Retraction

Retraction: A Comprehensive Study on Utilization of Waste Materials in Concrete (IOP Conf. Ser.: Mater. Sci. Eng. 1145 012045)

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IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1

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A Comprehensive Study on Utilization of Waste Materials in Concrete

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Abstract. Nowadays, waste materials are becoming issue to the environmental pollution, which is a danger to the climate and the general public. It is imperative to reuse these materials and clear them in an appropriate manner. Waste can be utilized in the infrastructure development by two different ways: reusing and by recycling. The old-style methods for creating materials for construction are from available natural resources. If we continue the same there will be no more resources left to avoid such cases we are practicing to recycle and reuse the solid waste in an effective manner. Owing to the development of industrial and urban management systems, a greater number of solid wastes are generated which is currently disposing them into the land and this causes various problems to the society and environment. To protect the environment from the threats, lot of efforts are being developed for recycling of variety of solid wastes in order to employ them in the creation of various building materials. In this paper, we have discussed about the recycling potentials of solid waste and possible utilization of waste materials in the construction industry.

Keywords: Solid Waste Materials, Durability, Recycled Materials, Flyash.

1. Introduction
We have a biggest problem to solve in our society that is to diminish the environmental issues that prevailing during the infrastructural development in the recent years. The utilization of recycled materials and solid wastes in the construction practices becoming a new trend in the environmental conservation point of view. The solid wastes and recyclable materials that are produced from the industrial revolution or by man-made activities or from agricultural waste products are converted into useful product [4]. The properties of solid wastes and recyclable materials should be addressed before utilization in the construction activities. The primary motto of waste utilization in the construction practices would be cost effective and environmentally friendly. The main purpose of this studies is to use as recycled solid waste in an appropriate manner [5]. Normally, recyclable materials would be having appropriate composition, chemical, physical and mechanical properties. Before utilization or replacement of recyclable materials to conventional materials, recyclable material properties to be addressed to get a better raw material for better life span of the building [12]. For the better understanding of the replacement approved conventional materials, their chemical and physical properties need to be checked along with optimum usage of specific waste materials. The recycled solid waste materials are somewhat different from the natural raw materials. The recycled waste
material should be carefully evaluated for each of the planned uses [13]. The characteristics of each and every recycled solid waste material should be clear to the engineer when working with this type of materials.

2. Need for this Research
Solid waste can be used in many ways. Solid waste can used as partial replacement either of fine aggregates, coarse aggregates and supplementary cementitious materials for the production of cost-effective concrete. Regarding utilization of solid waste many research studies had been conducted. The main objectives of most of the research works were based on the properties of solid waste on the physical, chemical and the mechanical properties of construction products and to reduce environmental pollution which is increasing day by day [14]. Some works gives the how the solid wastes can be utilized efficiently in construction or construction materials. Though further more research is required for the better understanding of the effects of solid waste and their properties and durability aspects of replacement approved construction products. The use of solid wastes is considered as follows [4][1]:

1. Using different types of processed waste materials for raw materials in construction.
2. The solid waste materials should be optimally used to produce useful construction materials.
3. For load-bearing construction materials solid waste materials can be effectively used.
4. To produce environment-friendly and sustainable construction materials solid waste materials can be recycled and reused in a effective manner.
5. Many researchers are still conducting experiments to test the durability of construction materials which is made of recycled solid waste materials.
6. By adding recycled solid waste along with the raw materials, we may produce higher grade construction materials.
7. Compared to the original raw materials these materials are much more cost-efficient and they show better life time performance.
8. Solid waste-based construction material’s performance has been evaluated in real time construction.

2.1 Solid Waste and their usage in Construction:
Solid waste types and their sources are listed in Table 1. This table shows the lists a very few examples on the use of solid waste-based construction materials in real construction [1][5].

| S. No. | Types of Solid Waste | Source Details | Recycled Materials used in Construction |
|--------|----------------------|----------------|----------------------------------------|
| 1.     | Inorganic - Industrial waste | Steel slag, Bauxite red mud, Coal combustion residues, | Concrete, Bricks blocks, Ceramic tiles, Cement, Paint, Fine and Coarse aggregates |
| 2.     | Organic - Agro Waste | Maize and Cassava crop, Rice & Wheat straw and husk, Jute, Cotton stalk, Vegetable Residues | Insulation boards, Cement boards, Particle boards, Wall panels, Roof sheets, Binder fibrous building panels, Bricks. |
| 3.     | Mineral / Mining waste | Mining waste from iron, copper, zinc, gold and aluminium industries. | Bricks and Tiles, it can be used in producing any type of concrete. |
| 4.     | Hazardous waste | Sludge from waste water and waste treatment plants, Blasting materials. | Boards, bricks, cement, ceramics, tiles. |
3. Methodology

