WASTE MANAGEMENT: MASK TO A SUSTAINABLE BRICK

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The Covid 19 pandemic has had serious economic, environmental, and societal consequences all over the world. The scientific analysis and data emphasize the favourable environmental benefits of outbreaks, such as reduced greenhouse gases, nitrogen oxides and sulphur oxides. From the literature, we witnessed a -17% reduction in CO_2 emissions per day. Simultaneously, the vast extent of medical waste created throughout a pandemic, which includes the surgical gloves and face masks is challenging to dispose, resulting in a negative impact. The developing issue is that excessive generation of plastic medical waste needs particular waste management measures, taking into consideration the possibility of pathogen contamination. Face masks, which are mostly made of plastic, are harmful garbage rather than plastic waste. This thought justifies the difficulties of discarding of medical waste or managing personal protective equipment (PPE). These factors have no bearing on the production of plastic medical equipment or disposable plastic applications. Disposable plastics, according to medical authorities, are more sanitary and safer than other materials such as plastics. Apart from throwing away plastics, paper waste produced by enterprises and recycling factories, known as paper sludge, is disposed in landfills. This is a significant concern because there is no appropriate process or customary procedure for recycling these materials. This issue needs a quick and fruitful solution. Upon devoting a substantial amount of time in the laboratory, ripping properly prepared disposable plastic post-use and paper effluent blended in particular combinations with some unique inhibitors. We obtained an averaged the compressive strength of 7.5 N/mm^2 from the samples with equal mix proportions. Furthermore, we intend to investigate the use of various additives in various quantities to enhance the durability of bricks. These bricks are cost effective and suitable for partition walls, framed G+1 structure, parapet walls and many more.

Keywords: Mask, Compressive strength, Paper waste, Recycling

1 Introduction :

The World Health Organization (WHO) declared COVID-19 a pandemic due to the fast spread of Sars coronavirus 2 (SARS-CoV-2). A number of nations throughout the world required or strongly recommended that citizens wear face masks to prevent the spread of the virus. The CDC and WHO recommend donning and doffing personal protective equipment (PPE) correctly when interacting with infected patients. PPE is clothing that has been specially made to protect its wearer from potentially dangerous elements, including bacteria, viruses, chemicals, radiation, electricity, and other physical agents standard personal protective equipment consists of a mask, gloves, a gown or coverall, a head cover, and rubber boots[1].

High demand for one-time-use plastic items has been attributed to the global COVID-19 epidemic. It has been argued that the pandemic has hampered legislative progress against single-use plastics and that recycling programmes have been halted because of the risk of transmission, despite the fact that the use of PPE like face masks, face shields, and gloves has increased dramatically as an efficient way to prevent the spread of the virus. The usage of personal protective equipment (PPE) in public areas is also mandated by most governments, which presents a problem for traditional trash disposal and may further worsen plastic pollution. The maritime ecology may be adversely affected in the long run due to PPE contamination[2].
The concept of sustainability is rapidly rising in importance in the building sector across the world. Recycled concrete aggregate, glass, ceramic, fly ash, and slag are just some of the waste materials and

industrial by products that can be used in place of or in addition to traditional building materials like sand, gravel, and Portland cement to create new varieties of concrete for conventional building projects. It has been demonstrated that, within specific constraints, these materials possess the necessary characteristics to create fresh concrete. Accordingly, many investigations have been carried out to determine the optimal concentration of these components in concrete that does not compromise the technical qualities of concrete. Many types of landfill waste, such as plastics, can be recycled into useful components of concrete. Plastics are preferable to other materials because they are less expensive, have a greater strength-to-weight ratio, are more durable (resistant to degradation), can be easily worked and shaped, and have a low density[6]. Lots of plastic trash is generated annually. Due to the high processing costs and labour intensity involved, only a fraction of plastic ever gets reused or recycled. The rest ends up in dumps, incinerators, and landfills[7].

