PREPARATION OF ARTIFICIAL AGGREGATES FROM SILT OF NASIR BAGH CANAL- A CASE STUDY OF PESHAWAR

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Abstract

Sedimentation has become a major problem in all over the world and especially in Pakistan. Discharge capacity of the canal has been reduced and the chances of overflowing in critical situations have increased. Cleaning of the sediments from canal require huge resources and the silt obtained after cleaning the reservoir not only will be wasted but will also cause pollution. In order to prevent the pollution and reduce the cost on the cleaning the reservoir, the silt is needed to be used beneficially to generate some revenue.

We conducted this project to use this silt beneficially, in our case to manufacture artificial aggregate. A number of tests were performed to check the viability of artificial aggregates for being used in construction industry. Shape and particles size distribution properties of artificial aggregates are excellent but in properties like abrasion resistance, water absorption and compression strength artificial aggregates does not performs very well. However from the results it can be concluded that these artificial aggregates can be used as artificial light weight aggregates.

Keywords: Sedimentation, silt, artificial aggregate, natural aggregate and light weight aggregate.
I. Introduction

Aggregate is also called mineral materials such as gravel, sand and crushed stone. These aggregates are also used with binding materials such as (bitumen, Portland cement, lime, water etc.) and form new compound materials such as asphalt concrete and Portland cement concrete. Both flexible and rigid pavements the aggregates are used in base and sub base courses [I].

Aggregates are of two type’s i.e. natural and artificial aggregates. Natural aggregates are obtained from larger rocks through quarry. The natural aggregates are extracted from rock by mechanical crushing. The artificial aggregates are the byproduct of manufacturing industries. Byproduct aggregates includes blast-furnace slag, cinders or manufactured aggregates like lightweight aggregates which includes expanded clay or shale, processed diatomaceous earth, processed volcanic glasses, and expanded slag (McLaughlin and others, 1960) are called Artificial aggregates [II].

Now a days the construction industry is on peak. The industrial by product such as bottom ash, paper sludge, fly ash, pet bottles, paper pulp, steel slag, heavy metal sludge, palm shell, sewage sludge, marine clay etc. are the causes of pollution for the environment. Continues use of natural resources are also dangerous for the environmental condition. [III].

Researchers are trying to introduce new materials to remove the deficiency in the construction industry. The coarse aggregates formed from the waste materials such as fly ash, rice husk ash and iron ore dust are used in concrete with binder. The continues use of natural aggregates cause shortage of natural resources. This continues use of natural resources may cause the depletion of natural resources. To avoid this depletion of Natural aggregates, artificial aggregates can be produced which may be ecofriendly and can be used in concrete [IV].

The artificial aggregate n also prepared from waste stone sludge and waste silt. The waste silt is obtained from aggregates washing plants and waste stone sludge is obtained from slab stone processing. The fine powder of stone sludge was used with larger particles of waste silt, vibratory compaction was performed and solidifying agent was added to make it solid. The ratio of waste stone sludge and waste silt in artificial aggregate was 35:50 because it form more compact structure having water absorption value less than 0.1%. Further doing vibratory compaction of 33.3 HZ and curing for 28 days the compressive strength of artificial aggregates become double above 29.4 Mpa. Thus the artificial aggregates which are prepared from the waste stone sludge and discarded silt can replace the sand and stone but also environmental pollution solution to the remaining of sludge and silt. [V].

II. Related Work

Encompassing temperature process was created for the assembling of artificial aggregates. Form the aggregates reusing plants silt samples were collected for the preparation of artificial aggregates. Sand, silt and binder was taken and
binders were PVA and PC. Different samples of sand, silt, Portland cement and PVA were arranged. Silt metakaolin and PFA were used in the production of artificial aggregates. During the production of aggregates in this case three sets of experiments were performed. Primary streamlining mean how use the silt. The second is how to use the metakolin and silt. The third is the PFA and the silt in the production of geopolymers specimen. The dry powder material was blended sodium silicate “actuating arrangement”. In actuating arrangement the NaoH was first dissolved in refined water which is a high temperature exothermic reaction. The solution was then cooled to occasion temperature and then sodium silicate was added to it. [VI]

The dehydrated solid was completely blended with the initiating arrangement utilizing a domestic blender for 10 min. Squeezing samples diminishes porosity, which influences mechanical properties and property fluctuation. Examination demonstrated that sediment created from aggregate and waste washing plants can be helpfully recycled utilizing geo polymerization for the generation of aggregates. The mechanical properties of the last items rely upon synthesis and curing conditions. Commercial utilization of geo polymerization for the treatment of silt is confined by the high introductory water content. This can be overwhelmed by blending silt with a water diminishing agent, for example, metakaolin [VII].

Lightweight synthetic aggregates from fine deposit sediments was formed, which were dredged from the Shihmen basin in northern Taiwan using the sintering technique.

The main apparatus used in this survey is a rotating oven. While traveling through the furnace, a pellet passed through a sequential process started with drying at temperatures of 100-105 ° C, followed by preheating at temperatures of 500-700 ° C, and then expanding at temperatures 1100-1150 ° C.

