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Editorial: Insights in waste management in agroecosystems: 2021

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Editorial on the Research Topic
Insights in waste management in agroecosystems: 2021

The world is immersed in a change of the economic paradigm from the linear economy of a take-make-consume and dispose model to a circular one. In the circular economy, the value of all resources should be maintained for the longest possible time within the productive system, without damaging the environment. The waste material from one sector becomes the source material for another sector with minimum waste production, moving toward zero waste. The idea is to reduce the extraction of natural resources of finite nature and avoid the production of waste. Therefore, in a circular economy the amount of primary resources is reduced, decreasing the environmental impacts linked with the extraction of resources. This is achieved by optimizing the use of the resources within the different economic sectors. This new system requires the development of new processes and technologies to extract the value of the waste and to produce new products without the need for natural sources. The waste materials are the key point for the reuse-recycle-repair sector to ensure the circular model.

In the bio-based economy (or Bioeconomy) the organic wastes or by-products are the renewable biological resources for conversion into valuable materials: food, feed, energy, chemicals, etc. As an alternative to virgin materials, waste could provide sustainable resources for the bioeconomy. The transformation of such organic wastes or by-products in the biorefinery can lead to the production of a variety of high value products, such as biofuels and bioenergy, bio-based platform molecules (e.g., organic acids), proteins, or biopolymers (Bakan et al., 2022). The biorefinery is intrinsic to the bioeconomy, since it covers all the processes necessary to convert biomass into bio-based products and bioenergy.

The numerous novel processes and materials developed for new industries have increased the diversity of organic wastes/by-products generated. The treatment of such new materials requires the development of new technologies, or the adaptation of existing ones to the characteristics of the organic waste, in order to prevent accumulation and avoid disposal. Integration of the waste biorefinery with the circular bioeconomy is a strategy for carbon management and for reducing emissions of greenhouse gases (GHGs). This approach would achieve a low carbon economy, diminishing the GHGs footprint, and thus would represent a significant step toward a sustainable and greener global economy (Leong et al., 2021). The benefits associated with a circular bioeconomy include enhanced efficiency in resource use, greater eco-efficiency, diminution of GHGs footprints, lower dependency on fossil resources, and addition of value to waste and by-products from different sources including agroindustry, through their conversion into usable resources.

The Research Topic "*Insights in waste management in agroecosystems: 2021*" aims to highlight the latest advancements and future perspectives in research across the field of waste

management in agroecosystems. The Research Topic has covered novel questions arising in organic waste management with regard to developing a circular economy and bio-based processes.

At present, society requires a strong food sector with new technological development which will result in different organic wastes or by-products being transformed into valuable products. The aquaculture sector faces a number of challenges for sustainable growth as well as environmental risks derived from the amount of sludge accumulated in the sediments of fish ponds. Traditional methodologies and procedures to transform organic waste are still very useful to promote the circularity in the agricultural sector. Composting of pond sludge of freshwater snakehead fish to produce organic fertilizers, thereby reducing the input of mineral fertilizer in vegetables, was studied by Thanh et al.. Such substitution of chemical fertilizers by compost also implies economic savings for the farmer. The recycling of fish pond sediments was demonstrated as a strategy to integrate aquaculture and agriculture systems for improving food production.

As an example of a biofuel biorefinery, Mermejo et al. compared the performance of *Clostridium pasteurianum* DSMZ 525 (a solventogenic clostridial species) and the non-solventogenic *Clostridium beijerinckii* Br21 for the production of a polymer subunit (1,3-propanediol) from glycerol fermentation. Glycerol is considered a by-product of ethanolic fermentation and biodiesel transesterification. The authors concluded that *C. beijerinckii* Br21 can produce 1,3 propanediol efficiently with good productivity if the glycerol concentration and pH are controlled during fermentation.

The presence of plastics and microplastics in agricultural ecosystems (soil-plant-water) constitutes a great environmental concern for modern agriculture. The accumulation of plastic in soils should be avoided, which requires the removal of the polyethylene plastic mulch from the agricultural soils and its safe disposal. Different end-of-life options for polyethylene mulch were reviewed by Madrid et al.. The authors identified different options to improve plastic waste management, and special attention was paid to soil-biodegradable plastic mulches. In fact, recycling and upcycling of used polyethylene mulch were considered the more sustainable disposal options. However, the technical and economic viability of cleaning and decontaminating used polyethylene mulch is an obstacle difficult to overtake. Soil-biodegradable plastic mulches can help to reduce the plastic accumulation in agroecosystems. The authors clearly identified the future research needs concerning the degradability of different biodegradable mulches under diverse soil conditions, including predictive degradation models. Also, the application of some materials to biodegradable mulches, which could enhance the degradation rate, has been revealed as highly novel.

The policymaking implications of waste management in agroecosystems with respect to the promotion of circular systems have been discussed by Duquennoi and Martinez. Their manuscript describes, from a historical perspective, European environmental regulations for the management of organic residues in agroecosystems. Constraints concerning soil preservation, water quality, gaseous emissions, human health, and resource efficiency have been identified. The main handicaps identified include the fact that waste from agriculture is not included in the European Union's official statistics (Eurostat) for solid waste, and only estimations can be found from diverse surveys. Also, the lack of unification and sometimes the use of vague terminology to describe residual material is one of the main issues highlighted. The authors pointed out the lack of a robust policymaking framework for the agricultural wastes, co-products, and by-products and, in general, the mechanisms to add value to the residual matter in agroecosystems, and suggested that innovative interactions between scientists and policymakers will significantly help to solve this. They have identified the concept of "sustainable circular bioeconomy" as an interesting way for science and policymaking to interact in sustainable waste management, to promote circular agroecosystems.

This Research Topic has covered a wide range of subjects, trying to solve questions arising from waste management in agroecosystems and to promote the circularity of the agricultural sector: from nutrient use through classical technologies such as composting, to the production of biopolymers through novel bioprocesses, across the environmental aspects of plastics in agroecosystems to the policy constraints in waste management and circularity in agroecosystems.

Author contributions

MB: writing original draft. MV: review and editing. Both authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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