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“Organic environmental pollutants as quality indicators and sentinels for circular bioeconomy and development of sustainable energy resources”

As an important prerequisite of sustainable future circular bioeconomy strategies, recycling of both non-renewable and renewable nutrients from organic residues will be important. Thus, application of organic residues as soil amendment and fertilizer are expected to recycle the nutrients contained in the residues but may also imply a dispersal and accumulation of contaminants on agricultural soils. From soils, contaminants may be absorbed into food and fodder plants, ultimately resulting in animal and human exposure. The development of suitable production pathways for renewable energy production in recent years still do not take potential associated pollutant transfer sufficiently into account. Various technologies have been promoted and applied with the potential of uncontrolled emission of anthropogenic pollution. For instance, the use of biological (waste) material in anaerobic digestion, both as decentralized farm biogas plants as well as municipal plants for handling of, among others, organic household waste, has increased significantly in Europe and the North Americas. This development leads not only to an increasing amount of bioenergy produced, but also to a considerable amount of production waste to be handled properly (i.e., biogas digestate). The most attractive option to manage these digestates is to apply them as organic fertiliser to agricultural land allowing to recover nutrients, primarily nitrogen and phosphorus, and, in addition, potentially improving soil quality by adding organic matter. Unfortunately, such residues may also contain complex organic compound mixtures, salts, anthropogenic pollutants and/or pathogenic bacteria that can adversely affect terrestrial organisms and may accumulate in plants. Thus, the identification of potential pollutant sources and the development of suitable mitigation strategies are a prerequisite for the success of the currently propagated circular bioeconomy.