A Review Paper on Use of Copper Slag As A Partial Replacement of Sand

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Abstract - During matte smelting and refining of copper a by-product is obtained which named as Copper slag. A very common management options for copper slag are recycling, recovering of metal, production of value added products such as abrasive tools, roofing granules, cutting tools, abrasive, tiles, glass, road-base construction, railroad ballast, asphalt pavements. Despite increasing rate of reusing copper slag, the huge amount of its annual production is disposed in dumps or stockpiles to date. One of the greatest potential applications for reusing copper slag is in cement and concrete production.

Keywords: - Copper Slag, Sand, Concrete, etc.

1. INTRODUCTION

Concrete is the most important building material in the world however the production of cement has diminished the limestone reserves in the world and required a great consumption of energy. River sand has been the most popular choice for fine aggregate component of the concrete in the past but overuse of material has led to environment concern and economical price increased in the material. Therefore it is desirable to obtain cheap, environmentally friendly substitution of sand that is preferably copper slag used as a by-product. Copper slag increased the strength of concrete over concrete. it is also increased a workability of concrete.

Granulated copper slag (or) copper slag is a byproduct of metallurgical operations in Sterlite operations in Sterlite industries (India) Ltd [9]. For every tone of metal production, about 2.2 ton of waste slag is generated. Dumping or disposal of such huge quantities of slag cause environmental problems. During the past two decades, attempts have been made by several investigators and copper producing units all over the world to explore the possible utilization of copper slag. The physical and mechanical properties of granulated copper slag shows it can be used to make products like coarse and fine aggregates, cement, fill, ballast roofing granules, glass, tiles and many more.

2. IMPORTANCE OF SAND IN CONCRETE MIX

In the olden days the sand was acquired from river beds the creeks. Today, however builders and contractors, are at the mercy of contractors who quarry the sand and process it unscientifically with no regard for the specifications. Most building materials still adhere to the age old 1:2:4 nominal mix concrete [10]. This mix was supposed to produce a concrete of grade 150 kg/cm2 (15N/mm2) at 28 days. But what does 1:2:4 really mean? It stands for one part (by volume) of cement (not any type of cement, but Ordinary Portland Cement[17], OPC as specified previously by BS;12 and now as per IS;269). The cement has to have a minimum strength of 220 kg/cm2 at 7 days, it has to be fresh (or properly stored) and it has to be packed in air-tight bags weighing 50 kg each (50kg cement has an approximate loose bulk volume of 1,25 cubic feet- about 35 litres) [17] 2 stands for two parts) of fine aggregates. However, the quality of sand has to be as per specifications which we will deal with below. 4 stood for four parts (by volume) of coarse aggregates (stone metal) – 2 parts of Metal 1 (1/2″size stones) and 2 parts of Metal II (1″size stones). Those who are still adhering to the old formula 1;2;4 should know that the specifications do not permit the concrete to be specified volumetrically as 1;2;4 but by weight.

3. COPPER SLAG

Copper slag, which is produced during hydrometallurgical production of copper from copper ores contains materials like iron, alumina, calcium oxide, silica etc. For every tonne of metal production about 2.2 ton of slag is generated [7]. Dumping or disposal of such huge quantities of slag cause environmental and space problems. During the past two decades attempts have been made by several investigators and copper producing units all over the world to explore the possible utilisation of copper slag. The favourable physico-mechanical characteristics of copper slag can be utilised to make the products like cement, fill, ballast, abrasive, aggregate, roofing granules, glass, tiles etc. apart from recovering the valuable metals by various extractive

metallurgical routes. This paper gives a review of characteristics of copper slag as well as various processes such as hydro and combination of hydrometallurgical methods for metal recovery and preparation of value added products from copper slag.

4. EXPERIMENTAL PROGRAM

A total of 48 cubical specimen of standard dimension 150X150X150 mm are going to be tested samples were taken in 8 to 16 batches. In various grades of cement such as M-20, M-25, M-30 grades of concrete is used [17]. Utilization of copper slag as a sand replacement is up to 100 percent is taken during testing. A constant water cement ratio is 0.43 was adopted for making concrete mixture. The mix proportion used was **0.43:1:1**[17].The slag serves as fine or binding agent, which help holds the large gravel particles with concrete together and also increase a strength of cementations mixture in such a way slag help to improve the property of concrete that cube specimen were tested at 7 days and 28 days and samples were cast in 8 to 16 batches in different moulds. Ordinary Portland cement of grade 53 is used for the experiments. After that I am going to construct a fixed beam with this sample of normal size and various test such as ultra pulse velocity test for density and result are going to be calculated during thesis report.

5. TESTING PROGRAMS

The mix design [16] chosen for grade M20, M25, M30 Concrete mixes with different proportions of copper slag used. 0 to 100% sand replacement with copper slag and Total 16 cubes, 2 TO 3 beams were prepared for these tests. The slump tests were done on fresh concrete to determine its workability. Compression test [11], split tensile test, flexural strength test, water absorption [14] test and ultrasonic pulse velocity tests were done on the specimens as per IS specifications. To find all the desired values of concrete mix these tests are very important. All tests are conducted as per Indian Standard Codes.

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