The utilization of waste in construction industry will have three major benefits. First, there is a major environmental pollution reduction due to the reuse of solid wastes in construction to produce raw materials [6]. Second, the natural resources can be conserved for future generation by reusing the waste materials. Last, we can modify the physio-chemical properties of the conventional material to produce better materials that can be used in construction [4]. The reuse and recycle of waste materials in the practices of construction includes 7 stages starting from production of waste to users end. The stages include pre and post treatment, physio-chemical properties of the waste materials, factors affecting the waste material properties and potential site performance evaluation for the proposed use. There are 3 main stages in the utilization of wastes materials: processing and treating, properties of end products and intrinsic properties. These three relationships are considered important for reusing and recycling of waste materials [7]:

I. The relationship among mineral and chemical properties with negative properties.
II. The relationship among performance necessities of end product with negative properties.
III. For obtaining optimum utilization, usage of end products with various different properties.

For effective utilization of the waste materials, it is required to understand the mineral and chemical composition affecting the potentially negative property of the appropriate materials. During the investigation, end product mechanical and physical properties how it is affected by negative properties should be determined. After understanding the properties of raw materials, it is essential to treat and change the waste material properties appropriately and we have to maintain the quality during the utilization of waste materials [15]. Once, after the proper treatment of the waste materials it can be used in construction process. Once the waste product is completely ready to use in construction the process becomes more practical. For obtaining the optimum use of waste materials in the construction, it is necessary to determine the potentially negative properties of the replacing specific waste materials. Few of the waste materials that we are reusing are energy-upholding materials [7].

4. Materials and Methods

1. Tyre rubber: This is a transportation type of waste which is reused in construction industry. In these used tyres are reused. The reuse of tire could be effectively used in grass turf, stone cladding, concrete, asphalt mix and clay composites [15].

2. Glass: The composition of glass consists mainly of sand or silica. It is a type of inert waste (i.e. which means it will not decompose in years). Glasses are recycled and reused in secondary level applications, manufacture of fibre glass insulation, roadbed aggregate, structural component and external cladding [2].

3. Plastic: The recycled plastics are used to make polymeric timber which reduces the cutting down of timber trees. Concrete with stronger properties can be made by utilizing the recycled plastics [14]. It is also used in indoor insulation which can keep our home’s temperature regulated.

4. Carpet: It can be readily reused in construction. Life of the carpet is finished means, without disposing we can use them in the automotive parts, stepping stones, rail road ties and carpet cushion. Concrete toughness and tensile properties would be increased by utilizing the carpet materials as fibres. By utilizing the carpet material as fibres in concrete, advantages achieved would be reduction of shrinkage, wear resistance and durable concrete, improved fatigue strength [3].
5. **Cement kiln dust (CKD):** During the cement manufacturing process, one among the by-product is cement kiln dust and also coming by means of industrial waste products. It has the potential to be recycled as a raw material if the high concentration of chlorine and potassium are removed [8]. It can be reused as soil stabilization materials, landfills, water treatment plants.

6. **Foundry Sand:** During the ferrous and non-ferrous metal casting, waste material obtained would be foundry sand [3]. Foundry sand can be reused as an ingredient for portland cement, used as a partial replacement for natural sand in construction of retaining walls, masonry mortar mixes, subways, barrier layers and flowable fills.

7. **Fly ash:** During the coal combustion in power generation, one among the by-product obtained is flyash. Fly ash is a fine-grained, powdery particulate material. It can be utilized as a partial replacement for cement in construction [1][6].

8. **Slag:** During the iron and steel manufacturing process, one among the by-product is slag. Slag is used in as cement in construction occasionally. The properties which make a slag to use as an absorbent in construction industry is particle size, holding capacity, bulk density, porosity [3].

9. **Citrus peel:** citrus peel is obtained from lemons, oranges and various fruits. It can be used as an activated, which is ideal absorbent for elimination of Methylene Blue (MB) [9].

10. **Sewage sludge:** This material is generated through wastewater treatment and transportation [3]. So, this material may contain toxic and inorganic compounds. It has good hardening properties, so it is used in the production of cement in construction industry. The slag generated in melting process can be used as a roadbed material, concrete aggregate and it is also used as a material for the production of tiles.

5. **Results and Discussion**

Due to the infrastructural developments, larger number of solid wastes are being produced as by-products from the various manufacturing industries, mining, domestic and agricultural activities. These solid waste materials day-by-day creating the various environmental issues and larger space is essential for dumping and disposing. There would a large scope for utilization of solid waste materials in the construction materials manufacturing process, which would reduce the environmental issues and also it paved the way for opening the second level industries [11]. The utilization of solid waste materials in the construction materials as partial or complete replacement, which would be making the materials as cost effective, energy efficient and environment-friendly and reduced the exhaustion of naturally available materials [13].