The paper mill residual is chemically unique from the primary paper mill waste. Several stages of filtering are used in the production of recycled paper in order to preserve the cellulose fibre as much as feasible. The manufacturers of paper consider the remnants of the final filter to be waste, so they store them away. Approximately 60% of the materials in this residue are inorganic, such as calcite and clay. The paper business generates a large quantity of waste as a by-product of the various mechanical, chemical, and biological effluent treatment procedures. The process of making paper, the types of raw materials utilised, and the methods employed to treat the wastewater all affect the total amount and chemical make-up of the residues. There was enough waste produced to equal half of annual paper output. In most cases, the waste is either buried or incinerated. The paper industry faces serious environmental and financial challenges related to the disposal of this residue.[10-14]

The increase in the use of the PPE kit will lead to massive waste generation due to its single usage. According to the Wuhan report, it has been noticed a rapid increase in medical waste generation from 40 to 50 tons to 247 tons per day during pandemic. One of the innovative methods of recycling ppe waste along with paper waste while a binder is being used is discussed in this paper and also it emphasizes on sustainability. This paper demonstrates that using pulp made from recycled newspapers and medical protective equipment can affect properties like water absorption, Compressive Strength etc.

2 Materials and Methods :

2.1 Materials

2.1.1 PPE waste

To prevent cross-contamination between patients, disposable isolation gowns are made from nonwoven materials that are either impermeable to liquids or combined with other materials, including plastic films, that provide further protection against liquid penetration. Fabrics can be designed to have specific qualities by the manipulation of fibres, bonds, and surface treatments (chemical or physical treatments). The discarded PPE kits and masks were collected and kept aside for the disinfection process so that the materials would be free from any sort of virus. Reusing plastics reduces waste and helps preserve precious resources. Turning plastic waste into mortar and concrete products that can be used in building and construction is one way to increase the proportion of recycled plastic in use[3].

2.1.2 Paper waste:

In the world, paper recycling currently sits at a respectable 58%. Seventy to seventy-five per cent of a country's total wastepaper is recycled. India Paper Manufacturer Association(IPMA) predicts that by FY 2026-27, Indian paper consumption will have increased to 30 million tonnes, a growth rate of 6-7% annually. Reasons for this include the government's push to improve education and literacy, as well as the expansion of the retail industry, especially chain stores. High-quality packaging for fast-moving consumer goods (FMCG), pharmaceuticals, textiles, organised retail, and the rapidly expanding online retail market is another key factor[8,9]. This is the case in many industrialised nations. These industrialised nations may increase their paper recycling rates and bring the global average up by investing in better trash recycling infrastructure[4]. Because of the organic and inorganic components of recycled paper processing wastes, they may be a viable alternative raw material source for the manufacture of porous anorthite ceramics[8,9]. The fact is that a lot of pulp after recycling ends up in landfills after treatment and recycling are done on paper. The waste is collected from local paper mills and is being utilised in order to avoid getting into landfills.

2.1.3 River sand
The experiment used river sand with a particle size of less than 2.36 mm, a specific gravity of 2.69, a bulk density of 0.87 kg/l, and a water absorption rate of 2.5%. Before beginning the process, the sand is kept aside for around 20 minutes to get rid of the excess moisture present

2.2 Preparation:

2.2.1 Disinfection:
First, when the masks and abandoned personal protective equipment kits have been purchased, they are placed in separate bins with ethyl alcohol until they are saturated, and then they are left alone for about three days without being touched. This is done in order to eliminate any potentially dangerous viruses or bacteria that might be present on the personal protective equipment (PPE) material or masks.

2.2.2 Batching:
After being treated with disinfectant, the materials are shredded with shredders and then it breaks down the material into tiny bits of pieces.

2.2.3 Mixing & Casting
The composition of brick consists of 40% of PPE kit and masks and 50% of paper waste obtained from paper mills along with 10% of binder(Gypsum-$\mathbf{CaSO_4 \cdot 2H_2O}$.) making it a proper batch. Specimens of size 10cm X 10cm X 10cm is placed in the mould as per the requirements.

2.2.4 Drying and Curing
Sunlight provides the heat necessary for the setting of specimens placed in moulds, therefore they should be exposed to attain basic strength. After being moulded, test specimens were left to dry for 24 hours. For a period of twenty-one days, the specimens were stored in a curing tank.

