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Effect of Initial Moisture Content on Unconfined Compressive Strength of Cemented-Fiber-Clay

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ABSTRACT
Compressive strength of soil is an important measure in geotechnical engineering. On the other hand, stabilization of soils has been critical these days due to existence of by-product and recycled materials. This study aims to evaluate effect of initial moisture content (IM) in UCS values. The mixture was prepared as combination of cement and clay and fiber. The percentage of fiber was varied from 5% to 15%. The IM had significant effect on UCS values.

Key Words: UCS, fiber, cement

1. INTRODUCTION

Investigation on soil strength both shear and compressive strength being studied in literature [1-10]. As example effective stress investigation in [2], the consideration of non-evasive method [3], anisotropic stresses [4], stress distribution in different applications [5,6]. Some also relevant to stresses in liquefaction [7,10]. The literature for clayey materials raised some concerns especially if the clay is soft and inclined to fail under relatively low stresses. One of the approaches which is popular due to its cost and being quick is unconfined compressive strength (UCS).
On other hand, application of stabilization techniques in its different forms such as fiber, cement, flyash and slag etc being studied as an example, fiber being studied in terms of direct shear, permeability issues, UCS tests, compaction and dynamic behaviour in [11-21], Flyash slag sawdust and waste tyre investigated in among others [22-37]. Fly ash application among others [32-34]. In addition, as an example tyre chips [36, 37].

The principle of UCS testing is based on the fact that a compression load is applied till sample fails. This study considers the effect of initial moisture content (IM) into the behavior of soil mixed with cement and fiber. The moisture content is defined as amount of water trapped in soil matrix. The moisture content is calculated as ratio of water mass and dry soil mass. This work is continuation of stabilization research on soil in Curtin university.

2. MATERIALS

This study aimed to consider the mixture of clay, fiber and cement. The following sections show the used materials:

2.1 Clay

The clay which was used in this study is kaolinite clay. The PSD of kaoline can be seen in Figure 1.

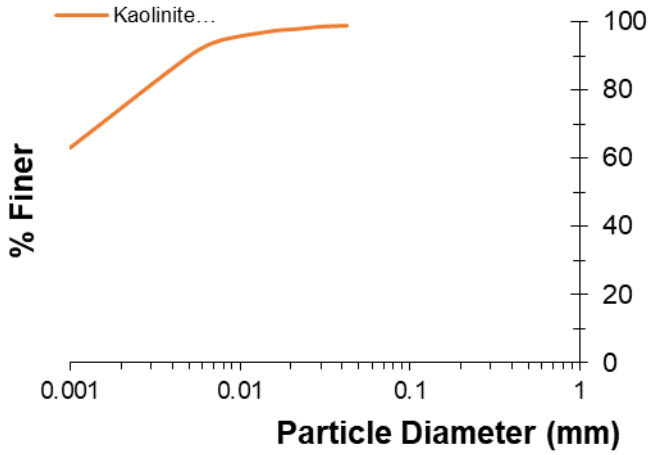

Figure 1 : PSD of kaolinte

2.2 Cement

Portland cement (PC) was used to build the mixture. The Type II was employed in this study.

2.3. Fibre

The fibre used in this study was in gray color and non-rough surface. The length of fiber measured as 10mm±2.

2.4 Fillers

As fillers 0.5% powdered tyre and 0.5% flyash was added to the whole mixture.

3. TESTING PLAN

The UCS device was used in this study. The device can be seen in Figure 2. Table 1 presents the characteristics of samples and testing plan.

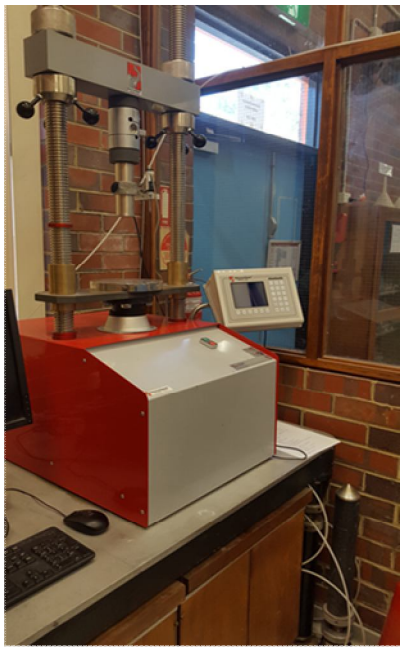

Figure 2: UCS device

Table 1: Testing program utilized in this study

Sample ID	PC (%)	IM/C	Fiber (%)
K-5F-5PC	5	0.2, 0.4, 0.6	5
K-10F-5PC	5	0.2, 0.4, 0.6	10
K-15F-5PC	5	0.2, 0.4, 0.6	15

4. TEST RESULTS

4.1. Compaction Results

Table2 presents the characteristics of compaction. The OMC (optimum moisture content) and MDD (maximum dry density) are presented. Figure 3 and 4 presents a comparison among samples.

