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Review of Eco-Friendly Concrete: Utilization of Dry Leaves Ash, Fly Ash, and Organic Sucrose Plasticizers

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***Abstract*— The construction industry heavily depends on Portland cement, which causes serious environmental impacts. To reduce this problem, researchers are exploring sustainable alternatives for concrete production. This review focuses on the utilization of dry leaves ash and fly ash as partial replacements for cement, along with organic sucrose-based plasticizers as eco-friendly admixtures. Dry leaves ash, obtained from agricultural and domestic waste, contains reactive silica that contributes to strength development through pozzolanic reactions. Fly ash, a by-product of coal-based power plants, improves workability, long-term strength, and durability while reducing carbon emissions. Sucrose-based plasticizers enhance concrete flow and workability without compromising strength and are biodegradable and non-toxic. The review summarizes existing studies on fresh and hardened concrete properties and highlights the environmental benefits of these materials. The findings indicate that combining waste-derived ash and organic plasticizers can produce cost-effective, durable, and sustainable concrete, supporting greener construction practices. Further experimental and field studies are recommended for large-scale implementation.**

***Keywords*— Eco-friendly concrete, Dry leaves ash, Fly ash, Sucrose-based plasticizer, Sustainable construction, Green materials, Waste utilization, Low-carbon concrete**

I. INTRODUCTION

Concrete is very popular for building things. This is because cities are growing fast and we need a lot of concrete. People like concrete because it is strong and it lasts for a time. We use concrete everywhere. To make concrete we need a powder called ordinary Portland cement. The thing about this powder is that it takes a lot of energy to make it. Also, when we make this powder it puts a lot of stuff into the air. Just making ordinary Portland cement is responsible, for some of the things that we put into the air.

We use a lot of Portland cement to make concrete and that is a problem. This is a problem. We really need to find ways to make things that're better for the earth. Concrete is used a lot. We need to make concrete in a way that's better for the earth.

The earth is what we need to think about when we make concrete. We have to make concrete better, for the earth. People are worried about the environment. So, researchers are looking into using materials in cement that come from industrial and farm waste. One of these materials is fly ash. Fly ash is a leftover from coal-fired power plants. Researchers have studied fly ash because fly ash has some properties. Fly ash is available everywhere. Fly ash helps make concrete stronger and last longer. The thing about fly ash is that fly ash is really good, for concrete. Dry leaves ash is something that people do not use much as they should. This ash is made when we burn leaves and other waste from nature in a way. We can also use dry leaves ash to make cement. When we get rid of leaves by throwing them it can harm the environment. This happens because it makes the air dirty and fills up the places where we throw away trash. If we burn these leaves and turn them into dry leaves ash, then we can use this dry leaves ash to make concrete. Using leaves ash in this way helps us to get rid of waste and save the things that we need to survive. We can use the ash from leaves to make concrete. This is really helpful for managing waste. It also helps save our resources. The ash from leaves is a good thing to use when we make concrete because it helps with waste management and it saves our resources, like the ash from leaves. The thing about concrete is that it needs some extra support to be really good. So, we use things like mineral replacements to give it a hand. We also need to use admixtures to make the green concrete work the way it should. Concrete really needs these helpers to be at its best. We are talking about concrete and concrete needs a little assistance, from these sustainable admixtures to make it work well. One good thing we can use is sucrose-based plasticizers. These sucrose-based plasticizers are an option than the usual chemical things we add to stuff because those chemical things are not good, for the earth. These natural plasticizers make the concrete easier to work with they use water. The best part is that these natural plasticizers are biodegradable and they do not hurt the environment much.

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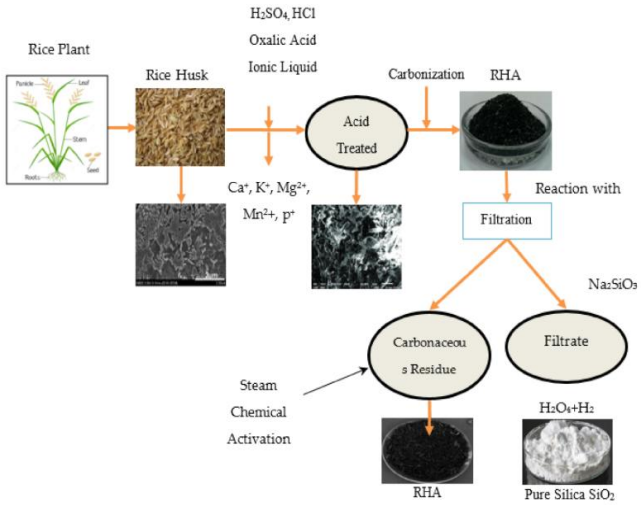

When we use leaves ash and fly ash and organic sucrose plasticizers together it is a terrific way to make concrete in a sustainable way. Green concrete made like this is better, for the earth. Still strong enough to use for building things. This review aims to analyse existing research on these materials and assess their potential in developing environmentally responsible concrete for future construction practices.

