MANUFACTURING PROCESS OF ALKALI ACTIVATED COARSE AGGREGATE USING PELLETIZATION TECHNIQUE

Mr. Naveena M.P.[1*], Dr. G.Narayana.[2]

Corresponding Author: Mr. Naveena M.P.

1*Research Scholar, Department of Civil Engineering, SJC Institute of Technology (SJCIT), Affiliated to Visvesvaraya Technological University (VTU), Chickballapura, Karnataka, India.

2 Professor & Head, Department of Civil Engineering, SJC Institute of Technology (SJCIT), Affiliated to Visvesvaraya Technological University (VTU), Bengaluru, Karnataka, India.

1*E-mail: mpsnaveena@gmail.com

Abstract

The Present study focused on the Manufacturing Process and Properties of Alkali Activated Coarse Aggregate (AACA). The manufacturing process of Alkali Activated Coarse Aggregate using the Pelletization technique. Pelletization technique which converts fine powder to Spherical or Semi spherical units. Ground Granulated Blast Furnace Slag is a source material and an alkali activator solution is used as a binder solution. The alkali activator is Sodium Hydroxide and Sodium silicate s used. The concentration of sodium hydroxide 6M is used and the ratio of Sodium Silicate to Sodium Hydroxide is 2.5. The physical and chemical properties of AACA and NCA are studied. The results show that the physical properties of both the aggregate are similar except for water absorption and abrasion value. It can be attributed that water absorption is more presence of voids. The chemical properties of Alkali Activated Coarse Aggregate (AACA) and Natural Coarse Aggregate (NCA) are obtained from Energy Dispersive X –ray Analysis (EDX). It is observed that silica content is more in NCA may be the reason for better Crushing and Impact Value than AACA.

Key Words: Pelletization, Alkali Activated Coarse Aggregate, molarity

DOI Number: 10.14704/nq.2022.20.13.NQ88178 **Neuro Quantology 2022; 20(13):1443-1445**

1. INTRODUCTION

The theory of Pelletization was developed in 1940's. The process depends on engineering properties of material, moisture content, angle of drum or mixer and revolution speed. The fine grained material is moisturized, there is a formation of thin liquid film on the surface of grains. When this particle are moved in a drum they form a spherical like structure and bonding between grains also increases by centrifugal force as shown in Figure 1(a),(b)(c)[1].

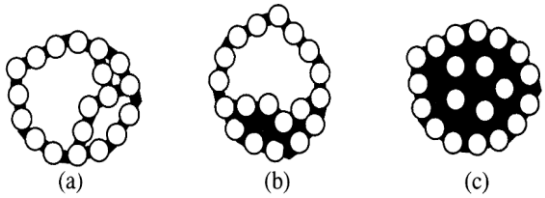

Fig. 1.Mechanism of Pellet formation [1]

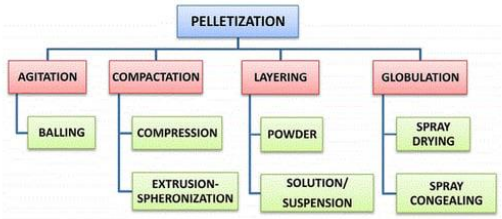

Fig. 2. Types of Pelletization [2]

Agitation is a process where finally divided particle into spherical particle by additing suitable liquid binder. Disc or drum or pan mixer may use to produce pellets [3]. Compaction is type of pressure agglomeration, granules are formed due to mechanical force [4,6]. In laying technique binder solution is sprayed first and followed by addition of powder. The powder particle pick up the binder solution in rotating disc or pan and by capillary force the pellets are formed [7]. Globulation is a process where liquid

materials like melt, solution, or suspension are atomized to generate spherical particles or pellets.

Mechanical parameters of palletization process is depends on tilt angle and speed of the mixer [2]. The aggregates are manufactured using fly ash , the palletization depends on the particle wettability and content of moisture[3].

MANUFACTURING PROCESS

The alkaline solutions were prepared using sodium hydroxide and sodium silicate. Sodium hydroxide of 6 molarity Is prepared by adding required quantity of flakes to a tap water and it has allowed for 24 hours. After 24 hours the calculated quantity of sodium silicate is added to the sodium hydroxide to make alkaline solution. In a drum mixer GGBS is thoroughly mixed, after uniform mix of GGBS, slowly the Alkaline solution is added until the formation of pellets. The angle of rotation is kept is 45 degree. The palletization technique adopted as agitation, where finally divided particle into semi-spherical shape by adding alkaline solution. The addition of binder leads to **b**onding between grains also increases by centrifugal force. Once aggregate formed allowed for ambient temperature of two hours. The developed Alkali Activated Coarse Aggregate shown in Figure 1.

Fig. 3.Manufactured Alkali Activated Coarse aggregate

2.1 RESULTS AND DISCUSSIONS

The physical properties of Alkali Activated Coarse Aggregate (AACA) and Natural Coarse Aggregate (NCA) are carried out as per IS 2386 Part IV and properties are tabulated in Table 1.The physical properties of both the aggregate are similar except for water absorption and abrasion value. It can be attributed that water absorption is more presence of voids.

