Special Session 4: March 17, 10:30–12:00 (JST)

Material Cycles in Construction Works

Organized by the Japan Society of Material Cycles and Waste Management

The Journal of Material Cycles and Waste Management is currently running a Special Issue entitled "Material cycles in construction works" to explore the contributions of construction industry to solutions and prescriptions for technical, political, and environmental problems of material cycles and waste management. This session collaborates with the special issue and introduces some latest and innovative achievements in reuse and recycle of municipal and industrial wastes in construction works. Also, the session would like to give a comprehensive review on Japanese status on sustainable management of construction and demolition materials including excavated surplus soils.

Program

Session Chair : Dr. Toru Inui, Osaka University, Editor of the Journal of Material Cycles and Waste Management

10:30-10:35

Introduction and welcome — Dr. Toru Inui, Osaka University, Japan

10:35-11:00: Special presentation

Material reuse and recycling in construction works in Japan

Prof. Takeshi Katsumi, Kyoto University, Japan

The status of material reuse and recycling in Japan is reviewed with an emphasis on the efforts by the national government. The current status of the generation, treatment, and reuse/recycling of construction waste and by-products is provided. The national policy, including the regular survey and action plan, is summarized. The newest version of the "Material Reuse and Recycling Promotion Plan in Construction Works," which was formulated in 2020, is introduced. Efforts to solve three major challenges for material reuse and recycling are discussed. The statuses and problems of each waste and by-product generated from construction works are described.

11:00-11:50: General presentations

(1) Hydroponic technique using waste concrete and ferronickel slag instead of fertilizer

Hiroyuki Ishimori, National Institute for Environmental Studies, Japan

This presentation introduces whether some minerals in waste concrete and ferronickel slag are available for hydroponics instead of commercial fertilizer. Waste concrete and ferronickel slag contain rich nutrients for plants. In this study, small-scaled hydroponic plant growth tests targeting romaine lettuce and spinach were conducted in order to verify this idea. According to the experimental results, the calcium in waste concrete was effective for growth of the romaine lettuces. The magnesium in ferronickel slag improved not only the growth of the spinaches due to photosynthesis but also the uptake amount of the phosphorous, resulting in the reduction of operating costs such as lighting electric power and nutritional resources for plant factories.

(2) Predicting the particle size distribution of fine-grained and sandy soils using deep learning for classifying recovered soils separated from tsunami deposits

Masaya Iwashita, Okumura Corporation, Japan

Disaster wastes, particularly those generated in tsunami, comprise soil and sediments and

recovered soil is yielded through treatment such as separation from disaster waste and tsunami deposits. Sieving method is used to determine the particle size distribution of recovered soil before reuse. This study uses a convolutional neural network (CNN) model to predict the particle size distribution of fine-grained and sandy soils. Soil with a particle size range of <4.75 mm was size-fractionated and used as training data. The photo image of the size-fractionated soil was divided and merged to prepare the training data as data augmentation. This study shows that the particle size distribution of fine-grained and sandy soils could be predicted with the RMSE of <0.11 using photo images.

(3) Durability analysis and optimization of a binary system of waste cement concrete and glass-based geopolymer mortar

Sourav Kumar Das, Malaviya National Institute of Technology, India

Enormous generation of construction and demolition (C&D) waste along with municipal solid waste (MSW) is required to managed properly for developing a sustainable environment. In this study waste cement concrete (WCC) from the C&D waste group and glass waste (GW) from the MSW group is considered as a precursor for preparation of binary geopolymer mixture. The alkali solution used for alkalination is the mixture of sodium hydroxide (10M) and sodium silicate at a ratio of 2.5. WCC is replaced by GW up to 50% with a 10% interval. Results indicate that the inclusion of GW enhances both mechanical and durability properties with an optimum dosage of20% GW content. Specimens with 20% GW content reported the lowest mass loss of2.22% and 4.28% when exposed to 5% hydrochloric and 5% sulfuric acid, respectively for 90D. While the maximum residual compressive strength after 90D exposure is found to be 83% and 76% for 5% hydrochloric and 5% sulfuric acid, respectively of their 28D compressive strength. Binary specimens also reported higher resistance to sulphate attack than control WCC specimens. Finally, it can be concluded that WG can be effectively used with WCC based geopolymer mixture in a binary system.

(4) Hydration characteristics of coconut fibres reinforced mortars containing CSA and Portland cement (TBC)

Mohamed Boutouil, ESITC Caen, France

11:50-12:00: Q&A and Summary