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STUDY OF CONCRETE BY USING GRANITE INDUSTRIAL WASTE POWDER

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Abstract

Granite industry generates huge amount of waste, during the process of sawing. Current research intended to mix granite saw powder waste in Ordinary Portland Cement (OPC) to get compatible quality cement, in lines with Portland Pozzolana Cement (PPC) where a maximum of 35% of fly ash is mixed in OPC. The granite saw dust waste has been collected from three different locations of Divya Shakti Granites Ltd., at Madurai Tamilnadu, India. All samples were mixed with OPC in different proportions ranging from 20 - 35%.Using these proportions several experiments were conducted to assess compressive strength, physical properties as well as chemical properties. The results indicate compatibility of granite powder waste as a perfect cementing material, which can be added up to 35% without hampering the quality parameters like compressive strength.

1. Introduction

Ordinary Portland Cement (OPC) is commonly used as a best means of cementing material for construction, with different grades including 33, 43 and 53 grade, available in the market as per Bureau of Indian Standards (IS: 12269: IS 1489:2005). OPC consists of calcium silicates, aluminates, and iron. Calcium carbonate is first dissociated at around 900^{o}C to produce calcium oxide and carbon dioxide, further it is heated at around 1400^{o}C and made to react with silica, alumina and iron, to form small pebbles called clinker, which is then grinded to approximately 100 micrometer size to produce OPC cement. An amount of approximately 5% gypsum is added to retard setting time, which serves as a buffer time during construction.

Portland Pozzolana Cement (PPC) is produced by mixing a maximum of 35% (BIS: IS 1489:
1991) of fly ash in OPC cement. Fly ash is produced at thermal power stations as a waste material, when huge volumes of coal are burnt in boilers. The flu gas is made to pass through electrostatic precipitators, and the fine dust (fly ash) is collected. Fly ash consists of

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silica, calcium oxide, and traces of alumina as well as iron, which is cementing compatible material. The present line of work is to replace fly ash with granite waste, in OPC cement. Earlier fly ash was considered as waste and was used for land filling, similarly granite waste, is presently used in land filling.

Materials and Methods:

Granite Samples: Granite industry cuts the granite rock to slabs based on the requirement of the client, using metal saws, and the fine powder is produced during cutting is considered as solid waste and is being sent to dump. During the conveyance from granite cutting zone to waste dump, samples were collected at different intervals. Sample -1 is collected just below the cutting zone and the same is blended with different percentages starting from 20% to 35% in Ordinary Portland Cement (OPC). Similarly Sample -2 is collected from the middle of the path between sawing zone and dumping zone and the same is blended with different percentages starting from 20% to 35% in OPC. Likewise sample-3 is collected from the end point, which is the dumping zone and the same is blended with different percentages starting from 20% to 35% in OPC.

Preparation of testing specimen:

Aggregates are prepared with reference to the BIS standards by mixing laboratory grade sand (supplied by Tamil nadu minerals Ltd, Innore, Chennai) cement and water, in the ratio of 3:1 (sand: cement-granite mix -mass basis), water is added based on the normal consistency. These composites are thoroughly mixed in pony mixer for 2 minutes, poured into standard mould of 7.5 x 7.5 x 7.5 cm, then subjected to compression in vibrating machine for 2 minutes, and then kept in humidity chamber for 24 hours, maintaining 27 degree centigrade. The specimens are then taken out and cured for 1, 3, 7, and 28 days in curing chambers of same temperature

Testing of samples:

1.Compressive Strength: Specimen cubes are subjected to compressive strength test in the standard compressive strength machine, supplied by AIMIL, New Delhi. All the blended samples were analyzed for physical and chemical analysis as per Bureau of Indian Standard norms.

Results and Discussions:

Sample-1, sample-2 and sample-3 of granite are mixed up to 35 % in OPC, and its physical properties measured and are reported in Table-1. It has been observed an increase of bulk density and tapped density as the percentage of granite mix increased [Matthews et al., 2011]; this could be because of variance in particle size and shape of granite waste and OPC

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cement. When the bulk density increases, the tapped density also found to be increased. Flow ability index shows decrease in values which infers increase in flow ability, and is in line with porosity values (E.C.Abdullah et al.,

The critical quality parameter 'compressive strength' of samples are shown in Table-2. A maximum of 41.71 Mpa for 20% granite mix and minimum of 36.23 Mpa for 35% granite mix is observed for sample-1, similarly for sample-2 maximum of 42.81 Mpa and minimum of 37.12 Mpa is observed, and for sample-3, a maximum of 43.51 Mpa and a minimum of 38.39 is observed, after curing 28 days. The compressive strength is increasing as the number of days of curing increases, in line with the established research [Wig et al., 1915]. The values of compressive strengths of sample-1 and 3 for 1, 3 days compressive strength found to be increasing as the percentage of granite waste increased, this could be because of initial reaction of iron. As the sample-1 is collected right below sawing zone, percentage of iron could be little higher, similarly sample-3 is collected at the dumping zone, where sedimentation takes place there by yielding slight higher percentage of iron, in comparison with sample-2. Iron is present in granite waste as eroded powder of iron saws, during sawing operation.

