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Study and Investigation on Cypress Tree Extract used in Concrete

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Abstract: *This study focuses on using a natural plant-based material (cypress tree extract) as an eco-friendly admixture in concrete. Normally, chemical admixtures are added to concrete to improve strength and workability, but they often harm the environment and are costly. To find a better option, we tested cypress bark extract at different dosages (5%, 10%, and 15%) in M25 grade concrete. The results showed that this natural extract delayed setting time, improved workability, and increased compressive, split tensile and flexural strength, especially at 10% dosage for compressive strength and up to 15% for the other two. This suggests cypress extract can replace chemical admixtures to make concrete more sustainable and cost-effective. The method also helps reduce the carbon footprint of construction while promoting the use of natural and renewable materials..*

Keywords: Eco-friendly concrete, Natural admixture, Cypress tree extract, Sustainable construction etc

I. INTRODUCTION

Concrete is one of the most commonly used materials in the construction industry. It is made by mixing cement, sand, coarse aggregates, and water. To improve its strength and workability, chemical admixtures are often added. However, these chemical additives can be harmful to the environment and human health. They are expensive and sometimes not easily available, especially in developing countries.

As the need for sustainable construction grows, researchers are exploring natural and eco-friendly materials that can replace chemical admixtures. One such option is using plant-based extracts. In this study, we focus on cypress tree extract, which is known for its natural oils and useful properties like water resistance and anti-bacterial effects.

This report presents an experimental investigation into the use of cypress tree extract as a natural admixture in concrete. Different dosages of the extract were tested to see their effect on the concrete's strength, workability, and durability. The aim is to find an affordable and environmentally safe way to improve concrete performance while reducing the harmful impact of construction on nature.

II. LITERATURE REVIEW

All the research studies show that the construction industry needs to find better and more eco-friendly ways to make concrete. Many chemical admixtures and cement used today are harmful to the environment and expensive. Natural materials like cypress tree extract, jaggery, and sugarcane can be used instead. These natural admixtures help improve concrete's strength, make it easier to work with, and delay the setting time, which is useful in hot weather. Also, waste materials like ceramic waste and rice husk ash can partly replace cement. This not only saves money but also reduces pollution and landfill waste. Pervious concrete mixed with glass powder helps with rainwater harvesting, especially in rural areas. In short, using natural and waste materials in concrete is a smart and green choice, but more research is needed to make it work even better.

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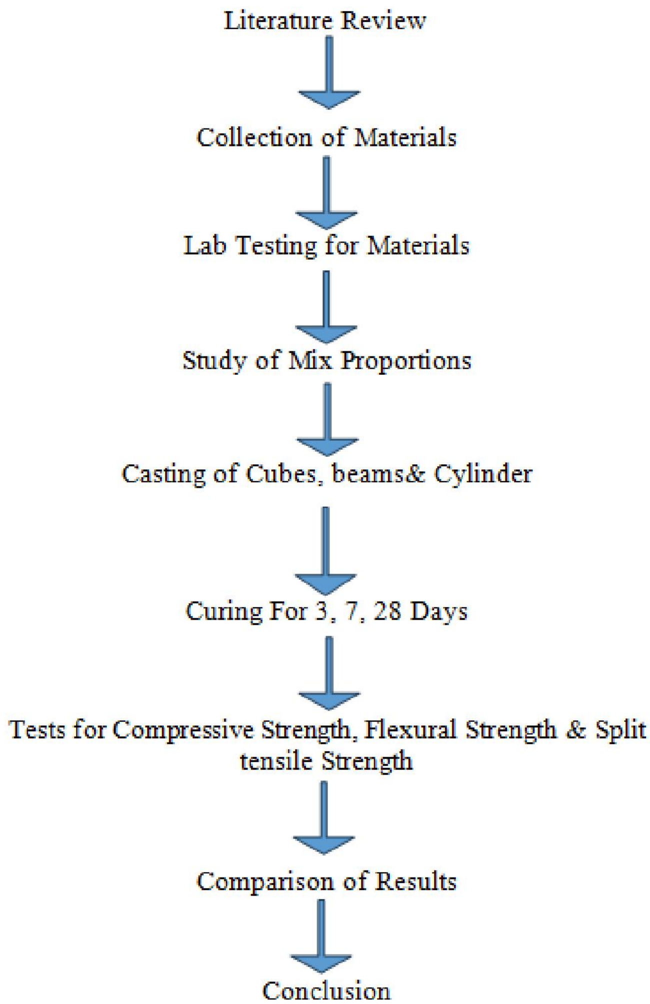
III. EXPERIMENTAL INVESTIGATION

