The potential of biofuel production from urban wastes to contribute to a sound material cycle society
-Case studies on construction and food waste-
循環型社会形成にむけての都市廃棄物からのバイオ燃料生産の可能性
-建築廃木材と食品廃棄物活用に関する事例研究-

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1. Introduction

Japan's Kyoto Protocol Target Achievement Plan called for a clear role for biofuels with an indicative target for introduction of liquid biofuels for transport at 500,000 kl of crude oil equivalent by FY 2010. Driven by multiple policy objectives including not only climate change but also energy security, regional development, and development of a sound material cycle society, biofuels have been officially promoted since mid-2000s, although the scale of introduction is quite modest compared to that of other countries. Although biofuels are expected to contribute to mitigating green-house gases (GHG) emissions from the transport sector to a certain extent in the short term, its long-term potential remains ambiguous due to the factors such as the rates of technological development of the second/third generation biofuels and development of advanced vehicles such as electric vehicles and fuel cells. Nevertheless, biofuels may still have a significant potential to facilitate a sound material cycle society in the long run, if sufficient progress is made in technologies related to material conversion and the collection/transportation of their feedstocks.[1] This research aims to analyse the potential of biofuel production from urban wastes and their opportunities and challenges based on two case studies.

2. Methodology

Case studies are conducted on two pilot projects of ethanol production from urban waste: construction waste timbers in Osaka Prefecture and food waste in Kitakyushu City. Both cases are recognised as the first projects in the world to utilise those wastes for biofuel production. Data were obtained through field visits, interviews and written sources. The analysis considered potential contributions to reduction of waste, fossil fuel use, and GHG emissions; and challenges and opportunities of the projects including feedstock (waste) collection efficiency, energy efficiency, economic viability, marketing of the products, and support by stakeholders. Based on the results, the potential implications for other Asian countries will be also discussed.

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3. Preliminary Results

Data show that substantial amount of both construction waste timbers and food waste is still unutilised (Table 1), indicating that ethanol production can further promote recycling of wastes instead of combusting. The construction waste timber case appears to have a high potential of GHG emission reduction compared with gasoline, but it is still less than if the timbers are used as solid fuel. Ethanol production from food waste shows high energy conversion efficiency, but scaling-up is needed to achieve economic viability. For that purpose, collaboration among stakeholders including waste generators (citizens), local government, and waste treatment companies is essential. Further analysis will include assessing the portfolio of waste biomass, roles of eco-towns, and the laws related to recyclables.

Table 1: Summary of preliminary results

Feedstock	Construction Waste Timbers (in Osaka Prefecture)	Food Waste (in Kitakyushu City)
Overview	Production of 1,400 kl/year ethanol from 40,000 – 50,000 ton of construction waste	Production of 400 l/day ethanol from 10 ton of food waste
Potential contributions	• 30% of construction waste timbers (total 4.7 million ton) is unutilised[2] • An estimate shows GHG emission reduction by 90 % compared to gasoline[3]	• 80 % of food waste (total 20 million ton) is unutilised • Energy conversion efficiency is high because fat content in the waste can be collected as oil[4]
Opportunities	• Treatment fee can provide income to the ethanol plant • Timber waste can be preserved better than soft cellulose	• The plant can process waste mixed with improperly segregated trash (up to 10%) • Collaboration from the citizens was facilitated through point systems
Challenges	• Criticism on the selected enzyme • Feedstock supply fluctuates reflecting oil price and construction market • Efficiency is lower than its direct use as solid fuel	• Scaling-up is needed for attaining economic viability • Prompt and simple treatment is necessary to prevent odor • Collaboration among stakeholders is crucial

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Reference

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