AN EFFECT OF SUGARCANE BAGASSE ASH (SCBA) ON THE STRENGTH OF STABILIZED PEAT: FOCUS ON SCBA AVERAGE PARTICLE SIZE AND OTHER ADMIXTURES EFFECT

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1. INTRODUCTIONS

The vastness of peat land coverage and its occurrence close to or within population centres and existing cropped areas means some form of infrastructure development has to be carried out in these areas [1]. Sugarcane production is world number one commodities. Approximately 32% of bagasse is produced from every tonne of sugar cane been processed [2].

2. BACKGROUND

It is well recognized that organic soils can retard the proper hydration of cement unless a large quantity of cement is mixed in order to neutralize the acids in peat soil [3]. In order to generate power for factory usage, bagasse burned and eventually left the ash as a waste. Hence, the utilization of Sugarcane Bagasse Ash (SCBA) in the stabilization of peat soil can be a compelling idea and seems to be promising alternative when considering issues of energy consumption and pollution.

3. METHODOLOGY

The materials that had been used are Hokkaido peat soil, Ordinary Portland Cement (OPC), calcium chloride ($CaCl_2$), silica sand so called K7 and two types of SCBA. In order to clarify an effectiveness of SCBA, Unconfined Strength (UCS) test was performed on some factors that affect the peat stabilization. These factors are OPC-SCBA composition, OPC dosage, K7 dosage and preloading effect. The important factors was included in a multiple regression analysis to find an equation that can be used to predict the unconfined strength, q_u of Hokkaido peat–SCBA mixtures which emphasize given on average particle size, D_{50} of SCBA.

4. RESULTS AND DISCUSSIONS

The results in Figure 1 shows the experimental results of the effect of SCBA on the q_u of the stabilized peat. An optimal q_u was evaluated based on the results of UCS tests on the specimens of stabilized peat with partial replacement of the cement with two types of SCBA that varies from 5% to 25%. It can be observed that the test specimen with 20% and 5% partial replacement of OPC with SCBA has the highest q_u for SCBA 1 and 2 respectively. However, optimum mixture for SCBA 2 not reach the minimum target of q_u. ASTM D4609 [4] states that an increase in q_u of 345kPa (minimum q_u target in this study) or more must be achieved for a treatment to be considered effective. At the optimal mix design of both SCBA, the q_u of the stabilized peat specimens increased with increasing of OPC dosage, K7 dosage and preloading rate but still the SCBA 2 needed higher amount of admixtures compared to SCBA 1 (Figure 2, 3 and 4). The main different between SCBA 1 and 2 characteristics is their particle sizes like shown in figure 5. SCBA 1 was recorded the finer particles compared to SCBA 2. Therefore, it is important to estimate the effect of this characteristic on the strength of-stabilized peat. In order to achieve this goal, all the q_u results were collected for carrying out a statistical analysis. The following regression model for predict the q_u of Peat-Cement-Bagasse ash (PCB) mixtures was developed:

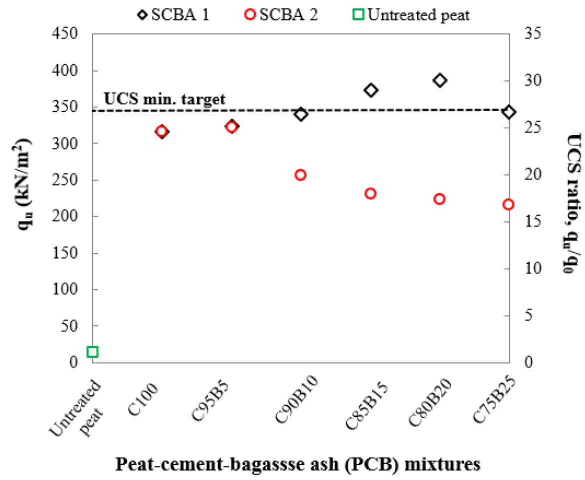

Figure 1 Effect of OPC-SCBA on the unconfined compressive strength of the stabilized peat

