

Perguruan tinggi menjadi salah satu penyumbang sampah perkotaan secara signifikan, diantaranya merupakan sampah sisa makanan. Larva *Black Soldier Fly* sangat populer bagi dunia penelitian karena mampu mereduksi sampah sisa makanan sebanyak 50.057,80 kg tahun⁻¹. Namun, kajian terkait dampak lingkungan dan kerusakan masih sangat terbatas khususnya pada lingkungan perguruan tinggi.

Penelitian ini mengidentifikasi pengolahan sampah organik berbasis Larva *Black Soldier Fly* (Skenario 1) sebagai teknologi inovatif yang sedang diterapkan oleh Rumah Inovasi Daur Ulang, Pusat Inovasi Agroteknologi, Universitas Gadjah Mada melalui pendekatan *Environmental Life Cycle Assessment*. Perbandingan juga dilakukan terhadap teknologi lain, yaitu Sistem Pengomposan (Skenario 2) sebagai metode daur ulang yang umum digunakan. Penelitian dilakukan tanpa terlibat dalam teknis operasional kedua skenario tersebut. Penelitian secara khusus mengkaji data dan parameter dampak lingkungan, seperti *Global Warming*, *Stratospheric Ozone Depletion*, *Terrestrial Acidification*, *Freshwater Eutrophication*, dan *Marine Eutrophication*. Pengolahan data menggunakan perangkat lunak SimaPro Developer v.9.5 dengan *impact assessment method* adalah ReCiPe 2016. Selain itu, evaluasi total biaya pada kedua teknologi melalui perspektif *Environmental Life Cycle Cost*.

Penelitian menemukan bahwa total *Global Warming* pada Skenario 1 sebesar $4,45 \times 10^{+03}$ kg CO₂ eq tahun⁻¹. Nilai tersebut paling kecil dibandingkan Skenario 2 serta dampak lainnya: *Terrestrial Acidification*, *Stratospheric Ozone Depletion*, dan *Freshwater Eutrophication*, sedangkan *Marine Eutrophication* paling kecil adalah Skenario 2 sebesar $5,10 \times 10^{-02}$ kg N eq tahun⁻¹. Nilai 97,35 Pt tahun⁻¹ merupakan total kerusakan paling kecil yang disebabkan oleh Skenario 1 dibandingkan Skenario 2. *Environmental Life Cycle Cost* per tahun dari kedua skenario adalah Rp249.378.501,80 (Skenario 1) dan Rp399.873.476,89 (Skenario 2) dengan biaya kerusakan lingkungan paling kecil adalah Skenario 1 sebesar Rp130.935,04. Nilai *Net Present Value* dan *Payback Period* yang dirancang selama 20 tahun pada Skenario 1 menghasilkan Rp108,775,021,07 dan 4,93 (4 tahun, 11 bulan). Skenario 2 tidak memperoleh *Payback Period* karena *Net Present Value* yang negatif, yaitu -Rp1.036.183,306,15. Maka, penelitian ini menunjukkan Skenario 1 merupakan skenario pengolahan sampah organik yang lebih ramah lingkungan karena potensi dampak lingkungan dan kerusakan paling kecil, serta total biaya ekonomi dan biaya kerusakan dampak paling kecil dibandingkan Skenario 2.

Kata Kunci: *Sampah Sisa Makanan, Black Soldier Fly, SimaPro, Environmental Life Cycle Assessment, Environmental Life Cycle Cost*

Universities are significant contributors to urban waste, with food waste being one of the main components. *Black Soldier Fly Larvae* are highly popular in research due to their ability to reduce food waste by 50.057,80 kg year⁻¹. However, studies on their environmental impact and damages remain limited, particularly in university.

This study identifies organic waste management using Black Soldier Fly Larvae (Scenario 1) as an innovative technology implemented by the Rumah Inovasi Daur Ulang at the Pusat Inovasi Agroteknologi, Gadjah Mada University, using the *Environmental Life Cycle Assessment*. A comparison was also made with another technology, the Composting System (Scenario 2) which is a commonly used recycling method. The study was conducted without involvement in the operational aspects of both scenarios. It specifically examined data and parameters related to environmental impacts, such as *Global Warming, Stratospheric Ozone Depletion, Terrestrial Acidification, Freshwater Eutrophication, and Marine Eutrophication*. Data processing was carried out using SimaPro Developer v.9.5 software, with the impact assessment method being ReCiPe 2016. Additionally, the total cost evaluation for both technologies was conducted from the perspective of *Environmental Life Cycle Cost*.

The study found that the total *Global Warming* impact in Scenario 1 was 4,45x10⁺⁰³ kg CO₂ eq year⁻¹. The smallest compared to Scenario 2 and other impacts such as *Terrestrial Acidification, Stratospheric Ozone Depletion, and Freshwater Eutrophication*. However, *Marine Eutrophication* was lowest in Scenario 2 at 5,10x10⁻⁰² kg N eq year⁻¹. The total damage of 97,35 Pt year⁻¹ caused by Scenario 1 was the smallest compared to Scenario 2. The annual *Environmental Life Cycle Cost* of both scenarios was IDR249.378.501,80 (Scenario 1) and IDR399.873.476,89 (Scenario 2) with the lowest environmental damage cost in Scenario 1 at IDR130.935,04. The *Net Present Value* and *Payback Period* projected over 20 years in Scenario 1 yielded IDR108.775.021,07 and 4,93 years (4 years, 11 months). Scenario 2 did not achieve a *Payback Period* due to its negative *Net Present Value* of -IDR1.036.183.306,15. Therefore, this study indicates that Scenario 1 represents a more environmentally friendly organic waste management approach, with the smallest potential environmental impacts, damages, total economic costs, and environmental damage costs compared to Scenario 2.

Keyword: *Food Waste, Black Soldier Fly, SimaPro, Environmental Life Cycle Assessment, Environmental Life Cycle Cost*