Table 2: Results of compaction tests

Sample ID	Fiber (%)	OMC (%)	MDD
K-5F-5PC	5	26	1.25
K-10F-5PC	10	27.5	1.23
K-15F-5PC	15	29	1.22

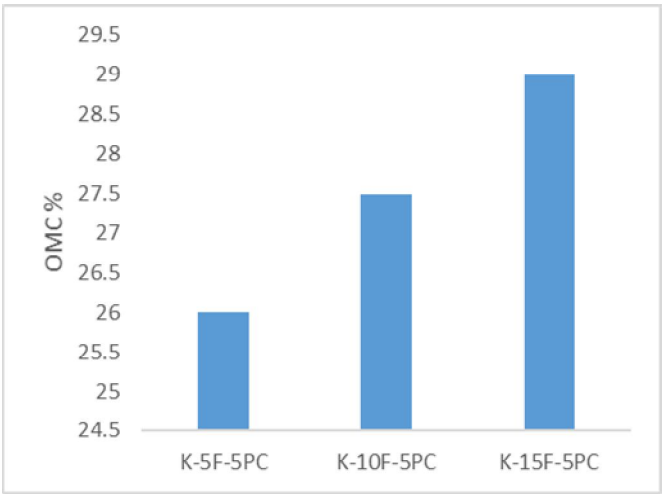

Figure 3 : OMC of samples

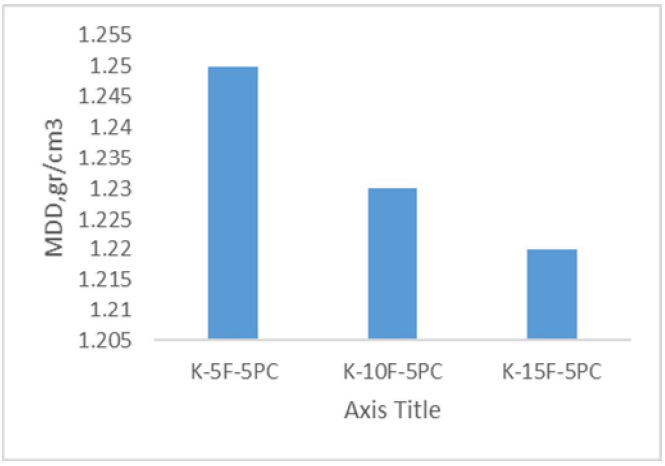

Figure 4 : MDD of samples

4.2. Unconfined Compressive Strength

UCS testing were conducted on a soil mixture of fiber dosage of 5, 10 and 15%. The cement dosage kept constant at 5percent. The clay mixed with the cement and fiber with percentages explained.
The UCS test was conducted in accordance with Australian standard. The rate of compression was selected as 1 mm/min. The samples were prepared in different initial moisture contents. The outcome of UCS tests can be seen in Figure 5 to Figure 7.

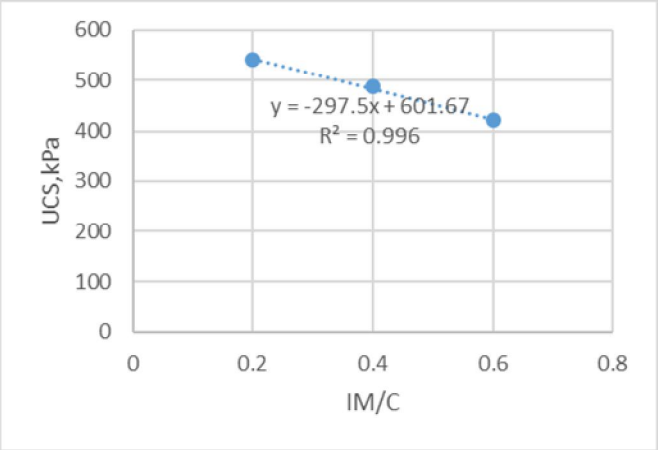

Figure 5: UCS results for 5% fiber.

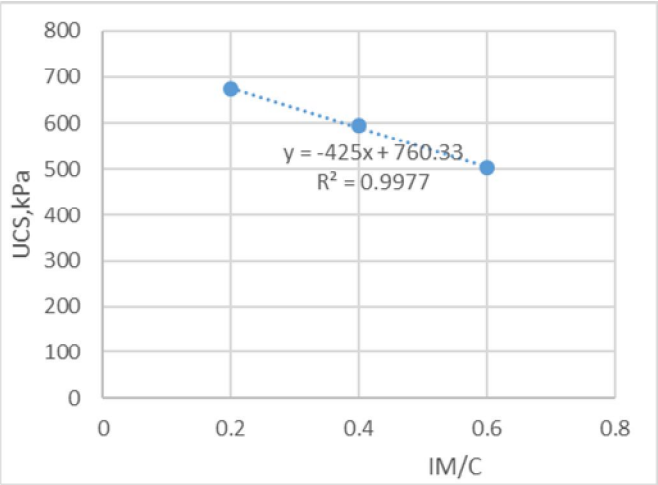

Figure 6: UCS results for 10% fiber.

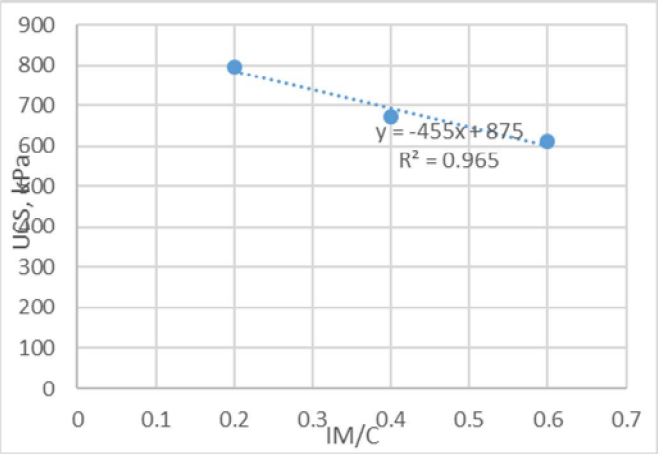

Figure 7: UCS results for 15% fiber.

5. CONCLUSION

A series of compaction tests were conducted, the outcome of compaction shows that with increasing in fiber dosage the OMC increased and MDD decreased. The UCS shows with increasing in IM/C the UCS values dropped in all fiber dosages.

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