3.1 Flow chart



3.2 Collection of materials: For concrete ingredients are,

- Cement
- Aggregate
  - a. fine aggregate
  - b. coarse aggregate
- Water

Cement:

Cement used was 53 grades ordinary Portland cement confirming IS 12269:1987.

Fine Aggregate:

Fine aggregates used were obtained from a nearby source. The fine aggregate confirming to zone 3 according to IS 383-1970 was used.

Coarse aggregate:

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Crushed stone was used as coarse aggregate. The coarse aggregate according to IS 383-1970 was used. Maximum coarse aggregate size used is 20mm.

Admixtures:
Pine tree = 1 kg

3.3 Process for Preparing Cypress Tree Extract Admixture

Refined Process for Preparing Cypress Tree Extract Admixture

1. Preparation of Raw Material

Source: Bark of the Cypress tree.

Pre-treatment: The bark is cut into very small pieces to increase surface area for effective extraction.

2. Extraction Process

Quantity Used:

1 kg of Cypress bark.

Liters of water.

Boiling Conditions:

The bark is boiled in water for 1.5 hours.

Temperature maintained between 90–100°C.

Extraction Yield:

An average of 700 ml extract per kg of bark is obtained through successive boiling.

3. Filtration and Storage

After boiling, the solution is filtered to remove any residual solid particles.

The resulting Cypress extract is collected and stored under appropriate conditions (cool, dark, airtight) to prevent degradation.

4. Application

This extract can now be further processed or used directly as an admixture in construction materials, herbal formulations, or other relevant products, depending on the intended use.

Fig. 3.3 Preparation of Cypress Tree Extract Admixture

Workability of Concrete Using Slump Cone Test

Table no.1 Slump values

ml of admixture	Slump value
0 ml	75 mm
50 ml (5%)	77 mm

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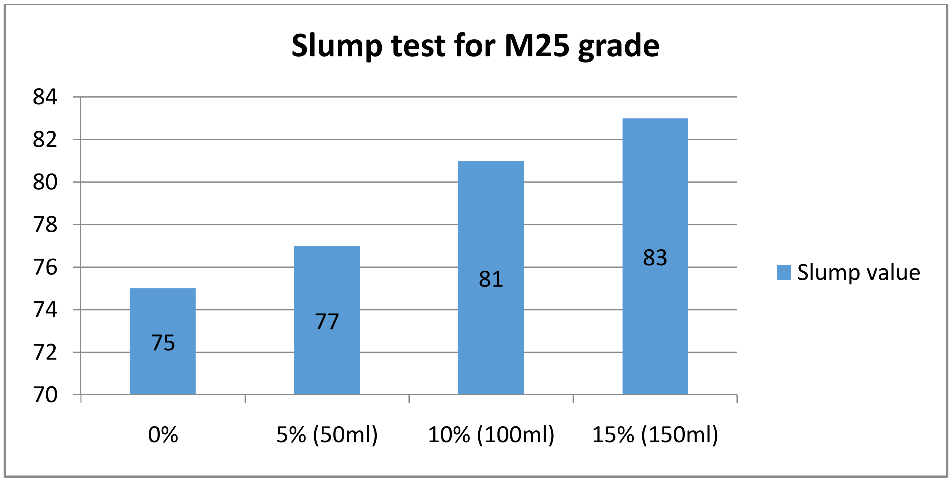
100 ml (10%)	81 mm
150 ml (15%)	83 mm



