



学位論文要旨

専攻名 共生環境学専攻

氏名 シティ ハンギッタ ラフマワティ

題目 Environment-Friendly Ground Improvement Technique Using Waste Shell Husk
(廃棄貝殻を用いた環境保全型地盤改良技術に関する研究)

Every year a huge amount of Seashell-By-Products (SBP) are produced in all over the world. According to the Japanese Ministry of Forestry, Fisheries and Agriculture, the total amount of abandon shell husk is about 151,000 tons/year which generated industry and household consumption. It nearly 32 million US\$/year are being used for disposal cost which still unexpected event for a developed country like Japan. In developing country, illegal dumping is a most common way to treat this waste due to a high cost of waste treatment. In a certain time, if this waste is untreated, the air pollution and other environmental problems occur. It is because of abandon shell husk without properly treatment becoming a source of unpleasant smells due to either the decay of remnant flesh attached to oyster shells or microbial decomposition of salts into gases such as NH_3 , H_2S , and amine. The development of technologies that use abandoned shell husk is needed according to the consequences for a human being.

In the present study, the abandon shell husks are being used as the recycle aggregate in ground improvement technique. Recycling aggregate utilization has the advantage to protect limited resources of natural aggregates, increasing the abandon waste value and problem-solving of waste storage. Ground improvement techniques are contributed to increasing the soil strength and performance under the load, also reducing the compressibility of soil. Recently recycle aggregate has recently been used in all over the world to reduce project budget and protect the environment. The shell husk has potency as recycle aggregate due to a composition which consists of mainly 95-99% (by weight) of CaCO_3 that potentially convert to CaO for reinforcing the soil or binding the material.

Furthermore, the utilization of shell husk are purposed to improve agriculture land which need lightweight material. Effective ground improvement technique is normally needed in improving agriculture land condition. To enhance the soil-shell husk material properties, then shell husks are mixed with cement. Cement is a soil stabilizing agents which used widely, due to its quick process. Application soil-cement with a nominal dosage of cement also has a significant contribution to the environment and it is cost-effectiveness. In Japan, many terrace land uses cement-treated soil to prepare new cultivation paddy fields from unused land.

Then, to evaluate this concept, in this study was prepared several specimens which are control (only soil), soil-shell husk, soil-cement, soil-cement-shell husk. The specimen which has cement percentages was cured for seven days before laboratory testing. The laboratory testings are included direct shear test, CBR (California Bearing Ratio), UCS (Unconfined Compressive Strength), triaxial test. In this study, the properties of soil and shell husk also had been clarified. The parameters were a shear strength, the angle of internal friction (ϕ), cohesion (c), dilatancy behavior, bearing capacity, stress, strain, moduli deformation, axial strain (ϵ_a), and principal stress difference ($\sigma_a - \sigma_r$). The outcome of this research indicated that shell husk has the capability as the recycle aggregate in ground improvement technique. Moreover, a combination of shell husk-cement is expected to improve agricultural earth structures.