

Experimental Study on Iron Tailing Foam Concrete

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Abstract. Through the foam concrete block cement type, water reducer type, content and tailings using water reducing powder content of the different experimental groups, analyzed the relationship between raw material composition and amount due to compressive strength of foam concrete and different effects of moisture content and compressive strength, and thus presumably the ideal mix. It can be used for future theoretical study reference.

Introduction

In our country, with the implementation of the policy of reform related wall materials and building energy saving and environmental protection, research and application of new energy-saving building materials received extensive attention. New material foam concrete has the advantages of energy saving, light weight, heat insulation, etc. into the line of sight of people. At present, foam concrete has been applied in our country engineering field. [1] Most of mechanically foam concrete blowing agent is added calcareous materials (cement, lime), siliceous material (sand, tailings powder, fly ash) additive mixed with water from the slurry and concrete containing a large number of pores formed. Foam concrete prospects are very broad in the construction field, production and application of foam concrete is imperative. [2]

The Main Chemical Components and Physical Properties of Iron Tailings

The experimental study adopts the AnSteel Group Qidashan mine iron tailings, the main chemical components in Table 1, the physical performance index in table 2.

Tab. 1 Main Chemical Composition of Tailings Sands [%]

MgO	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	Other
1.67	77.95	2.78	14.98	0.51	2.11

Tab. 2 Physical Properties of Tailings Sands

Project	Test value	Requirement of JGJ52-92	Conclusion
Particle size [mm]	0.075-0.35	-	District III fine sand
Mud content [%]	2.1	Less than 5.0	Qualified
Clay content [%]	0	Less than 2.0	Qualified
Moisture content [%]	7.61	-	-
Apparent density [Kg/m ³]	2678.8	-	-
Bulk density [Kg/m ³]	1875.6	-	-

The tailings tests also indicate that, AnSteel Group Qidashan mine tailings do not contain harmful substances, such as mica, sulfide and sulfate, also containing no organic material, meet the requirements of concrete fine aggregate, and in accordance with the "building materials radionuclide Limited" (GB6566-2001) regulations.

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Orthogonal Experimental Design

Consider the iron tailings foam concrete composite wall core material for the requirements of the experiment, comprehensive consideration of tailings utilization, reduce costs, meet the requirements of energy saving technology and other factors, by orthogonal test optimum formulation of foam concrete, compressive strength test, to determine the factors for tailings sand content, cement content, each factor selected 3 levels, cement with 42.5 ordinary Portland cement.

This experiment was carried out according to the relevant provisions of JC/T 1062 -- 2007 "foam concrete block", initially identified the compound additive content is 16%, the foaming agent content is 4%, the water temperature is 24 degrees. During test blocks preparation, first, cement, tailings powder, compound additive for mechanical method stirring into mixture, and then adding foaming agent [3] (hydrogen peroxide) to the mixture and stir, 5~10s quickly poured into the mold, the size is 100*100*100 (mm), test block curing in a laboratory environment for 12~24h. "Bread head" should be cut before stripping, and then use natural maintenance method [4], with the building of concrete curing membrane wrapped in the condition of room temperature curing 28d, relevant tests after reached the age. The test results are shown in table 3.

Tab. 3 Orthogonal Test Design and Test Results

No.	Cement content [%]	Tailings sands content [%]	28d Compressive strength [Mpa]
1	40	30	0.93
2	40	35	0.86
3	40	40	0.72
4	45	30	1.02
5	45	35	0.95
6	45	40	0.76
7	50	30	1.12
8	50	35	1.03
9	50	40	0.79

Analysis of Test Results

As seen 28d compressive strength values from Table 3, foam concrete prepared with the AnSteel Group Qidashan mine tailings, the tailings content at the time of 30%, the compressive strength of foam concrete value is the highest, with the tailings content increased compressive strength value decreased; changes in cement content has a significant effect on the foam concrete compressive strength, cement content increases, the compressive strength increases. Analysis of the reasons: As tailings sands contain part of superfine slag, superfine slag has powder effect [5], powder effect include filling effect and active effect, foam concrete can be pore filled and refined further, improve the density of the foam slurry, and consume and refine Ca (OH) 2 crystals form more hydration products, improve the compressive strength. But more than a certain number of superfine powder, it will affect the degree of hydration, and reduce the intensity.

According to DB21/T1794-2010 "cast-in-place lightweight composite wall application technical regulations" requirements, the core material of cast-in-place lightweight composite wall compressive strength is larger than or equal to 0.85 Mpa, consider that the impact of the overall cost and other factors, the optimal mixing ratio of iron tailings foam concrete can be determined: m

(cement: m (tailings):m (compound additive):m (foaming agent):=45:30-35:16:4-9, cement: 42.5 strength grade, water cement ratio: 0.65-0.70.

Conclusions and Recommendations

It is feasible that the foam concrete formulated with AnSteel Group Qidashan mine tailings in technically. Since the tailings contain part of superfine slag, superfine slag has powder effect, it can make foam concrete pore filled and refined further to improve the compressive strength of foam concrete.

The compressive strength of tailings foam concrete site pouring is low, can not use alone as a wall, it is suitable for the core material of composite sandwich wall.

The comprehensive utilization of mining waste slag produced foam concrete, energy conservation, pollution discharge patients, consistent with the policies for comprehensive utilization of national resources, product market prospect is broad, to open a new way for mining large utilization of waste residue.

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