

The Fourth Term's Research Themes

Social implementation of the bio-PET production from inedible biomass resources to mitigate global warming

Mitigating Global Warming through the Use of Biomass Resources



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Envisioned Future

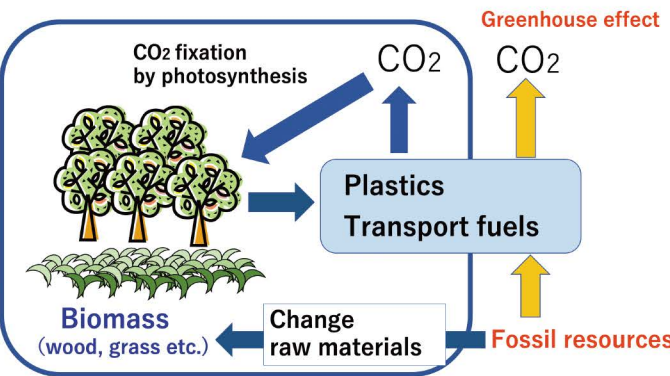
- Mitigating global warming by reducing CO₂
- Revitalization of the agriculture and forestry in rural areas

Social Background and Challenges

Due to the use of fossil resources since the Industrial Revolution, the concentration of carbon dioxide (CO₂) in the atmosphere has been increasing over the years. It is predicted that higher atmospheric CO₂ concentration will cause global warming due to the greenhouse effect, resulting in adverse effects such as sea level rises caused by melting glaciers/ice sheets on land, and changes in climate and vegetation. In addition, Japan's rural areas are facing the challenges of depopulation and aging.

To revitalize the rural areas in addition to mitigate global warming, the use of timber from forest thinning and biomass resources generated at lumber mills in the areas is being promoted. Biomass resources, plants and animals that can grow through photosynthesis, include timber and grass. They can fix CO₂ in the atmosphere through photosynthesis, so are considered to be more effective in reducing CO₂ emissions than the use of fossil resources. Currently in Japan, biomass resources are often used for heat and power generation by direct combustion. The reason that biomass resources are often

used as energy resources for heat and power generation instead of raw materials for products is that they are physically solid and composed of multiple components, making it more expensive to use them as raw materials. To overcome this issue, it is necessary to manufacture high value-added products from biomass resources, the demand of which should be expected to increase.



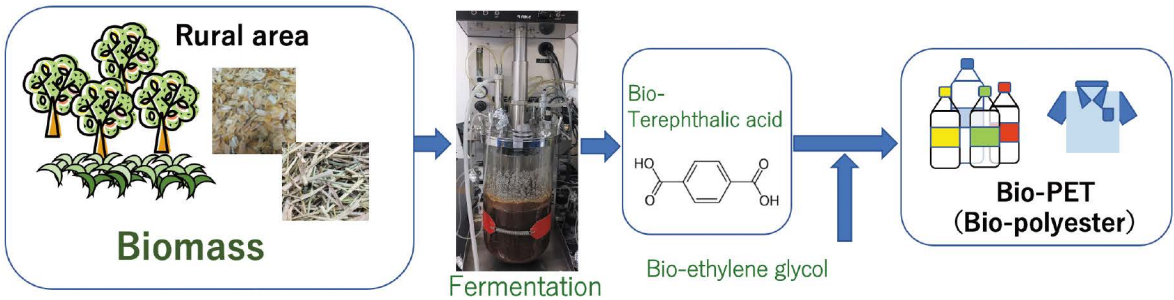
Reduction of CO₂ emission
by biomass resources utilization

Research and Development to Solve the Challenges

This research aims to reduce CO₂ emissions that cause global warming and revitalize the agriculture and forestry industries by producing terephthalic acid, a raw material for polyethylene terephthalate (PET) used in beverage bottles, clothing, films, and other products, from biomass resources.

Global demand for terephthalic acid was 62 million tons/year in 2017, and is expected to increase to 80 million tons/year by 2023. While various companies and research institutes are conducting R&D to produce terephthalic acid from biomass resources, many of the technologies use chemical processes that use thermal reactions, which can lead to high energy consumption in the production of terephthalic acid. In addition, competing

technologies require a large number of manufacturing processes in the production, which require high equipment costs. On the other hand, the manufacturing method used in this research has the potential to reduce energy consumption and manufacturing costs compared to competing technologies, because it uses a microbial fermentation method for producing terephthalic acid from biomass resources, which allows the reaction to conduct at room temperature, and also requires fewer manufacturing processes. In order to achieve this goal, we are working on the selection of suitable biomass resources for the production of terephthalic acid, the improvement of microorganism, and the establishment of mass production technology.



Revitalization of agriculture and forestry
Reduction of CO₂ emission

Process for the production of terephthalic acid,
a raw material for polyethylene terephthalate (PET) using biomass resources

Patents, Research Grants, Awards, etc.

- Patents:
"Method for producing terephthalic acid and polyester from biomass resources (PCT/JP2022/5192)"
- Research Grants:
Bio-oriented technology Research Advancement Institution (BRAIN), Small Business Innovation Research Support Program (SBIR Support)
Title: "Commercialization of terephthalic acid and polyester production technology from unutilized biomass resources to revitalize the agriculture and forestry industries"
Phase 0 (FY2021-FY2022), Phase 1 (FY2023) ,Phase 2 (FY2024-)
- Awards:
AgriFood SBIR Pitch Contest 2022 "Breakthrough Tech Award" (2022.4.25)