Graph No.1 Slump Values (mm)

3.5 concrete mix design for m25grade:-

STEP 1: Target strength for mix proportioning from table 9.7.2 IS 10262, 2009 for, M25 the value or S=4N/mm2

F'CK=FCK+1.65xS

=25+1.65x4

=31.60N/mm2

STEP2: Selection of water cement ratio it depends on

1) Expose condition

2) Maximum nominal size of aggregate and

3) Type of concrete (PCC OR RCC)

For moderate exposure condition for RCC work and for maximum nominal size of aggregate 20 mm refer table 9.7.3 or IS 45 maximum water cement ratio 0.5

Based on experience, adopted water cement ratio=0.45

$0.45 < 0.5$ ok

STEP 3: Selection of water content Selection of water content depends on

1) Shape and size of aggregate

2) Slump

For desired workability the required water content is increased by 3% for every additional 25mm slump or alternative admixture is used.

From table 9.7.4 maximum nominal size aggregate or 20mm and for slump 25 to 50mm. Maximum water content=186-liter,desired slump is 75mm;water content is increased by 3% for every 25mm increased in slump.

Required water content

=186+3/100x186

=191.58 liter.

STEP 4: Calculation for cement concrete

Water cement ratio=water content/cement content Cement content=water cement/water cement ratio

=191.58/0.45

=425.73kg/m3

Check for minimum cement content as per IS456:2000.

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Minimum cement content or moderate exposure condition=300kg/m3
425.73 kg/m3>300kg/m3 ok
STEP 5: proportion or volume of course aggregate content from table 9.75 or clause 4.4, volume of course aggregate corresponding to 20mm NMSA and fine aggregate (zone ii) for water cement ratio 0.5 =0.62
a) Correction in water cement ratio standard water treatment ratio=0.5 adopted water cement ratio = 0.45 water cement ratio is lower by 0.05
As water cement ratio is decreased by 0.05, the volume of course aggregate increased by 0.01
Corrected proportion or volume of course aggregate for water cement ratio 0.45= 0.62+0.01= 0.63
Proportion of volume of fine aggregate, =1-0.63=0.37
STEP 6: Mix calculation
The mix proportion per unit volume of concrete shall be follow:
a) Volume of concrete=1m3
b) Volume of Cement (Vc) =mass of cement/mass density of cement
=mc/sc.p =425.73/3.15x1000
=0.135m3
c) Volume of water Vw=mass of water/mass density of water
=mw/swp =191.58/1x1000
=0.1916m3
d) Volume of all in aggregate=a-(b+c)
=1-(0.135+0.196)
=1-0.311
=0.673m3
e) Mass of course aggregate=volume of all in aggregate x proportion volume of course aggregate x mass density of course aggregate.
=0.673x0.63 x (2.65 x1000)
=1124 kg.
f) Mass fine aggregate=volume of all in aggregate x proportion of volume of fine aggregate x mass density of fine aggregate.
=0.673x 0.37 x (2.6x1000)
=647.5 kg
STEP7: Mix proportions for trial number 1per m3concrete.
Cement=425.73 kg
Fine aggregate = 647.5 kg Course aggregate=1124kg
Water cement ratio =0.45
Therefore we adopt the Mix Proportion Taken is C: FA: CA=1:1.52:2.64

IV. EXPERIMENTAL INVESTIGATION

4.1 Compressive Strength of Cubes

The compression test is used to determine the hardness of cubical and cylindrical specimens of concrete. The strength of a concrete specimen depends upon cement, aggregate, bond, water-cement ratio, curing temperature, and the age and size of the specimen.

Mix design is the major factor controlling the strength of concrete. Cubes of size 15 cm x 15 cm x 15 cm (as per IS: 10086-1982) should be cast. The specimen should be given sufficient time for hardening, and then it should be cured for 3, 7, and 28 days.