REFERENCE:

[1] Abdullah, E.C., Geldart, D. The use of bulk density measurement as flowability indicators, Powder Technology, Vol. 102, March 1999, PP. 151-165 Asokan Pappu, Mohini Saxena, Shyam R. Asolekar., Solid waste generation in India and their recycling potential in building materials, Building and Environment, Vol. 42, no. 6, 2007, PP. 2311-232

[2] Barral Silva, M.T., B. Silva Hermo, E. Garcia-Rodeja, N. Vazquez Freire., Reutilization of granite powders as an amendment and fertilizer for acid soils, Chemosphere 61(7), November 2005, PP.993-1002

[3] Bureau of Indian Standards IS 1489(part 1): 1991 Bureau of Indian Standards IS: 12269: IS 1489:2005 Hanifi Binici, Tahir Shah, Orhan Aksogan, Hasan Kaplan.,

[4] Durability of concrete made with granite and marble as recycle aggregates, Journal of Materials Processing Technology, Vol. 208, November 2008, PP. 299-308 Lin, K.L., Wang, K.S., Tzeng, B.Y., Lin, C.Y.,

[5] The reuse of municipal solid waste incinerator fly ash slag as a cement substitute, Resources, Conservation and Recycling, Vol 39, November 2003, PP. 315-324 897

[6] International Journal of Engineering Research & Technology (IJERT) IJERT ISSN: 2278-0181 IJERTV2IS90194 www.ijert.org Vol. 2 Issue 9, September – 2013

[7] Marmol, I., Ballester, P., Cerro, S., Monros, G., Morales, J., Sanchez, L., Use of granite sludge waste for the production of coloured cement based mortars, Cement and Concrete Composites, September 2010, Vol. 32, PP. 617-622

[8] Matthew P. Mullarney, Lauren E. Beach, Rajesh N. Dave, Beth A. Langdon, Mark Polizzi, Daniel O. Black wood., Applying dry powder coatings to pharmaceutical powders using a comil for improving powder flow and bulk density, Powder Technology, vol. 212, October 2011, PP. 397- 402

[9] Mirabbos Hojamberdiev, Ashraf Eminov, Yunhua Xu., Utilization of muscovite granite waste in the manufacture of ceramic tiles, Ceramics International, Vol. 37, April 2011, PP. 871-876 Monteiro, S.N., Pecanha, L.A., Vieira, C.M.F.,

ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 1 – www.ijrmmae.in – Pages 13 - 16

[10] Reformulation of roofing tiles body with addition of granite waste from sawing operations, Journal of the European Ceramic Society, Vol. 24, July 2004, PP. 2349-2356
[11] Ozlem Celik, Erdem Damci and Sabriye Piskin., Characterization of fly ash and its effects on the compressive strength properties of Portland cement, Indian Journal of Engineering & Material Sciences, vol. 15, October 2008, PP. 433-44
[12] 0Romualdo R. Menezes, Heber S. Ferreira, Gelmires A. Neves, Helio de L. Lira, Heber C. Ferreira., Use of granite sawing wastes in the production of ceramic bricks and tiles, Journal of the Europian Ceramic Society, Vol 25, May 2005, PP. 1149-1158
[13] Torres, P., Fernandes, H.R., Olhero, S., Ferreira, J.M.F. Incorporation of wastes from granite rock cutting and polishing industries to produce roof tiles, Journal of European Ceramic Society, Vol 29, January 2009, PP. 23-30
[14] Wig, R.J., Williams, G.M., Gates, E.R., Compressive strength of Portland cement mortars and concretes, Journal of the Franklin Institute, Vol. 180, November 1915, PP.608-613
[15] Xiao-Dong Tong, Yan Sun., particle size and density distributions of two dense matrices in an expanded bed system, Journal of Chromatography A, Vol. 997, November 2002, PP. 173-183
[16] Ying Li, Hongfa Yu, Lina Zheng, Jing Wen, Chengyou Wu, Yongshan Tan., Compressive strength of fly ash magnesium oxychloride cement containing granite wastes, Construction and Building Materials, Vsol. 38, January 2013, PP. 1-7