ABSTRACT

Controlled low strength material (CLSM) is a flowable mixture such that it does not need compaction. It is produced by mixing Portland cement, fly ash, fine aggregates, water, and chemical admixtures. Sand is the most commonly used fine aggregates in the conventional CLSM. However, it is becoming more and more difficult to obtain sand in Korea. In this study, the characteristics of unconfined compressive strength, applicability of a new CLSM that is produced by a mixture of bottom ash, fly ash, water, cement are checked. Test results showed that unconfined compressive strength satisfied the standard unconfined compressive strength (0.5~1.0MPa) when the mixture ratio of bottom ash and fly ash was 30:70~70:30, cement ratio was 3.0~5.0%, and water content was 31~34%.

KEYWORDS: Controlled low strength material, Bottom ash, Fly ash, unconfined compressive strength

INTRODUCTION

Industrial byproduct generation is rapidly increasing as domestic industries expand in Korea. Most of the industrial byproducts are being reclaimed, resulting in serious issues in environment protection and resource recycling. Coal is globally used as thermal power plant fuel due to its abundant reserve, cheap price and stable supply. In Korea, coal ash generation increased from 3.95 million tons in 1999 to 6 million tons in 2007, as more coal power plants and cogeneration facilities were built. However, coal ash recycling use up to now has been limited to cement raw material, ready-mixed concrete admixture, embankment or earth covering. Among coal ash, fly ash is being recycled but the majority of bottom ash is being reclaimed in an ash disposal area without recycling. Furthermore, since fly ash (FA) and bottom ash with different properties are mixed with sea water and reclaimed in an ash pond; the engineering properties of ponded ash (PA) are not consistent, disabling recycling of ponded ash.

The recycling ratio of coal ash during recent three years are; year 2004, 67.9%, year 2005, 59.4% and year 2006, 67.7%. It is less than 70% of total generation of coal ash. The quantity of total coal ash reclaimed in the ash disposal area is estimated as 72 million tons as of 2008. Therefore, it is quite urgent to find a way to recycle coal ash in large quantities other than the existing recycling uses, in order to maximize the recycling of coal ash being generated. In this research paper, controlled low strength material (CLSM) is suggested as additional recycling use of coal ash. The low strength concrete concept of geotechnical engineering was applied to CLSM. It does not need compaction and it has high flowability. In general, fine aggregate (sand), fly ash, water, cement and admixture are mixed to make CLSM (ACI 229 Committee, 1994). CLSM has characteristics such as self-leveling, self-compacting, flowability and controllable strength. It is also easy to re-excavate after construction and it enables construction cost saving by shortening the construction steps (ACI 229 Committee, 1994). CLSM with such characteristics is being used as refilling material, joint-filling material or road paving for trenches, retaining walls and foundations, instead of sand. However, existing CLSM uses sand as fine aggregates, though it is increasingly difficult to get sand in Korea. If ponded ash would be used instead of sand in making CLSM, the CLSM could then be used as a filling material or joint-filling material for various structures filling or public water surface reclamation. The results would be that the environment can be protected by recycling ever-increasing coal ash to be reclaimed. It can also be supplied as a replacement for soil or sand required to reclamation and construction. Accordingly, in this research, the characteristics of CLSM made of ponded ash, fly ash, cement and water, and application possibility will be explored.

EXPERIMENT PLANNING AND METHOD