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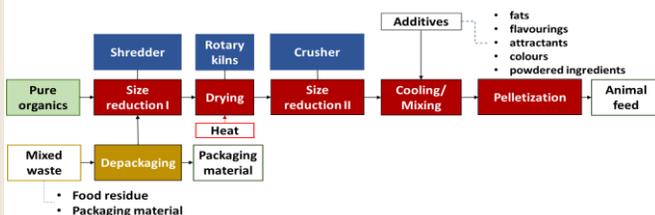
Animal feed from food waste

Introduction

Organic waste can be fed to animals directly but not all types of organic waste can be used for this (e.g. waste containing microbial pathogens). Hence, organic waste can be transformed into animal feed through pelleting production or black soldier fly (BSF) utilization. Pelleting production lines are widely applied but have high energy consumption. The use of BSF is much cheaper, however local legislation may restrict this. Turning organic waste into animal feed has gotten attention from a lot of start-ups.

Process for pelleting

Pelleting organic waste into animal feed is done for better storage and transportation. The organic wastes first are shredded to reduce them in size and to remove impurities such as packaging material through sieving. The core process is dehydrating the food waste, which requires heating (large energy consumption). After dehydration, the organic material is further reduced in size and after mixing in additives for the animal feed i.e. fats, minerals, flavorings, the mix is pelleted.



Pelleting production line for animal feed

Overview

Input products

Source separated organic waste

Output products

Animal feed

Waste generation in Iraq

approx. 60 % of MSW is organic

Current management in Iraq

Landfilling

Technical characteristics

large space requirement | mechanical and biological process | manual or automatic shredding and sieving possible

CAPEX

23.000-28.000 USD/t organic waste input

OPEX

12.000 USD/t organic waste input

Useful links and literature

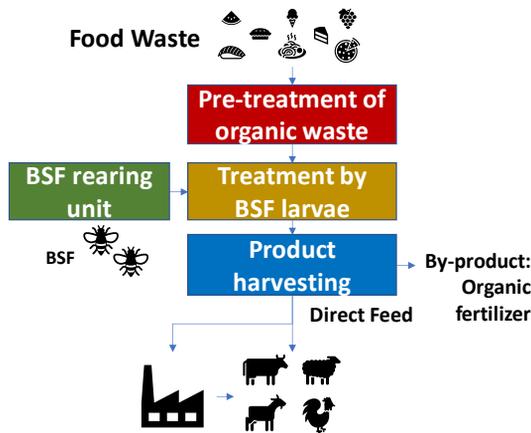
- Caruso, D., Devic, E., Subamia, I.-W., Talamond, P., Baras, E., 2013. Technical handbook of domestication and production of Diptera Black Soldier Fly (BSF) *Hermetia illucens*, Stratiomyidae. Bogor: IPB Press
- Dortmans, B., Diener, S., Verstappen, B., Zurbrugg, C., 2017. Black Soldier Fly Biowaste Processing: A Step-by-Step Guide. Dübendorf: Eawag – Swiss Federal Institute of Aquatic Science and Technology

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Process for Black-Soldier-Fly production

In BSF production, one ton of food waste can yield up to 250 kg fresh larvae. BSF larvae can be fed directly to animals or processed further (e.g. dried to sell as animal feed supplement). Most types of organic waste can be used as feedstock for BSF larvae production.

Depending on the type of organic waste, the waste should be pre-treated by grinding it into certain size (1 to 2 mm) to ensure a better availability to the larvae. Moreover, the pre-treatment stage shall ensure that the moisture is at 70 to 80%, and no hazardous substances remain in the feedstock.



Process scheme for BSF production

To assure the optimum process in biodegradation several parameters can be adjusted such as the temperature, pH and nutrients in the feedstock. High waste temperatures leads to BSF larvae moving to cooler areas, while lower temperatures can lower the larvae metabolism. The pH and nutrient content of the waste can be adjusted by mixing the incoming stream with other food waste materials.

Parameter		Optimal level
Process parameter	Temperature	T = 24-30 °C
	Moisture content	60-90 % (wet weight)
Waste feedstock	Nutrient content	21 % Carbohydrates 21 % Protein C/N ratio: 10-40

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- Joly, G., 2018. Valorising Organic Waste using the BlackSoldier Fly (*Hermetia illucens*), in Ghana. Stockholm: KTH Royal Institute of Technology

Start-up examples

- [Magalarva](#)
- [Enviroflight](#)
- [Protix](#)
- [Co-prot](#)

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Parameter		Optimal level
Waste feedstock	Moisture content	60-90 % (wet weight)
	Nutrient content	21 % Carbohydrates 21 % Protein C/N ratio: 10-40
	Particle size	1-2 cm
	pH	5-8

Optimal process conditions for BSF production

Industrial scale

One of the examples to the industrial production based on BSF larvae is Protix. Protix is a company breeding BSF to produce eggs and fish fed with BSF larvae, organic fertilizer and protein meal



Industrial scale BSF farming for animal feed and other products

Start-up case study

One of the start-up examples is BioBuu. It is a start-up based in Tanzania that produces protein as feed to chicken and fish, as well organic fertilizer.



BSF production factory BioBuu

The production process chosen by BioBuu is labor intensive and makes use of waste collected locally.

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