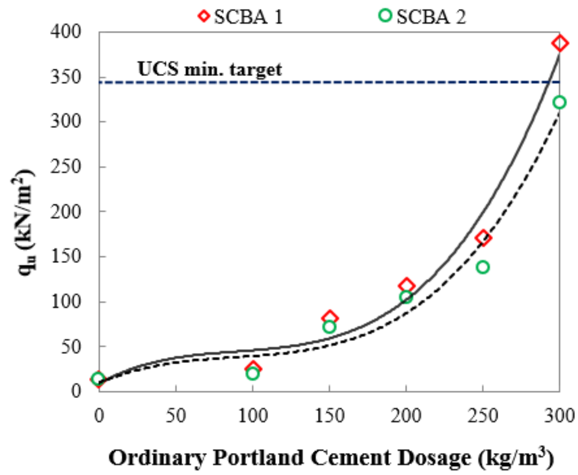

Figure 2 Effect of cement dosage on optimal binder mix

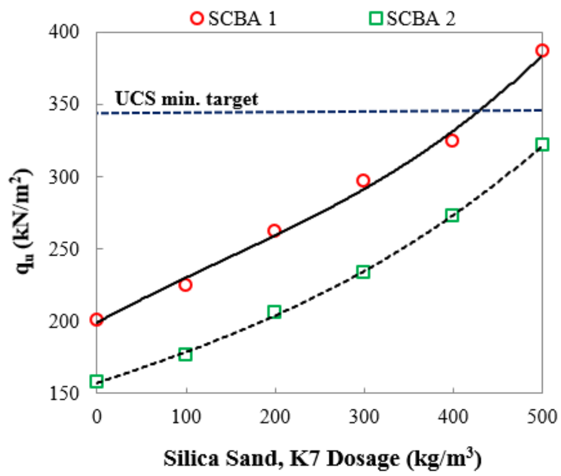

Figure 3 Effect of silica sand dosage on optimal binder mix

$$q_{u\,(treated)} = 1.91B - 0.34D + 1.65C + 0.27S + 3.1P - 292.95$$
………………………………………………….. (Equation 1)

