

SCALE UP PANEL GREENING MATERIAL LUMUT (*Sphagnum* sp.) DI ATAS ATAP BANGUNAN

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INTISARI

Penelitian *scale up* pada produksi *greening material* lumut (*Sphagnum* sp.) di atas atap bangunan penting sebagai persiapan skala industri komersial dengan segmen pasar pemerintah daerah, pengusaha hotel dan restoran, masyarakat daerah urban, serta komunitas pecinta lingkungan. Penelitian sebelumnya terbatas pada *pilot plant scale up* tahap *aquaculture* menggunakan metode analisis dimensional dan terbukti memiliki prinsip kesamaan geometris. Prinsip kesamaan geometris kemudian diterapkan pada *scale up* tahap perakitan panel sebagai kelanjutan proses *aquaculture*. Penelitian bertujuan untuk: 1) mengidentifikasi variabel-variabel kritis dalam model analog *scale up* tahap perakitan panel; 2) memperoleh hasil analisis sensitivitas perubahan geometris variabel-variabel kritis dalam model analog *scale up* tahap perakitan panel; 3) memperoleh rancangan *pilot plant scale up* tahap perakitan panel; 4) memperoleh hasil validasi *pilot plant scale up* tahap perakitan panel.

Identifikasi variabel-variabel kritis dalam model analog *scale up* tahap perakitan panel terbatas pada penerapan prinsip kesamaan geometris dalam metode analisis dimensional. Analisis sensitivitas perubahan geometris variabel-variabel kritis menggunakan perhitungan angka prediksi. Validasi *pilot plant scale up* tahap perakitan panel menggunakan uji beda *independent sample t-test*.

Hasil penelitian yaitu variabel-variabel kritis dalam model analog *scale up* tahap perakitan panel yang didentifikasi yaitu massa lumut kering (m), panjang panel (p), lebar panel (l), tebal panel (t), dan fotosintesis lumut (y). Analisis sensitivitas perubahan geometris variabel-variabel kritis yaitu ukuran panjang panel 100 cm (maka massa lumut kering 540 gram, lebar panel 70 cm, dan tebal panel 6 cm) dan ukuran panjang panel 125 cm (maka massa lumut kering 1054,688 gram, lebar panel 87,5 cm, dan tebal panel 7,5 cm). *Pilot plant scale up* yang telah dirancang yaitu *scale up* (100x70x6) cm³ dan *scale down* (25x17,5x1,5) cm³. Validasi *pilot plant scale up* menghasilkan rata-rata laju fotosintesis dan serapan CO₂ perlakuan *pilot plant* berbeda dengan laboratorium (kontrol) yaitu laju fotosintesis dengan perbedaan 25,333 $\mu\text{mol}/\text{m}^2/\text{s}$ (*scale up*) dan 6,33333 $\mu\text{mol}/\text{m}^2/\text{s}$ (*scale down*); serta serapan CO₂ dengan perbedaan 14,290 $\mu\text{mol}/\text{mol}$ (*scale up*) dan 35,40667 $\mu\text{mol}/\text{mol}$ (*scale down*).

Kata Kunci: *Scale up, panel, greening material, Sphagnum* sp.

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**SCALE UP OF PANEL FOR MOSS ROOFTOP GREENING MATERIAL
(*Sphagnum* sp.)**

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ABSTRACT

*The research of production scale up for moss rooftop greening material (*Sphagnum* sp.) is prior to commercial industry with market segments including local government, business hotels and restaurants, urban society, as well as the community of environmentalists. Previous research limited to scale up of aquaculture by designing pilot plant using dimensional analysis method based on the principle of geometric similarity. Subsequently, the principle of geometric similarity is applied to scale up of panel assembly. The research aims are: 1) To identify the critical variables in analog model of scale up of panel assembly process; 2) To derive the sensitivity analysis of critical variables geometric changing in analog model of scale up of panel assembly process; 3) To derive design of pilot plant scale up of panel assembly process; 4) To derive validation result of pilot plant scale up of panel assembly process.*

Identification of critical variables in analog model of scale up of panel assembly process using the principle of geometric similarity in dimensional analysis method. The sensitivity analysis of critical variables geometric changing using prediction values. Validation of pilot plant scale up using independent sample t-test.

The research results shows critical variables was identified in analog model of scale up of panel assembly process were mass of dry moss (m), length of panel (l), width of panel (l), and thickness of panel (t). The sensitivity analysis of critical variables geometric changing shows by increasing length of panel 100 cm (were 540 gram mass of dry moss, 70 cm width of panel and 6 cm thickness of panel) and increasing length of panel 125 cm (were 1054,688 gram mass of dry moss, 87,5 cm width of panel and 7,5 cm thickness of panel). Pilot plant scale up were designed scale up ($100 \times 70 \times 6$) cm^3 and scale down ($25 \times 17,5 \times 1,5$) cm^3 . Validation of pilot plant scale up results the differences between average of photosynthesis rate and CO_2 absorption in pilot plant and laboratory scale (control). The differences of photosynthesis rate were $25,333 \mu\text{mol}/\text{m}^2/\text{s}$ (scale up) and $6,33333 \mu\text{mol}/\text{m}^2/\text{s}$ (scale down); CO_2 absorption were $14,290 \mu\text{mol}/\text{mol}$ (scale up) and $35,40667 \mu\text{mol}/\text{mol}$ (scale down).

*Key words: Scale up, panel, greening material, *Sphagnum* sp.*

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