After 3, 7, and 28 days, it should be loaded in the compression testing machine and tested for maximum load. Compressive strength should be calculated by dividing the maximum load by the cross-sectional area.

Formula:

Compressive Strength (N/mm^2) = Ultimate Load / Cross-sectional Area of Specimen

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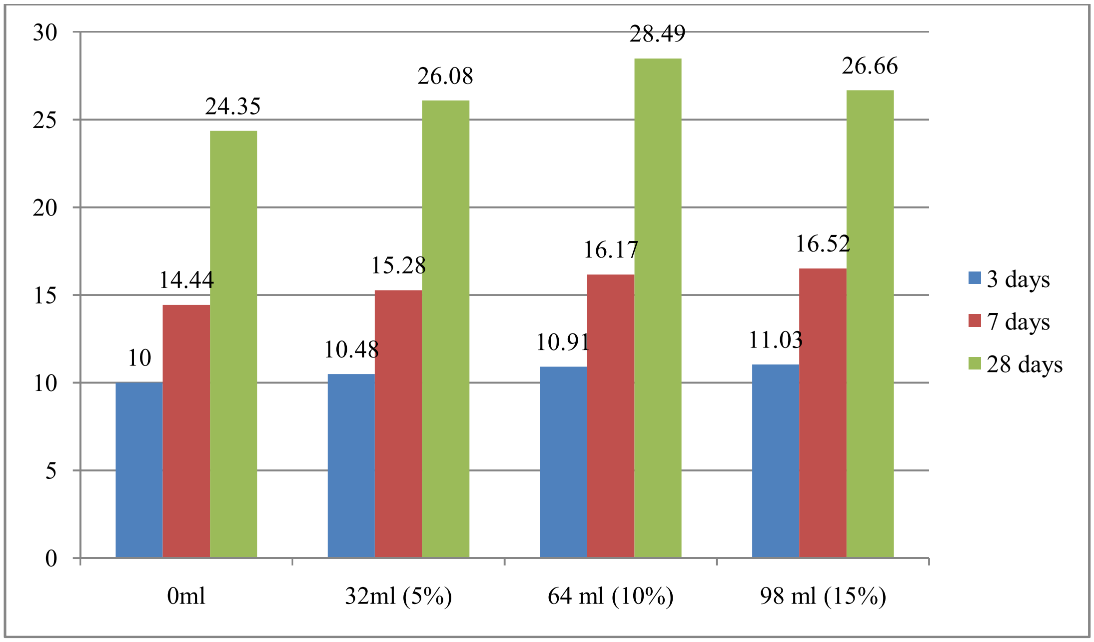
Table 2:-compressive test results at 28 days curing

ml of admixture	3days curing		7days curing		28days curing	
	Load (KN)	Compressive Strength (N/mm²)	Load (KN)	Compressive Strength (N/mm²)	Load (KN)	Compressive Strength (N/mm²)
0ml	225	10	325	14.44	548	24.35
32ml (5%)	236.01	10.48	343.84	15.28	588	26.08
64 ml (10%)	245.84	10.91	364.34	16.17	640.7	28.49
98 ml (15%)	248.22	11.03	372	16.52	600	26.66



Graph No.2 Compressive Strength of Concrete (N/mm2)

4.2 Split Tensile Strength of Cylinders

This test checks how well concrete can resist tension, which is important since concrete is weaker in tension than compression. Standard cylindrical specimens (150 mm × 300 mm) are cast and cured for 3, 7, and 28 days. After curing, the cylinder is placed horizontally in a Compression Testing Machine. Load is applied along the vertical diameter, causing the cylinder to split. The tensile strength is calculated using:

Split Tensile Strength = (2 × Maximum Load) / (π × Diameter × Length)