2.2.5 Samples
Totally 3 samples were casted using the proposed composition and they were kept in curing tank for a period of 28 days among them each sample were tested for 7 days, 14 days and 28 days.

3. Results & Discussion
3.1 Compression Test
By evaluating the basic factors that influence the specimen's behaviour under a compressive stress, compression testing can reveal how a product or material responds to being compressed, squashed, crushed, or flattened. The compressive strength testing equipment is used to examine the cube-shaped brick specimen. We will apply the weight on the brick in a smooth, steady motion after it is in place. Continuous load increases of 140kg/cm^2/min will be applied until the specimen fails under the stress. The brick specimen's maximum load, its appearance and kind of collapse, and any other peculiarities are recorded[5].The compressive test was performed on 3 samples with curing time of 7 days, 14 days & 28 days respectively and after applying the load on the samples using the compression testing machine and the values of the tests were recorded accordingly and mentioned in the table1.

3.2 **Water Absorption Test**
The samples water absorption capacity (%) was compared to that of normal sample by preparing blocks of 10 cm X 10 cm X 10 cm. Specific Gravity equipment with an electronic balance was used to measure

the water absorption (in percentage) in accordance with the American Society for Testing and Materials C127-04 standard. The block was placed in the basket attached to the spring balance, underneath and it was a container which was enough in space to accommodate block and filled with water so that specimen is submerged into water . Initially the specimen's dry weight was recorded and after placing the block on apparatus again the weight of specimen after 24 hours was recorded. It can be calculated using the formula :

Water Absorption(%) = (M2-M1/M1) X 100
M1-Initial dry weight of the sample
M2- Final weight of sample after 24 hours being placed in water

4 Conclusion
Based on the results obtained from experiment following are the points concluded regarding the properties of the bricks made out of PPE waste and recycled paper waste:

- The consistent increase in the compressive strength when the curing duration was increased from 7 N/mm^2 , 7.5 N/mm^2 & 8 N/mm^2 of samples of 7 days,14 days & 28 days respectively(Fig 1).
- The water absorption percentage was also close to less than 4% approximately and that is in a safe range for a specimen to be practically used(Table 2).
- These blocks can be further used in partition walls and construction of toilets in rural areas.
- The self-weight of the block is reduced noticeably compared to the normal building blocks.
- These blocks are cost efficient as there is less cost involved in procurement of materials.

5 Further Scope
Based on the experimental data obtained from the tests we are expecting to conduct further more tests in trying different binders

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Tables:

S.No	PPE Waste	Paper Waste	Binder	No. of Days	Compressive Strength (N/mm^2)
1	40%	50%	10%	7 days	7.0 N/mm^2
2	40%	50%	10%	14 days	7.5 N/mm^2
3	40%	50%	10%	28 days	8 N/mm^2

Table 1 compressive strength of specimens casted over 7days, 14 days, 28 days

Sample	Water Absorption (%) = (M2-M1/M1) X 100
1	3.1%
2	3.5%
3	3.5%

Table 2 Water absorption test of samples

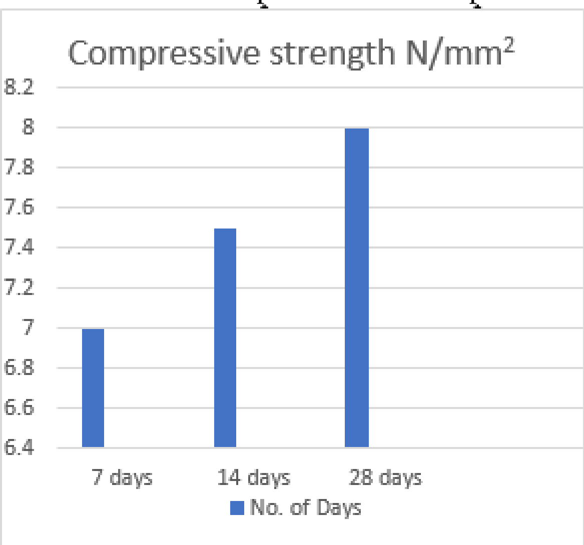

Fig1. Graph of compressive strength increase

Fig2 Casted specimen after demolding