\%$), blood glucose levels (233.92 ± 39.97 $\mu\text{g/g}$), and oxygen consumption rates (0.587 ± 0.256 $\text{mg O}_2 \text{ g}^{-1} \text{ jam}^{-1}$). Based on the research results, it can be concluded that the addition of a potassium concentration of 66.06 mg/L is the ideal concentration for the life of vaname shrimp in freshwater media. A potassium concentration of 66.06 mg/L was able to reduce the percentage of cannibalism by ($2.31 \pm 1.25\%$), blood glucose levels (233.92 ± 39.97 $\mu\text{g/g}$), and oxygen consumption rates (0.587 ± 0.256 $\text{mg O}_2 \text{ g}^{-1} \text{ h}^{-1}$).

Based on the results of the study, it can be concluded that adding a potassium concentration of 66.06 mg/L is the ideal concentration for vaname shrimp to live in freshwater media.

Vaname shrimp farming in freshwater media can be used as a basis for the application of water resource utilization in the concept of shrimp farming for food security with an urban farming system.

Keywords: *Litopenaeus vannamei*, macrominerals, osmolarity, cannibalism, physiology