II. Research Significance

This study is important because it looks at alternatives to regular concrete that can help the environment and still work well. The study shows that using ash from leaves and fly ash as part of the cement can be a good way to use waste from farms and factories that would otherwise hurt the environment and fill up landfills. Using sugar-based additives is also a thing for the environment because these additives are biodegradable and not toxic. This means that we do not have to use man-made chemicals in the concrete. The sustainable alternatives to concrete can really help the environment. The study looks at how we can use waste from farms and factories to make the concrete. This is a way to make the concrete sustainable. The sugar-based additives are a choice, for the concrete because they are biodegradable and not toxic. The research on materials is significant because it explores practical alternatives to conventional concrete that can reduce environmental impact while maintaining acceptable performance and this is what the study is all, about finding new ways to make concrete materials.

III. Materials

1. Cement

People usually use Ordinary Portland Cement as the material that holds concrete together. This Ordinary Portland Cement is the material that other things, like ash are compared to when they are used in its place.

2. Dry Leaves Ash (DLA)

People collect leaves from farms the side of the road or their gardens. They burn these leaves in a way that they can control. Then they grind the ashes into a fine powder. This powder is used to replace some of the cement when building things. The reason they use this ash is that it has properties that work well with the cement, which is called pozzolanic characteristics. The dry leaves ash is really good, for this because of these properties.

3. Fly Ash

Fly ash that we get from power plants is really useful. We use it to help make concrete better. It makes the concrete easier to work with. It gets stronger, over time. The concrete also lasts longer. The best part is that we do not need to use as much cement as we used to. Fly ash is a help when it comes to making concrete.

4. Fine Aggregate

We use natural river sand or manufactured sand that meets the rules to make the mix just right and give it the strength it needs. The natural river sand or manufactured sand is what we call fine aggregate.

5. Coarse Aggregate

To make something like concrete we need small rocks. These rocks are called stone or gravel. We use rocks that are about 10 to 20 millimetres in size. The small rocks help make the concrete strong and able to hold things. The crushed stone or gravel is like a skeleton for the concrete. It gives the concrete the ability to bear loads. We use crushed stone or gravel to form the skeleton and provide load-bearing capacity, for the concrete.

6. Organic Sucrose Plasticizer

Sucrose is used to make concrete better. We get sucrose from things. It helps to make the flow more easily. Sucrose also helps to use water when we make the concrete. This is good, for the concrete. Sucrose makes the concrete flow better. It is a natural thing.

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7. Water

Clean, potable water free from harmful impurities is required for mixing, curing, and hydration of concrete.

8. Optional Laboratory Equipment

Mixing trays or concrete mixer, weighing balance, measuring cylinders, molds, tamping rod, curing tank, and testing machines are required for experimental work.

IV. Mix Design

We do not have a way to mix concrete that includes dry leaves ash and organic sucrose plasticizers. So we have to develop the mix proportions based on the practices, for Ordinary Portland Cement concrete and what other people have found out from their experiments with this kind of concrete. We have to use the information from studies to figure out the right mix of concrete that includes dry leaves ash and organic sucrose plasticizers.

General Mix Design Considerations:-

- We start with the Ordinary Portland Cement mix design, as the base. The Ordinary Portland Cement mix is what everything is built on.
- People are using fly ash and dry leaves ash to replace some of the cement. They do this by mixing the cement with fly ash and dry leaves ash. The cement is not completely replaced it is partially replaced with fly ash and dry leaves ash.
- The total amount of content, in concrete is kept at about seventy five percent to eighty percent of the total weight of the concrete.
- Organic sucrose plasticizer is a thing that helps reduce the amount of water in things. It is used for this purpose. Organic sucrose plasticizer is very useful, in this way.
- Water–binder ratio is adjusted to achieve workable concrete without segregation.

