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Insects save the planet: Recycling organic waste and producing proteins in an environmentally friendly way: Subject review

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Abstract

Recycling organic waste using insects offers a sustainable and environmentally friendly solution. This technology relies on the ability of some insect species, such as the black soldier fly (BSF) and mealworm, to decompose organic matter and convert it into nutrient-rich organic fertilizer.

Keywords: Organic waste conversion, compost, animal feed, greenhouse gas emissions reduction, black soldier fly, biological recycling

Introduction

Organic waste recycling using insects is a sustainable technique for converting food scraps and other waste into nutrient-rich organic fertilizer. This process relies on the ability of some insect species, such as the black soldier fly (BSF) and mealworm, to decompose organic matter and convert it into manure rich in organic matter and protein (Manna, 2023) [16]. Recycling organic waste to produce compost using insects is a sustainable technique for converting organic waste, such as food scraps and garden waste, into nutrient-rich organic fertilizer. This process depends on the use of insects, such as the black soldier fly (BSF), to decompose organic waste and turn it into insect manure that can be used as fertilizer. In recent years, modern technologies have emerged that use insects in the processes of recycling organic waste in an effective and less harmful way to the environment. Studies show that insects such as black flies and kingworms can transform organic waste into compost rich in beneficial nutrients through a digestion process called 'ost digestion'. These insects are stimulated to carry out the transformation process by providing them with suitable conditions, such as a specific temperature and humidity. These technologies are very promising in the field of waste management and environmental preservation, as they do not cause harm to the environment and limit the amounts of waste produced daily. In addition, recycling organic waste using insects is a natural biological process that improves soil quality and reduces reliance on harmful chemicals. In addition, the accumulation of organic waste is considered one of the greatest environmental challenges facing humanity today, as this waste constitutes approximately 40% of the total municipal solid waste. As a result of the anaerobic decomposition process of this waste, harmful greenhouse gases such as methane are released, which contributes to worsening global warming (Sharma & Jain (2020) [1]. Our world today faces enormous environmental challenges, the most important of which are the accumulation of organic waste and the negative effects of livestock farming. Insects are a promising solution to these challenges, as they play a vital role in recycling organic waste and turning it into valuable products such as high-quality protein and organic fertilizers.

Benefits of using insects to recycle organic waste

Reduces the amount of waste heading to landfills: This technology contributes to reducing the amount of organic waste being buried in landfills, reducing greenhouse gas emissions and pollution. Pang, (2020) produces high-quality organic fertilizer: The compost resulting from this process is rich in nutrients, such as nitrogen, phosphorus and potassium, and is an excellent source for promoting soil health and improving plant growth

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and provides a rich source of protein for animal feed. Insect manure can be used as protein-rich animal feed, reducing reliance on conventional feed and providing a sustainable food source for animals (Hawkey *et al.*, 2021) ^[17]. Insects are natural creatures that are adept at recycling organic materials, feeding on a wide range of waste such as food scraps, animal waste, and dung. It breaks down these materials and turns them into nutrients that can be used in agriculture or as animal feed.. One of the most important things insects produce is protein. Insects are a rich source of protein, as they contain a higher percentage of protein than most animal food sources. Insect farming is a sustainable alternative to livestock farming, as it requires less water, food and land to produce a similar amount of protein.

Environmental Benefits

Insect farming offers many environmental benefits, including:

1. Reducing the accumulation of organic waste in landfills.
2. Reducing greenhouse gas emissions resulting from livestock farming.
3. Reduce the use of Poveda chemical fertilizers.
4. Improving soil health.
5. Preserving natural resources (Rumpold & Schlüter, 2017) ^[18]; Pastor & Rojo, 2015) ^[19].

Recycling organic waste using insects

Organic waste recycling using insects offers innovative and sustainable solutions to environmental challenges related to waste:

1. **Reducing the amount of accumulated waste:** Insects contribute to converting large amounts of organic waste into useful products, which reduces the need for landfills and reduces pressure on the environment (Chavez, M., 2021) ^[20].
2. **Reducing greenhouse gas emissions:** Insect recycling helps reduce methane emissions, which is a major greenhouse gas (Oonincx, 2010) ^[21].
3. **Produce valuable products:** Insect recycling produces high-quality protein that can be used in animal feed or human food products, as well as organic fertilizers that improve soil fertility (Cappelozza, *et al.*, 2019) ^[22].
4. **Creating new job opportunities:** Recycling projects using insects provide new job opportunities in the fields of insect breeding, waste processing, and product conversion.