Table 1: Physical Properties of AACA and NCA

Sl. No	Properties	AACA	NCA
1	Fineness Modulus	6.5	7.2
2	Specific Gravity	2.6	2.65
3	Water Absorption (%)	2.89	0.5%
4	Bulk Density (kg/m^3)	1391	1422
5	Aggregate Crushing Value (%)	27.8	18.2
6	Aggregate Impact Value (%)	26.21	13.54
7	Aggregate Abrasion Value (%)	83.8	30

The chemical properties of Alkali Activated Coarse Aggregate (AACA) and Natural Coarse Aggregate (NCA) are obtained from Energy Dispersive X –ray Analysis (EDX). It is observed that silica content is more in NCA may be reason for better Crushing and Impact Value than AACA.

Table 2: Chemical Properties of AACA and NCA

Sl. No	Properties	AACA	NCA
1	Silica (%)	25.31	55.57
2	Alumina (%)	7.01	0.87
3	Calcium oxide (%)	31.94	12.31

2. CONCLUSIONS

The physical properties of both the aggregate are similar except water absorption and abrasion value. Chemical Analysis observed that silica content is more in NCA may be reason better Crushing and Impact Value than AACA.

REFERENCES

Srb J, Ruzickova Z. "Pelletization of Fines", Elsevier Science Publishing Company,1988.

Sagar Muley, Tanaji Nandgude, Sushilkumar Poddar, "Extrusion–spheronization a promising pelletization technique: In-depth review", Asian Journal of Pharmaceutical sciences. Vol.11, pp.684-699, 2016.

Lavanya kammili. "Pelletization technology :A quick review".Int J Pharm Sci Res 731.Vol. 2:1337–1355, 2011.

Ghebre-Sellassie I. "Mechanism of pellet formation and growth". Pharmaceutical pelletization technology,pp.123–145.,2011.

Walker GM, Holland CR, Ahmad MMN, et al. Influence of process parameters on733 fluidised hot-melt granulation and tablet pressing of pharmaceutical powders. Chem734Eng Sci; Vol.60,pp.3867–3877. 2005.

Kovacevic J, Mladenovic A, Djuris J, et al. Evaluation of powder, solution and736 suspension layering for the preparation of enteric coated pellets. Eur J Pharm Sci, Vol.737 85:pp.84–93, 2016.

Gokhan Baykal , Ata Gurhan Doven. "Utilization of fly ash by pelletization process; theory, application areas and research results", Resources, Conservation and Recycling, vol. 30, pp. 59–77, 2000.

K.I.Harikrishnan, K.Ramamurthy. "Influence of pelletization process on the properties of fly ash aggregates", Waste Management, vol. 26, pp. 846–852, 2006.

K. Ganesh Babu, V sree Rama Kumar, "Efficiency of GGBS in concrete," Cement and Concrete Research, (2000) vol. 30, 1031–1036.

Rangan, B.V. Fly ash based Geopolymer Concrete. Research Report GC1, Curtin University of Technology, Australia. (2010), ISBN 978-1-4507-1490-7.

Davidovits "Geopolymers: Ceramic-Like Inorganic Polymers." Ceramic Engineering and Science Proceeding, (2017), DOI: 10.4416/JCST2017-00038.

Sreekesh.U.Menon, Kalpathy, Balakrishnan Anand, Anil Kumar Sharma, "Performance evaluation of alkali-activated coal ash aggregate in concrete", Waste Resour. Manage. (2018) 171 (1), 4–13.

Venugopal K, Radhakrishna, Vinod Sasalatti "Development of Alkali Activated Solid and Hollow Geopolymer Masonry Blocks" Materials Science and Engineering (2016) doi:10.1088/1757- 899X/149/1/012072.

United Nations Environment Programme (UNEP) Global Environmental alert Service (GEAS), Nairobi, Kenya, Report: Sand, Rarer than One Thinks, March 2014.

Central Electricity Authority, New Delhi, 2017, Report on Fly ash Generation at Coal/Lignite Based Thermal Power Stations and its Utilization in the Country for the Year 2016-2017.

Sudhakar M Rao, Indra Prasad Acharya, "Synthesis and Characterization of Fly Ash Geopolymer Sand" Journal of Materials In Civil Engineering (2014), Volume 26 Issue 5.

F. Puertas, S. Martıń ez-Ramírez, S. Alonso, and T. Vázquez, "Alkali-activated fly ash/slag cements: Strength behaviour and hydration products," Cement and Concrete Research, (2000). vol. 30, no. 10, 1625–1632.

Sethu Parvathy S, Anil Kumar Sharma ,K.B, Anand, "Comparative study on synthesis and properties of geopolymer fine aggregate from fly ashes", Construction and Building Materials (2018), 428-437.

A.Oner, S.Akyuz An experimental study on optimum usage of GGBS for the compressive strength of concrete, Cement & Concrete Composites (2007), 505–514.