The durability properties of solid waste replaced construction materials to be investigated thoroughly before utilization and also setting up second level industries for recycling and consumption of solid wastes materials [12]. For the efficient utilization of solid waste materials in the construction industry, technology centres were established for making the entrepreneurs to familiarize the solid waste partial / complete utilization in the construction materials. Firms essential to be state-of-the-art in their utilization of recycled materials and diminish their dependency on raw materials. For encouraging the utilization of waste recycled materials in construction industry, efficient properties obtained documentation to be provided as a proof documents [10].

6. **Conclusions**

To conclude that, solid waste materials could be efficiently used as a partial or full replacement material to produce construction material of higher grade. As compared with original raw materials these are more affordable and have more durability. By reusing and recycling we help in creating eco-friendly environment. It gives an idea regarding the physio-chemical properties of the solid waste materials to effectively utilize in real time construction. By using these materials, we can decrease the price of construction to some level. It paves the way to set up industries to produce real time construction materials from solid waste materials.
References

[1] Md. Safiuddin, Mohd Zamin Jumaat, M.A. Salam, Islam M S and Hashim R, Utilization of Solid Waste in Construction Materials, International Journal of the Physical Sciences, 5(13), 2010, pp. 1952-1963.

[2] Vikas Kumar, Anil Kumar Chhotu, Mani K and Deepak Gupta, Use of Waste Materials in Construction Work: Step Towards Waste Minimization, Environment Sustainability: Concepts, Principles, Evidences and Innovations, pp.413-419.

[3] Johnny Bolden, Taher Abu-Lebdeh and Ellie Fini, Utilization of Recycled and Waste Materials in Various Construction Applications, American Journal of Environmental Sciences, 9(1), 2013, pp. 14-24.

[4] Kathurba A K, Reddy K R and Venkat Reddy D, Sustainable Approaches for Utilizing Waste in Building Construction: Two case studies in India, International Journal of Earth Sciences and Engineering, 7(3), 2014, pp. 838-844.

[5] S. D., & H, A. (2019). AODV Route Discovery and Route Maintenance in MANETs. 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS). doi:10.1109/icaccs.2019.8728456

[6] H. Anandakumar and K. Umanaheswari, An Efficient Optimized Handover in Cognitive Radio Networks using Cooperative Spectrum Sensing, Intelligent Automation & Soft Computing, pp. 1–8, Sep. 2017. doi:10.1080/10798587.2017.1364931.

[7] Karrar Raaof Kareem, Pandey R K, Study of Management and Control of Waste Construction Materials in Civil Construction Project, International Journal of Engineering and Advanced Technology, 2(3), 2013, pp. 345-350.

[8] Lin Yang, Yi Chen Li and Mengping Zhang, The research of Waste Materials in Building Construction, Asia Pacific Engineering and Technology Conference, 2017, pp. 70-76.

[9] Mohd Reza Esa, Anthony Halog, and Farrah Zuhaira Ismail, Waste Management in Construction Industry: A Review on the issues and Challenges, International Conference on Environmental Research and Technology, 2015, pp. 100-106.

[10] Muhammad Fikri Hasmor, Ahmad Faizul Md Zin, Sasitharan Nagapan, Rafikullah Deraman, Norhaslinda Abas, Riduan Yunus and Mustafa Kluallah, The On-site Waste Minimization Practice for Construction Waste, IOP Conference Series: Materials Science and Engineering, 713-012038, 2020, pp. 1-11.

[11] Larissa A. R. Freitas and Alessandra Magrini, Waste Management in Industrial Construction: Investigating Contributions from Industrial Ecology, Sustainability, 9-1251, 2017, pp. 1-17.

[12] Sasitharan Nagapan, Ismail Abdul Rahman, Ade Asmi, Aftab Hameed Memon, Imran Latif, Issues on Construction Waste: The need for sustainable waste management, IEEE Colloquium on Humanities, Science & Engineering Research, 2012, pp. 329-334.

[13] Catalin Badea, Corneliu Bob and Liana Iures, Waste Materials used for Building Construction, Advances in Energy Planning, Environmental Education and Renewable Energy Sources, 2016, pp. 54-59.

[14] Tong T. Kien, Le T. Thanh and Phung V. Lu, Utilization of construction demolition waste as stabilized materials for road base applications, The international Conference on Sustainable Built Environment for Now and the Future, 2013, pp. 285-293.

[15] Ch. F. Hendricks, Sustainable use of recycled materials in building construction, The Sustainable City II, WIT Press, pp. 417-425.