jResource Recovery

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Editorial Note

# Resource Recovery for Sustainable Development and Circular Economy

Modern technology requires the availability of resources at present and in the future. For example, the unique properties of elements on the periodic table, such as metals (e.g., lithium, nickel, cobalt, copper, etc.) allow them to be used in given applications with high efficiency. The everlasting supply of resources, however, is questionable due to the decrease in natural reserves (DuChanois et al., 2023). Therefore, resource recovery is crucial and inevitable to reach sustainable development and circular economy.

Resource recovery is a critical aspect of sustainable resource management. It involves various issues, including identification, collection, and processing of waste materials and wastewater streams to extract and recover value-added resources, materials, and chemicals (Chen, 2022; Ingrao et al., 2018). Thus, resource recovery can play an important role in protecting the environment, conserving natural resources, and promoting economic growth. By recovering resources from waste and wastewater streams, the number of used materials, chemicals, and liquids that end up in landfills or the environment can be reduced, natural resources can be conserved, and the environmental impacts associated with the exploration and extraction of natural resources can be reduced, as well. Furthermore, resource recovery can create economic opportunities and generate revenue, while also helping to conserve energy. Therefore, resource recovery is an essential part of achieving a sustainable and circular economy, where waste material, wastewater, and waste energy are considered as valuable resources to be reused, recycled, or repurposed instead of being discarded or wasted. Figure 1 shows the main items that represents the importance of resource recovery.


**Fig. 1.** Main reasons to highlight the importance of resource recovery.

As it is indicated in Figure 1, resource recovery is quite important for several reasons, which are briefly discussed as follow.

Many resources are finite and non-renewable, such as metals and fossil fuels. Resource recovery helps to extract these resources from waste materials and wastewater streams and reuse them for the same or new applications. A good example is metal recovery, such as lithium (Li) and cobalt (Co), from waste batteries for either reusing in the energy sector or other applications (Mishra et al., 2022). Another example is the recovery of precious metals, such as gold (Au), platinum (Pt), and silver (Ag), from industrial wastewater streams (Taghvaie Nakhjiri et al., 2022). Consequently, this can considerably reduce the need for new resource extraction and preserving resources for future generations, as well.

Resource recovery can also reduce the amount of waste that is sent to landfills and incinerators, which can help to reduce greenhouse gas emissions. By recovering valuable resources from waste, we can also reduce the amount of waste that needs to be disposed of and promote a more sustainable approach to waste and wastewater management. All these have made resource recovery as an important part of the circular economy, which aims to keep materials in use for as long as possible and minimize waste generation. By recovering resources from waste, we can create a closed loop system where materials are reused instead of discarded. Moreover, resource recovery can help to reduce the environmental impacts of exploration and extraction of raw materials and the consequence waste disposal in these activities. For example, mining for exploring and producing new resources can cause habitat destruction and pollution (Harpprecht et al., 2021), while incineration of waste can release harmful chemicals into the air (Tait et al., 2020). Resource recovery can help to minimize these impacts by reducing the need for new resource exploration and extraction as well as reducing the amount of waste and wastewater that need to be disposed of.

Furthermore, resource recovery can also make economic opportunities by providing jobs in waste management and resource extraction industries, and by creating and developing new markets for recycled materials. The economic aspect of resource recovery can be specifically important for developing countries. Resource recovery can help these countries to address environmental, economic, and public health issues (Yu et al., 2022). By recovering resources from waste, developing countries can move towards a more sustainable and circular economy, promote self-sufficiency and economic growth, and improve public health and well-being.

In conclusion, resource recovery plays a vital role in achieving sustainable development and circular economy. It promotes the efficient and responsible use of resources, reduces waste generation and environmental pollution, and fosters the circular economy. By recovering resources such as materials, energy, and water, the human reliance on virgin resources and the environmental impact of human activities, can be reduced and minimized, respectively. Additionally, resource recovery can create new economic opportunities and provide social benefits by creating jobs, reducing energy costs, and improving public health. Therefore, it is crucial to prioritize resource recovery in policy and making decisions at all levels, from individual households to global institutions, and among all decision makers and politicians, to ensure a more sustainable and resilient future for all.

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