CORROSION OF MORTAR MIXED WITH QUARRY DUST AS FINE AGGREGATE DUE TO SULFURIC ACID

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ABSTRACT

This research studies the corrosion on quarry dust mortars due to sulfuric acid. By fully using quarry dust instead of sand and w/c = 0.45, the mortar specimens are formed and cured for 28 days before immerse them into 5 % (W/W) of sulfuric acid solution. From the results, it is found that quarry dust mortars can resist the corrosion better than normal mortar.

KEYWORDS : Mortar, Quarry dust, Sulfuric acid, Corrosion, Fine aggregate

1. INTRODUCTION

Due to the proliferation of construction industry in Thailand, the production of crushing rock is also increased for responding the demand inside the country (Figure 1-3). At the present day, there are 467 of crushing rock operating units and the total output is about 300 tons/year. During the digesting process, the quarry dust is the most part of unwanted material and the physical properties of quarry dust are similar to sand. Then notion of using the quarry dust instead of fine aggregate (sand) is suitable. From the results, it is found that the compressive strength of concrete specimens larger than 300 ksc (Khamput, 2005). Hence this is figure that there is the possibility of using the quarry dust instead of sand. As above mention, this research addresses on the corrosion of mortar, which sand is replaced by quarry dust, due to sulfuric acid. This situation occurs in food industry therefore this research may inform the practical and advantage data for such industry.

Figure 1. Limestone Mountain in Saraburi

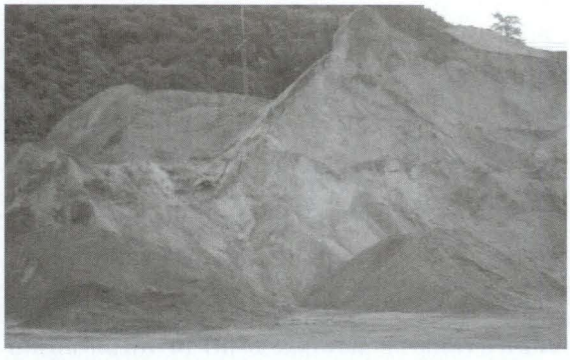

Figure 2. Big amount of quarry dust at grindstone house in Saraburi

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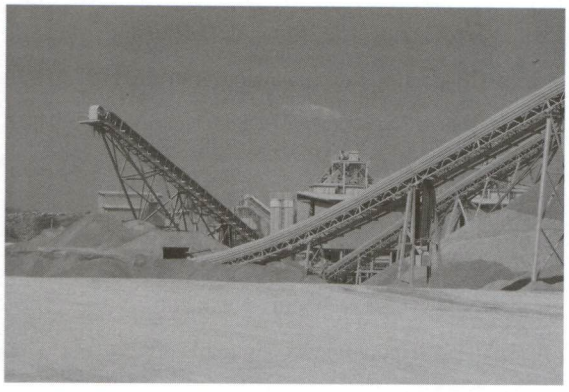

Figure 3. grindstone house in Saraburi

2. METHODOLOGY

Preparing the two types of mortar specimens; mortar which sand is replaced by quarry dust and controlled (or normal) mortar which uses sand as the fine aggregate. The mortar specimens, which the dimension of each mortar specimen is 5×5×5 cm, are formed by using 1: 2.75 for the ratio of cement to fine aggregate and 0.45 for the ratio of water to coupling agent (cement). Before immersing the specimens into the sulfuric acid solution which has intensity about 5%, the specimens were cured for 28 days and the weight of specimens was measured. These specimens are immersed into the solution for 7, 14, 28, 42, 56 and 90 days. After that the weight of specimens is read again. Finally, the loss of weight due to the corrosion of sulfuric acid is determined and compared with each other.

3. RESULTS, DISCUSSIONS AND CONCLUSION

The physical properties of sand and quarry dust are illustrated in Table 1.

Table 1. Physical properties of sand and quarry dust (Khamput, 2005)

Properties	Sand	Quarry dust
Fineness modulus	2.82	3.68
Specific gravity	2.64	2.71
Unit weight (kg/m^3)	1620	1695

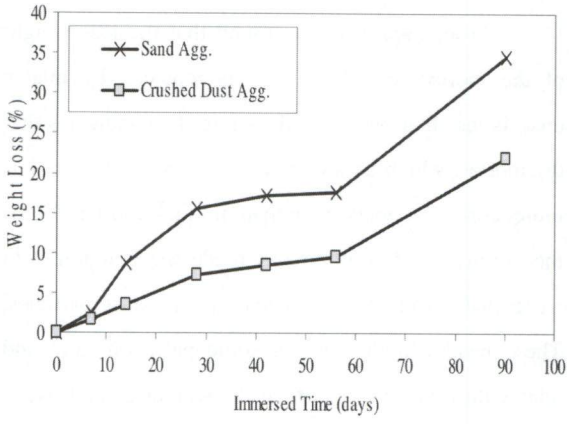

Figure 4. Weight loss and immersed time relationship

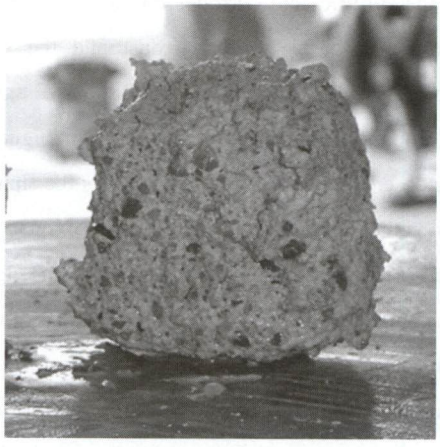

Figure 5. Corrosion of normal mortar at 90 days

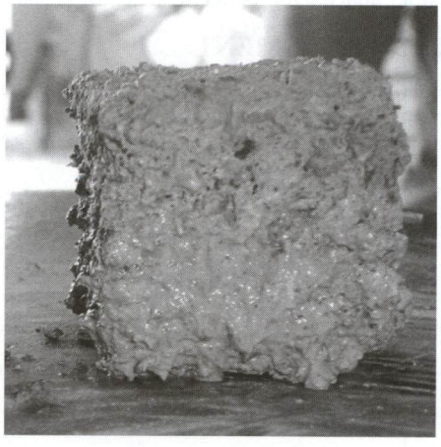

Figure 6. Corrosion of quarry dust mortar at 90 days

From Figure 4, it is found that the loss weight of the mortar, in which sand is replaced by quarry dust, is less than the normal mortar. This indicates that the mortar, which uses quarry dust instead of sand, has more corrosion resistance than normal mortar. Since the sulfuric acid solution has made the reaction with paste that covers the sand and quarry dust particles. These results in the loss of some paste on sand and quarry dust particles and then the weight of both types of mortar are reduced. The loss weight of normal mortar, however, is larger than quarry dust mortar. Because the sulfuric acid corrodes on paste of sand more effective than paste of quarry dust and the sand is smaller than quarry dust therefore the loss of sand has more progressive than quarry dust. From Figure 5, it can be observed that normal mortar shows the significant corrosion but in Figure 6, the surface of quarry dust mortar has rougher than normal mortar in Figure 5 because the only outer surface of paste has corroded but inner surface of paste still remain. Then the remaining paste is function to glue the quarry dust for confining the mortar. Hence we may conclude that the using of quarry dust instead of sand in acid environment is possible and maybe better than using of sand.

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