Proposed Mix Proportions (per m^3 of Concrete) Binder Composition:-

- Cement: 80%
- Fly Ash: 15%
- Dry Leaves Ash: 5%
- Total cement replacement: 20%

V. Mixing And Placing

To make concrete we need to mix all the ingredients. This includes cement, fly ash, ash from leaves, aggregate and coarse aggregate.

We have to mix ingredients well, so concrete ingredients are all spread out evenly. Then we add water to the mix. The water has something, in it called sucrose plasticizer. We add this water to the mix slowly while we keep mixing the concrete mix. We keep doing this until we get a mix of concrete that's all the same and easy to work with the concrete. We need to be careful when we mix concrete. If we mix it much the concrete will not turn out right. We also have to make sure the different parts of the concrete do not separate from each other. Concrete is what we are trying to make. Our goal is to have concrete. We are making concrete by mixing all these things to get the right concrete. We want our concrete to be concrete. The prepared concrete is placed into molds in layers and compacted properly using tamping or vibration to remove entrapped air. After finishing the surface, the specimens are kept undisturbed for 24 hours before demolding and curing.

VI. Curing Methods

- *Initial Setting Period:* When we make the specimens we have to leave them alone for about 24 hours. This is so the concrete can start to set and we do not damage the surface of the concrete specimens.
- *Demolding:* When the specimens have gotten strong enough they are taken out of the molds carefully. This is done so that the specimens do not get cracks or hurt on the edges. The people doing this have to be careful with the specimens, during the Demolding process. They want to make sure the Demolding is done right so the specimens are okay.
- *Water Curing:* The specimens that have been taken out of the mold are put in water. This keeps them moist all the time. Water helps the Water Curing process because it supports the cement and ash-based materials, in the Water Curing to get the water they need to work.
- *Ambient Temperature Curing:* We do the curing at the temperature you find in a room. This is because we want it to be like it is on a site. We also want the strength of the material to develop slowly over time. This way Ambient Temperature Curing is, like what happens in real life.
- *Curing Duration:* The concrete is cured for time periods, such as 7 days or 14 days or 28 days to see how the concrete strength of the concrete changes over time, with the concrete.

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- *Moisture Control:* Adequate water levels are maintained throughout the curing period to prevent drying and shrinkage, ensuring improved durability and performance.

VII. Properties Of Eco-Friendly Concrete

1. Workability

When you mix fly ash and a special kind of plasticizer made from sugar into the concrete the concrete gets a lot better. The tiny fly ash particles are very small and round. This shape really helps the fly ash move easily. The fly ash also reduces the friction, inside the concrete. This is because the fly ash particles are so small and smooth which makes the concrete better. The sugar plasticizer is really helpful because it uses water. This makes the concrete mix smooth. It also makes the stick together well. This is great because it makes it easy to put the concrete in place. The concrete does not separate when you use the sugar plasticizer. Fly ash and sugar plasticizer are a team. They really make the concrete better. When you use fly ash and sugar plasticizer the concrete is easier to work with. Fly ash and sugar plasticizer make a difference in the concrete.

2. Compressive Strength

Ash-based concrete is really strong. This is because it is made with the ash from cement. The ash, from cement makes the concrete very strong. When you use ash from cement to make concrete it turns out to be very strong. The fly ash in this concrete is really good because it makes the concrete stronger as time goes by. The fly ash is what does this. It helps the concrete get stronger, over time. This happens because of the way the fly ash reacts with things. The fly ash is the problem. When the fly ash comes into contact with things it does something that causes this to happen. The way the fly ash reacts with these things is the reason, for this. The ash from leaves is really good for this because the ash from leaves helps to hold everything. It is like a kind of glue that keeps things in place and that is why the ash, from leaves is so useful. At first this concrete might not be as strong as concrete. The ash-based concrete is just as strong after 28 days. It is really strong at this point. The ash-based concrete has the strength, as other types after 28 days. The fly ash and the ash from leaves all work together with the ash-based concrete to make this happen. This is because the fly ash and the ash from leaves and the ash-based concrete all do their part. The fly ash helps and the ash from leaves. The ash-based concrete helps too. This is how the fly ash and the ash, from leaves and the ash-based concrete make things work.

Ash-based concrete is really good. The reason ash-based concrete is good is that ash-based concrete gets stronger over time. This is a thing, about ash-based concrete.