The related densities of the aggregates produced ranged from 1.01 g / cm3 to 1.38 g / cm3, and the physical properties and compressive strength of the sedimentary LWA were much better as compared to marketable obtainable LWA. This was due to the reason that the sedimentary LWA particles have a hard ceramic shell. How-Ji concluded from the results directed that sedimentary LWA can act as an aggregate source for structural concrete [VIII].

The achievability of the creation of artificial aggregates in view of granulated Si02 responsive powders which are fit to associate with cementitious framework and benefitize the contact zone in the LWA concrete. The movement or this arrangement densities the cementitious lattice contiguous the aggregate contact zone and prompts the development of insoluble gel periods of poly silicates, sodium fluorides, and additionally sodium or aluminum mixes inside the permeable space of the solidified phases on the surface of the cement and aggregate particles bringing about a solid AAGS-cementitious network composite with decreased porosity and low water absorption [IX].
III. Materials and Methodology

Excavation activity which is carried under water for the purpose to gather the sediments and to dispose them to different location is term as dredging. Silt can be obtained from the reservoir through the process of dredging.

A: Processing of Silt
The silt obtained is first dried and then after grinding it is screened on sieve #30 to remove any other particles.

B: Preparing the solution of PVA
Include PVA gradually while mixing for adequate decentralization and swelling before warmed. Blending to swell PVA at the encompassing temperature can productively abbreviate the dissolving duration. At the point when warmed up to over 80-90°C, inside 30-an hour around, the medium alcoholic compose PVA is gotten. Mixing amid disintegration guarantees that the temperature does not increment quickly.

For making aggregates following materials were mixed by weight proportions:

- Polyvinyl Alcohol PVA = 2%
Ordinary Portland cement = 18%
Silt = 20%, 30%, 40%
Sand = 40%, 50%, 60%

C: Manufacturing of the aggregates

Three batch were made having 20%, 30% and 40% silt, cement content were 18% constant.

- First of all the PVA is dissolved in water.
- Solution of PVA is then thoroughly mixed with OPC cement and Silt.
- Cylinders or cubes are made by using mixture of PVA, Silt, sand and OPC cement.
- Cubes are placed for curing for 28 days.
- Cylinders or cubes are crushed to get coarse aggregates

D: Test Conducted

Following test were conducted on the aggregates to asses some of their properties:

- Water Absorption Test Coarse Aggregates (ASTM C0127-04)
- Loss Angles Abrasion Test for Aggregates ASTM (C0131-03)
- Impact Value for aggregates (IS: 2386 (Part IV) 1963)

IV. Results/Discussion

Result of the test performed on both natural and artificial aggregates are given below:

| Name of Test                      | Artificial aggregates | Natural Aggregates |
|-----------------------------------|-----------------------|--------------------|
|                                   | 20% silt              | 30% silt           | 40% silt           |
| Water Absorption                  | 9.89%                 | 16%                | 19.5%              | 2.05%              |
| Impact Value Test                 | 27.75%                | 34.30%             | 40.15%             | 14.72%             |
| Loss Angles Abrasion              | 44%                   | 50%                | 59.80%             | 18%                |

Table 1: Engineering properties of natural and artificial aggregates
The main objective of this research was to evaluate the properties of asphalt and asphalt mix by the addition of additives i.e. fly ash and shredded rubber. These additives were added in different percentages such as 3%, 5% and 7%. The tests were performed in the laboratory in controlled condition and the result were collected and analyzed. Following are the conclusion drawn from the different test.

- Since artificial aggregates are produced synthetically there is always room for improvement.

V. Conclusion and Recommendations

The main objective of this research was to evaluate the properties of asphalt and asphalt mix by the addition of additives i.e. fly ash and shredded rubber. These additives were added in different percentages such as 3%, 5% and 7%. The tests were performed in the laboratory in controlled condition and the result were collected and analyzed. Following are the conclusion drawn from the different test.

- Since artificial aggregates are produced synthetically there is always room for improvement.
Artificial aggregates produced can be used in the backfill, sub base and for other nonstructural uses.

This research can be further be extended by addition of other fly ash or other binders to enhance different characteristics of the aggregates.

**Recommendations**

Several issues observed in this research concerning the methods and material used in the research for the preparation of artificial aggregate, following are the few recommendations based on them:

- Voids in artificial aggregates must reduce by compaction, thus producing compacted artificial aggregates.
- Chemical properties of these artificial aggregates should be tested.
- Strength of aggregates should be checked for other mix ratios of aggregate with higher water cement ratios and other additives.
- For more authentic results they should be subjected for use in practical field as lightweight aggregates.
- To get better results, advance and maintained equipment should be used.
- Research should be done using other binding materials and methods.
- 28 days compressive strength of these aggregates should be tested to see the effect of aging.
- Such laboratory condition should be maintained that the paste should not get dried during casting of aggregates.

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