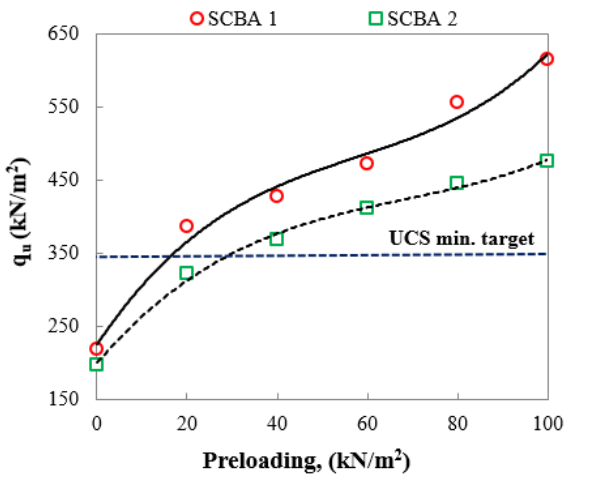

Figure 4 Effect of preloading on optimal binder mix

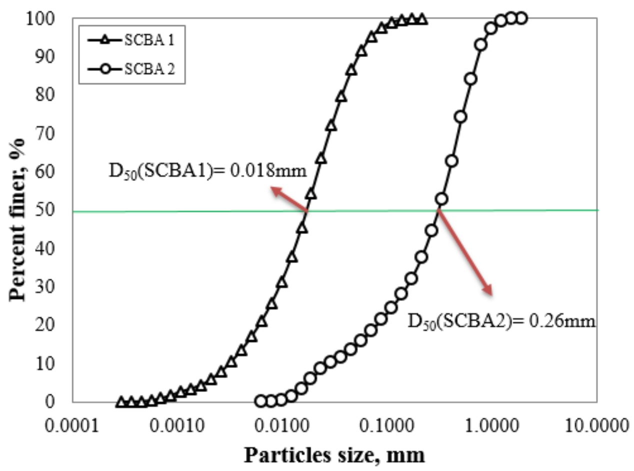

Figure 5 Particle size distribution of sugarcane bagasse

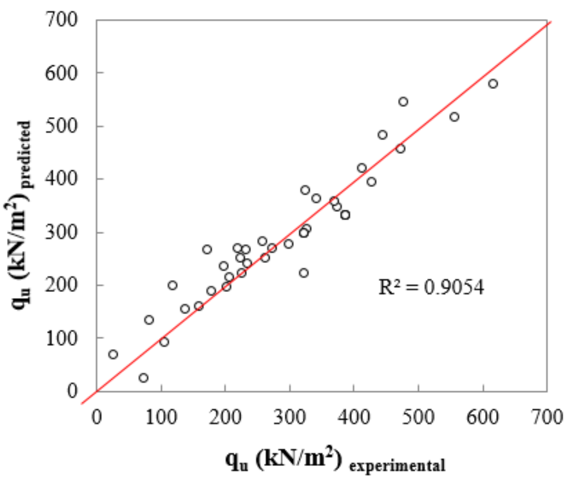

Figure 6 Predicted versus experimental unconfined compressive strength, q_u of Peat-Cement-Bagasse ash (PCB) mixtures

where **B**= SCBA % of OPC replacement; **D**= D_{50} of SCBA in µm; **C**= OPC dosage in kg/m^3; **S**= K7 dosage in kg/m^3; **P**= Preloading during curing in kN/m^2. A comparison of the predicted versus experimental unconfined compressive strength is shown in Figure 6. It shows that the regression model represents the q_u data is reasonably fit, with R^2 = 0.91. From the equation 1, the correlation chart between predicted q_u and D_{50} had been made like shown in figure 7. The developed charts was limited to apply on Hokkaido peat (hemic type) stabilization with constant dosage/amount of cement, silica sand and initial loading. According to Equation 1 and figure 7, the following inferences can be made: (1) smaller size of D_{50} indicates greater q_u of the PCB mixture; and (2) increase in the SCBA percentage decreases the q_u of the PCB mixture. It is suggested the maximum D_{50} is not exceed 120µm for at least 5% SCBA replacement of OPC content.

3. CONCLUSIONS

It was observed that that the test specimen with 20% and 5% partial replacement of OPC with SCBA has the highest unconfined compressive strength, q_u for SCBA 1 and 2 respectively. However, optimum mixture for SCBA 2 not reach the minimum target of q_u. Overall, q_u of peat soils can be increased using SCBA, but the quantity of increase depends on the SCBA characteristics e.g. average particle size (D_{50}), SCBA% amount, preloading rate, OPC and K7 dosage. From the statistical analysis, the regression model for predict the q_u of Peat-Cement-Bagasse ash (PCB) mixtures was developed. The smaller size of D_{50} indicates greater q_u of the PCB mixture while increase in the SCBA percentage decreases the q_u of the PCB mixture.

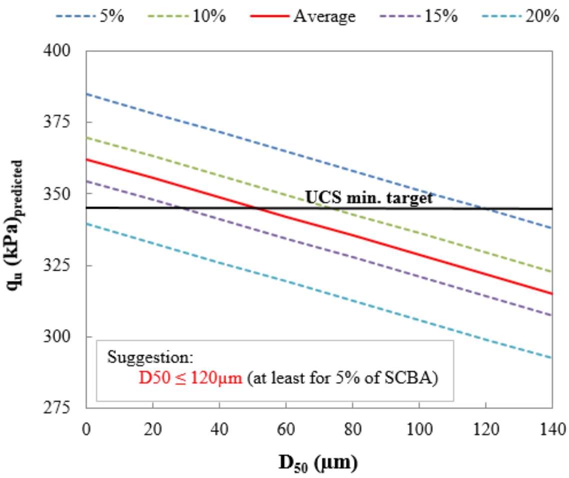

Figure 7 Correlation chart between predicted unconfined strength, q_u of stabilized peat and average particle size, D_{50} of sugarcane bagasse ash

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