3. Durability

The fly ash is really good for the material. It makes the material stronger when it comes to dealing with chemicals. The fly ash is a thing. It also helps keep water from getting in. This means you do not get cracks in the material. If you take care of the material properly it becomes even better at keeping water and bad substances out. The fly ash is very good at helping the material longer when it is outside. The fly ash is helpful to the material because it makes the material stronger and helps it longer. The fly ash is good, for the material.

4. Setting Time

When you add sucrose plasticizer to concrete it slows down the time it takes for the concrete to set. This is really useful. It makes the concrete easier to work with. You have time to handle the concrete. Long as you use the right amount of sucrose plasticizer the concrete will still set properly. The sucrose plasticizer will not slow down your construction project if you use it correctly. You can work with the concrete without rushing. The sucrose plasticizer helps you. It gives you time to do what you need to do with the concrete. You can still follow your schedule. Finish everything on time with sucrose plasticizer. Sucrose plasticizer is really helpful because it gives you time to work with the concrete without messing up your construction schedules. When you use sucrose plasticizer you have time to do what you need to do with the concrete. Sucrose plasticizer helps you get things done on time.

5. Density

Concrete with leaves ash in it is a little lighter. This type of concrete is not as heavy as the concrete. I think dry leaves ash concrete is good for things. The reason is that it is lighter. Sometimes people want to make things that're not too heavy but they still need to be strong and safe. Dry leaves ash concrete is a choice, for these kinds of things. Dry leaves ash concrete is lighter which is a thing. It still works well. When you need something that's not too heavy you can use dry leaves ash concrete. This is an option because dry leaves ash concrete is lighter and it is also strong. Dry leaves ash concrete is really useful when you want something that will not weigh you down. You can count on leaves ash concrete to be lighter and still be strong.

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6. Environmental Sustainability

One of the key properties of this concrete is its reduced environmental impact. Partial replacement of cement with waste materials lowers carbon emissions, promotes waste utilization, and supports sustainable construction practices.

VIII. Application

1. Residential and Low-Rise Buildings

This special kind of concrete is good for houses and small buildings. The best thing about this concrete is that it uses cement. This helps to save money when building something. The building will still be safe and strong. This eco-friendly concrete is really useful, for houses and low-rise structures.

2. Pavements and Rigid Flooring

This concrete is really good because it lasts a time and does not let water pass through easily. The concrete has fly ash in it which makes the concrete strong over time. This means concrete is perfect, for surfaces that have to support a lot of weight over like parking areas and industrial flooring.

3. Non-Structural and Semi-Structural Elements

It is a little less dense. That makes it easier to work with when you are making these things. This means you can cast them easily. The concrete is great, for these kinds of - structural components.

4. Precast Concrete Products

Eco-friendly concrete is also good for making drain covers and hollow blocks. When we make these things in a factory it is easier to control how the eco-friendly concrete sets and gets hard. This is because we can add helpers like sucrose, to the eco-friendly concrete.

5. Mass Concrete Works

The concrete with fly ash in it gets hot slowly. This makes the concrete good for jobs like foundations and walls that hold back dirt. It is also good for flat slabs of concrete. The reason is that we need to stop the concrete from cracking because of the heat. The fly ash concrete is a choice, for these big jobs because it does not get hot too quickly.

IX. Limitations

When we talk about concrete the strength that concrete has when it is young or at an age may not be as strong, as the strength of regular concrete.

The quality of leaves ash and the composition of dry leaves ash can be different. This is because the quality of leaves ash and the composition of dry leaves ash depend on where the dry leaves ash come from and how the dry leaves are burned to produce dry leaves ash.

If you use much sucrose plasticizer it can make the setting time take a lot longer than it should.

You have to be really careful when you mix things together because the amounts of each thing need to be just right or you will not get the results every time.

Limited long-term field performance data is available for large-scale applications.

Additional testing and standardization are needed before widespread commercial use.

X. Conclusion

Using leaves ash and fly ash and organic sucrose plasticizers in concrete is a good way to make construction more sustainable. Dry leaves ash. Fly ash and organic sucrose plasticizers help us use less cement. This is a thing because it reduces the bad impact on the environment. We can also use waste that would be hard to get rid of otherwise. Fly ash makes concrete stronger and last longer. Dry leaves ash helps us save resources. Organic sucrose plasticizers make concrete easier to work with. That is good for the earth. Using leaves ash and fly ash and organic sucrose plasticizers in concrete is a step, in the right direction. Although careful mix control is required, the overall findings indicate that this type of concrete can be a viable and environmentally responsible alternative for future construction applications.

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