Recycling organic waste using insects: a sustainable solution to environmental challenges

The problem of organic waste accumulation is one of the greatest environmental challenges facing humanity today, as this waste constitutes approximately 40% of the total municipal solid waste. As a result of the anaerobic decomposition process of this waste, harmful greenhouse gases such as methane are released, which contributes to worsening global warming (Sharma & Jaine, 2020) ^[1]. Our world today faces enormous environmental challenges, the most important of which are the accumulation of organic waste and the negative effects of livestock farming. Insects come as a promising solution to these challenges, as they play a vital role in recycling organic wastes into valuable products such as high-quality protein and organic fertilizers.

Challenges

1. **Changing public perception:** The field of insect farming

suffers from a negative perception by some people, which poses a challenge in promoting insect farming and its use in waste recycling and protein production.

2. **Financing:** Insect farming and organic waste recycling require large initial investments, which may pose a challenge for some people and communities.
3. **Research and development:** More research and studies are still needed to develop techniques for raising insects and recycling organic waste more efficiently and effectively.

Opportunities

1. **Population growth:** The global population is expected to reach 9.7 billion people by 2050, which will lead to increased demand for food, including protein. Insect farming offers a promising solution to fill this nutritional gap in a sustainable way.
2. **Environmental awareness:** People are increasingly becoming environmentally aware, which represents an opportunity to increase the acceptance of insect farming and its use in waste recycling and protein production.
3. **Technological advances:** New technological advances offer new opportunities for raising insects and recycling organic waste more efficiently and effectively.

Discussion

The study should be elaborately discussed with the significance of the results with the help of earlier work and reports.

Concluding Outcome

Insects offer natural solutions to the waste and protein problems facing our world today. Insect farming makes it possible to recycle organic waste in environmentally friendly ways, as our world today faces enormous environmental challenges, the most important of which are the accumulation of organic waste and the negative effects of livestock farming. Insects are a promising solution to these challenges, as they play a vital role in recycling organic waste into valuable products such as high-quality protein and organic fertilizers.

Types of insects used in recycling

- **Black soldier fly (BSF):** The black soldier fly is one of the most effective insects in recycling organic waste, as its larvae feed on a wide range of organic materials, including food scraps, animal waste, and agricultural waste.
- **Worms:** Worms play an important role in converting organic materials into organic fertilizer rich in nutrients, which improves soil fertility and reduces the need for chemical fertilizers.
- **Ants:** Some types of ants can be used to recycle food scraps and other waste.

Practical applications of organic waste recycling using insects

1. **Commercial projects:** Many commercial projects are being established around the world to recycle organic waste using insects. Organic waste is collected from homes, restaurants, and commercial establishments, then treated using insects and transformed into valuable products.
2. **Home projects:** Individuals can also contribute to recycling organic waste using insects by setting up small insect farms in their homes.

Successful examples

A successful example of using insects to recycle waste and produce protein is the “Black Soldier Fly” project in Kenya: This project uses black soldier worms to convert organic waste into protein-rich flour used in poultry feed (Maquart, (2019) ^[14], “Entocycle” project in the United States: This project uses shrimp (*Gammarus pulex*) to convert organic waste from salmon farms into organic fertilizer.

Then, in light of the increase in environmental awareness, modern techniques emerged to recycle this waste in sustainable and environmentally friendly ways, and among these techniques the recycling technique using insects emerged (Abdel-Shafy & Mansour, 2018) ^[2].

Challenges and opportunities:

The use of insects in waste recycling and protein production faces some challenges, including:

1. **Negative outlook:** Some people view insects with suspicion and feel disgusted by the idea of eating them.
2. **Cost:** The cost of raising insects can sometimes be high.
3. **Regulations:** There are currently insufficient regulations to regulate the raising of honey and its use in food.

However, there are many opportunities to enhance the use of insects in this field, including:

1. **Increase awareness:** By disseminating information about the environmental and health benefits of insects, the negative perception towards them can be changed.
2. **Support research and development:** More research is needed to develop new techniques for raising insects and use them more efficiently.
3. **Developing regulations:** Appropriate regulations must be developed to regulate the raising of animals and their use in food.

