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Review on Composition of WPC Bricks

Vedant Khandalkar[1], Megha Dorle[2], Chaitanya Babhare[3], Prof. Vaibhav Kalmegh[4]

[1,2,3,4]*Civil Department, BDCOE Sewagram, RTMNU University.*

Email: [1]vskwrd123@gmail.com, [2]meghadorle135@gmail.com, [3]chaitanyababhare@gmail.com, [4]vaibhavkalmegh05@gmail.com

Abstract: ***Producing experimental bricks can be a tedious process, using the right combination of materials is something that should be taken into consideration. Not keeping this in mind will most likely result in an inevitable failure of the final product. In this research paper, we will dive deep into what materials we have used in the production of WPC bricks. These materials will include, Maleic Anhydride, Magnesium Hydroxide, Stearic Acid, Wood Flour, PET waste (polyethylene terephthalate), etc.***

Keywords: Experimental, Tedious, PET waste, Maleic Anhydride, Magnesium Hydroxide, Stearic Acid.

1. INTRODUCTION

Millions of tons of polymer waste are produced every year, which end up in landfills or are burnt, creating an environmental problem by threatening the health of living organisms. New types of bio-based building materials made from renewable resources such as wood are becoming increasingly interesting. The main reason for this is global environmental challenges.

There is a long tradition of using thermoplastic materials such as polyethylene and polypropylene and an even longer tradition of using wood-based materials such as chipboard and fiberboard. A new material has emerged that is a combination of a thermoplastic component and a wood-based component, known as wood-plastic composites (WPCs).

The term wood-plastic composites is historically a broad term that includes all wood-containing composites in both thermosets and thermoplastic matrices. In this research paper, we are going to dive deep into the type of materials that were used in the production of WPC bricks. Understanding these materials on a deeper level is quite an important thing. There is a wide range of materials that were used in the production of WPC material, including certain types of Chemicals and other physical materials. Some of these materials were selected to produce WPC bricks.

2. MATERIALS

PET (Polyethylene Terephthalate)

The Polymer that will be considered in terms of chemical composition, is PET, one of the simplest compounds. This plastic has different applications, most common use is in manufacturing plastic bottles. Polyethylene terephthalate (PET) dominates the beverage bottle market as the third most widely used polymer in the packaging industry. Some of the characteristics for Polyethylene Terephthalate are: PET is a highly durable thermoplastic material that is both semi rigid and stretchable during processing. It boasts excellent

mechanical resistance to impact, making it an idea choice for the creation of WPC bricks. PET can undergo surface modifications through physical and chemical treatments.

Sawdust

Sawdust is a material which is nothing but a byproduct of woodworking operations, such as sawing, sanding, milling, etc. It's majorly used to create particleboard. We've added this material into the mix because it increases the volume and also will make it stronger when it comes to WPC brick's strength, it will sort of behave like a fiber which will avoid unnecessary breakage of the whole brick.

Maleic Anhydride

Maleic Anhydride is a highly reactive chemical intermediate that plays a crucial role in various industrial applications. Its versatility makes it a popular choice in the production of unsaturated polyester resin coatings, pharmaceuticals, and agricultural products, surfactants, and plastics additives. Maleic anhydride is a highly versatile chemical compound that is widely used across various industries worldwide. It is a key component in the production of resins, lubricant additives, and agricultural chemicals. However, the current production processes rely on the use of benzene or butane as raw materials. Maleic anhydride is mainly used to form unsaturated polyester resins for use in boats, cars, buildings and electrical goods, trucks, buildings, piping, and electrical appliances. Additionally, maleic anhydride-based lube oil adhesive has piping, shown to significantly prolong oil-change intervals and improve engine efficiency.

Stearic Acid

Stearic acid is a saturated fatty acid. Its natural occurrence in animal and plant fats showcases its importance in various industries. This white, waxy solid is often crystalline and has a mild odor. Stearic acid's hydrophobic nature and high melting point ensure the stability, texture, and spread ability of natural butters. We've used this chemical in the production of WPC bricks because it's a great lubricant and will help us when it comes to mixing the materials together.

