ABSTRACT

Comparing the other overseas clays, Japanese clays show extremely high water content or high plastic index. To investigate the effects of diatom microfossils contents on engineering properties of cohesive soils, physical properties tests, unconfined compression tests, direct shear tests, anisotropic consolidated triaxial compression tests and residual effective stress measuring tests are performed on reconstituted cohesive soils with different diatom microfossils contents. Data for diatom microfossils contents in soils and their effects on engineering properties of soils are quantitatively discussed. Finally, it is found that the physical properties, shear strength and deformation characteristics are considerably influenced by diatom microfossils contents.

KEY WORDS: residual effective stress; unconfined compressive strength; diatom microfossil; shear strength; physical properties.

INTRODUCTION

Many of researches have been carried out for years by authors through in-situ and laboratory examinations on the various types of soils from Japan and from several foreign countries to compare their engineering properties. As a result, it has been found that Japanese marine clays contain rather large amount of diatom microfossils. Probably this would be one of the reasons why the engineering properties of the Japanese marine clays are significantly different from those of foreign countries clays (Tanaka and Locat, 1999). Diatoms generally belong to a group of unicellular algae of several tens to several hundreds micrometers in diameter. They have porous shells which are made of silica acid (SiO₂). The remains of fossilized diatoms are called diatom microfossils.

Tateishi et al. (1994) studied on the mechanical properties of diatom microfossils in Oita Prefecture and Shigematsu et al. (1999) discussed the yield properties of diatom microfossils distributed in the northern part of Gifu Prefecture by laboratory test results. These studies clarified the strengths and the deformation characteristics of diatom microfossils. For the Pleistocene clay of Osaka Bay containing a large numbers of diatom microfossils, it was pointed out that the diatom microfossils strongly affected the compression properties of the Pleistocene clay (Tanaka and Locat, 1999). In order to investigate the effects of diatom microfossil contents on the mechanical properties, Shiwakoti et al. (2002) conducted incremental loading consolidation tests and direct shear tests on the samples of the diatom microfossils mixed with kaolin and Singapore clays. They showed that the mechanical properties such as the compression index, the coefficient of permeability the internal friction angle, and the rate of increase in strength, varied as the diatom microfossil contents increased.

In spite of those studies carried out so far, however it is still insufficient to find the hard data and results for the effect of the diatom microfossils on the mechanical properties of soils and many of issues are remained unclear. In a country like Japan where soils generally contain a large numbers of diatom microfossils, it is an important subject to quantitatively understand the effects of the diatom microfossils on the mechanical properties of clays. This paper reports the test results recently carried out by authors, where the diatom microfossils mixed with different types of clays like kaolin, Singapore, and Bangkok clays are used. The test samples were subjected to the following tests; residual effective stress measurement test, unconfined compression test, direct shear test and triaxial compression test. Through these tests, the effect of the diatom microfossil contents on the shear strength was to discuss in this paper.