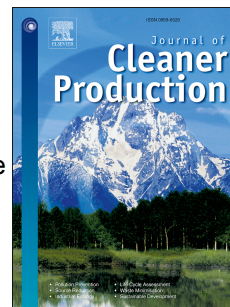


Accepted Manuscript

Insect as feed: An emergy assessment of insect meal as a sustainable protein source for the Brazilian poultry industry

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PII: S0959-6526(17)32256-4

DOI: [10.1016/j.jclepro.2017.09.244](https://doi.org/10.1016/j.jclepro.2017.09.244)

Reference: JCLP 10749

To appear in: *Journal of Cleaner Production*

Received Date: 27 June 2017

Revised Date: 21 September 2017

Accepted Date: 27 September 2017

Please cite this article as: Allegretti G, Schmidt Verô, Bogorni PC, Talamini E, Ortega E, Insect as feed: An emergy assessment of insect meal as a sustainable protein source for the Brazilian poultry industry, *Journal of Cleaner Production* (2017), doi: 10.1016/j.jclepro.2017.09.244.

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Insect as feed: an emergy assessment of insect meal as a sustainable protein source for the Brazilian poultry industry

ABSTRACT

Projections point to a global increase in meat consumption as a result of rising income and changes in food patterns, especially in developing countries. Poultry meat is an option for supplying this demand and Brazil is currently the main global exporter of this protein. Of the resources involved in this industrial process, soybean meal, which is a protein source for farmed animals, requires a large quantity of energy. In order to increase the sustainability of the poultry industry, it is necessary to find a more efficient alternative to this poultry feed. Through emergy assessment, this study proposes to evaluate the production and processing of Black Soldier Fly Larvae (BSFL) as an insect meal and to compare its use with soybean meal in a Brazilian poultry production system. The biological capacity of BSFL to convert the remaining energy from a previous process (grain residue) into a novel protein is demonstrated by emergy indices, whose best values favor this new technology. Transformity (emergy per energy of the product) decreased 144.74% while renewability increased by 45.64%. The emergy yield ratio (EYR) reduced from 1.71 to 1.00 in insect meal production compared to soybean meal, the environmental loading ratio (ELR) improved from 1.99 to 1.04 and the emergy sustainable index (ESI) improved from 0.86 to 0.96. Gains were also observed in poultry production: the transformity of poultry meat decreased by 16.45% (156,104 sej/J), renewability increased by 25.03%, EYR increased from 1.33 to 1.41 and ELR reduced from 4.96 to 3.68, when insect meal was used in comparison to soybean meal. These results, based on an experimental model, imply that BSFL meal can improve sustainability in the Brazilian poultry production process. Challenges and possibilities regarding the use of insect meal by the Brazilian poultry industry are discussed.

Keywords: bioeconomics, thermodynamic, energy, ecological engineering and industrial ecology

1. Introduction

The increasing global population and changes in food consumption patterns mean that it is important to find out other protein sources. Regardless of whether they are animal or vegetable in origin, they must be capable of supplying food demand in a viable and sustainable way (Ruviaro et al., 2012, Gandhi and Zhou, 2014). Growing income, especially in developing countries, such as China, India and African countries, is envisaged to be responsible for an increase in meat consumption of 1.9% per year over the next decade. Poultry is one of the available meats that can help supply that demand (USDA, 2016). Currently, Brazil is a main global poultry meat exporter, contributing 13.14 million tons to this industry in 2015 (ABPA, 2015). The three main producer and

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