Magnesium Hydroxide

Magnesium hydroxide is an inorganic compound that occurs naturally as the mineral brucite. It is widely used in antacids, such as milk of magnesia, owing to its low solubility in water. Magnesium hydroxide is an excellent choice for a flame-retardant filler due to its unique characteristics. It can be synthesized with high purity and in various useful morphologies, and responds well to surface modifiers.

Properties of Chemicals

1. Maleic Anhydride

Chemical Formula	Appearance	Odor	Melting point	Boiling point	Purpose
C4H2O3	White crystal or needles	Irritating and choking	52.6 ℃	202 ℃	Coupling agent

2. Stearic Acid

Chemical Formula	Appearance	Odor	Melting point	Boiling point	Purpose
C18H36O2	White solid	Pungent, oily	69.3 ℃	361 ℃	Lubricant

3. Magnesium Hydroxide

Chemical Formula	Appearance	Odor	Melting point	Boiling point	Purpose
Mg(OH)2	White solid	Odorless	350 ℃	672.5± 65.0 °C	Flame retarder

3. METHODOLOGY

Now that we have explained the purpose of each material, we will discuss their use in producing WPC bricks. Our selection of materials was carefully considered to ensure they meet all aspects of WPC material requirements. The initial step in creating WPC bricks is to gather the necessary materials. This ensures that we have everything we need in order, from PET to the chemicals discussed in the research paper. The first material we need to obtain is PET (polyethylene terephthalate). We have observed that most plastic bottles have polyethylene terephthalate in them, making them an excellent source for PET material. Collecting plastic bottles from the streets and local garbage dumps is an efficient way to reuse them. PET, which stands for polyethylene terephthalate, is a lightweight and reasonably strong plastic that can be used as a great binder when creating WPC bricks. After collecting PET, we will move on to the next raw material sawdust. Procuring sawdust was the easiest of all, as it is a by-product of woodworking operations. Since sawdust is made from wood, it contains fibers that ensure good bonding of the brick. Using sawdust provides an extra level of safety in regard to overall strength. We have considered that sawdust increases the overall mix volume, this is not only beneficial but also profitable. The next materials are three types of chemicals. Maleic Anhydride is a coupling agent that is crucial for binding PET with other materials. It is a highly reactive chemical intermediate that is widely used in various industrial applications, particularly in the production of plastic additives. Stearic Acid is a lubricant that facilitates the mixing of materials with little to no resistance. It is important to keep this in mind before melting and mixing PET with other materials. Stearic acid is a commonly used stabilizer, plasticizer, and color stabilizer in plastic products. It also serves as an activator and accelerator in rubber processing. For our purposes, the use of a heat retarder is crucial in creating WPC bricks using heating techniques. Magnesium Hydroxide is an excellent choice as it acts as a heat retarder and smoke suppressor, effectively minimizing smoke production. With the materials procured, we will now proceed to melt the Polyethylene terephthalate as the first step. To start the process, cut plastic bottles into smaller pieces and melt them. Gradually add more pieces until the desired amount of melted PET in paste form is achieved. Then, add sawdust into the mix and gradually increase the amount while continuing to mix the melted PET, the volume will eventually increase. To create the desired composition, then add the lubricating agent, (Stearic Acid) to ensure a smooth mixing process. Then, add the flame retarder, (Magnesium Hydroxide), to prevent the mix from overheating and igniting. Then at the end add the coupling agent, Maleic Anhydride, to the mix, it will ensure a proper bond between the materials. These steps will result in a well-mixed and safe product. After adding the materials, the casting process can begin. Pour the melted mixture into the desired mold and poke it with a tamping rod to eliminate any bubbles. This step is straightforward to execute. After the process is complete, the brick must be allowed to cool for approx. one and half an hour before it is removed from the mold. Upon removal, the brick can be inspected to ensure proper composition. A perfectly cast brick will be observed.

4. CONCLUSION

In Conclusion, This paper explores and reviews the impact of wood fiber and recycled plastic (PET) composition on the properties of wood-plastic composite (WPC) bricks, including strength, weight, and aesthetics. A balanced wood-plastic to chemical ratio is crucial for optimal performance, as highlighted in the paper. Furthermore, the paper discusses the importance of additives, such as coupling agents, Lubricant, and heat retarders. These materials are crucial in providing the necessary stability to the mix.

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