Insects offer promising solutions to organic waste and protein problems. By raising awareness, supporting research and development, and developing appropriate regulations, we can promote the use of insects as a sustainable alternative to livestock farming, contributing to environmental protection and sustainable development.

Keywords: insects, organic waste recycling, protein, sustainability, environment, livestock farming.

Insects: natural solutions to enormous environmental problems.

Concluding Outcome

Insects offer promising solutions to organic waste and protein problems. By raising awareness, supporting research and development, and developing appropriate regulations, we can promote the use of insects as a sustainable alternative to livestock farming, contributing to environmental protection and sustainable development.

Keywords: insects, organic waste recycling, protein, sustainability, environment, livestock farming.

Insects: natural solutions to enormous environmental problems.

Benefits of recycling organic waste using insects

The technology of recycling organic waste using insects offers many benefits, including:

Reducing the amount of waste: This technology contributes

to converting large amounts of organic waste into valuable products, reducing the need to bury them in landfills (Arancon & R., 2013) ^[3]. Production of rich manure: During the recycling process, insects produce manure that is rich in nutrients, making it an excellent organic fertilizer for improving soil fertility (Beesigamukama *et al.*, 2021; Beesigamukama *et al.* 2021) ^[4, 4].

Reducing greenhouse gas emissions: This technology contributes to reducing greenhouse gas emissions by converting organic waste into useful products instead of anaerobic decomposition and releasing methane gas López *et al.* (2013) ^[5].

Cost: The cost of setting up insect rearing and processing facilities can be relatively high.

Social acceptance: Some people may have difficulty accepting the idea of using insects to recycle waste (Sajna *et al.*, 2015) ^[9].

Laws: There may not be adequate regulations governing the use of insects in waste recycling in some countries (Lähtenmäki-Uutela, *et al.*, 2018) ^[10].

However, the opportunities for developing this technology and applying it on a large scale are great, thanks to increasing government support for sustainable technologies and increasing environmental awareness among members of society.

Concluding Outcome

Organic waste recycling technology using insects offers a sustainable solution to the environmental challenges facing humanity. Due to its many benefits, this technology is expected to witness significant growth in the coming years, as the problem of organic waste accumulation is one of the greatest environmental challenges facing humanity today, as it constitutes about 40% of the total municipal solid waste. As a result of the anaerobic decomposition process of this waste, harmful greenhouse gases such as methane are released, which contributes to the exacerbation of global warming, which is one of the greatest challenges of our time. Sharma & Jain (2020) ^[1], Our world today faces enormous environmental challenges, followed by the negative impacts of livestock farming.

Conclusion

The use of insects in organic waste recycling offers a sustainable solution to the problem of organic waste management. Insects contribute to reducing the amount of organic waste, producing organic fertilizer and animal feed, and reducing greenhouse gas emissions. However, there are still some challenges facing the use of insects in recycling organic waste, such as cost, lack of awareness, and laws and regulations.

It is important to work to address these challenges by increasing investment in research and development, enhancing awareness of the importance of using insects in recycling organic waste, and working to enact laws and regulations that support the use of insects in this field.

Advantages

1. **Reducing the amount of waste:** This technology reduces the amount of waste heading to landfills, reducing

greenhouse gas emissions and pollution.

2. Producing organic fertilizer: The fertilizer resulting from this process is rich in nutrients, such as nitrogen, phosphorus, and potassium, which makes it beneficial for plant growth.
3. Reducing dependence on chemical fertilizers: The use of organic fertilizer can contribute to reducing dependence on chemical fertilizers that are harmful to the environment.
4. Protein source: Insects are a rich source of protein and can be converted into animal feed or protein flour for use in human nutrition.
5. Organic waste recycling using insects is a promising technology to address the organic waste problem and achieve environmental sustainability.
6. This technology offers many benefits, including reducing the amount of waste, producing organic fertilizer, reducing reliance on chemical fertilizers, and providing a protein source.

Recommendations

Research and Development: More research is needed to develop more efficient and cost-effective insect recycling technologies.

Awareness and education: Public awareness of the benefits of recycling using insects should be increased, and the adoption of this technology should be encouraged.

Policy support: Governments should support the development and implementation of insect recycling programs by providing incentives and supportive regulations.

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