Table 3:- Split Tensile test results at 28 days curing

ml of admixture	3days curing		7days curing		28days curing	
	Load (KN)	Split Tensile Strength (N/mm²)	Load (KN)	Split Tensile Strength (N/mm²)	Load (KN)	Split Tensile Strength (N/mm²)
0ml	124.40	1.76	149.14	2.11	194.38	2.75
50 ml (5%)	129.35	1.83	129.35	2.23	207	2.92
100 ml (10%)	131.39	1.86	131.39	2.28	216	3
150 ml (15%)	132.10	1.87	132.10	2.29	217.7	3.07

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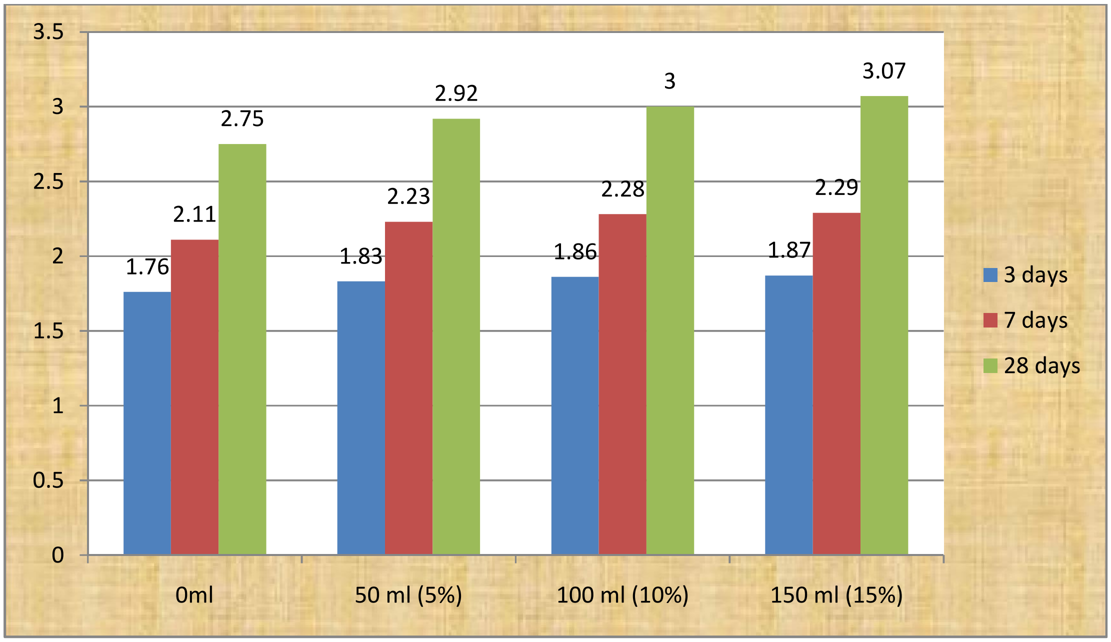

Graph No.3 Split tensile Strength of Concrete (N/mm2)

4.3 Flexural Strength of Concrete Beams

This test measures the bending strength (modulus of rupture) of concrete beams, which is important for slabs, pavements, and beams. Beam specimens (100 mm × 100 mm × 600 mm) are cast and cured for 3, 7, and 28 days. After curing, the beam is placed on rollers 400 mm apart, and load is applied either at the centre or one-third points. The flexural strength is then calculated using standard formulas based on the loading method.

Table 4:- Flexural test results at 28 days curing

ml of admixture	3days curing		7days curing		28days curing	
	Load (KN)	flexural Strength (N/mm²)	Load (KN)	Flexural Strength (N/mm²)	Load (KN)	Flexural Strength (N/mm²)
0ml	7.75	3.10	11.25	4.50	14.50	5.80
48 ml (5%)	8.63	3.45	12.13	4.85	15.50	6.20
96 ml (10%)	9.50	3.80	12.75	5.10	16.63	6.65
144 ml (15%)	4.10	4.10	13.25	5.30	17.50	7

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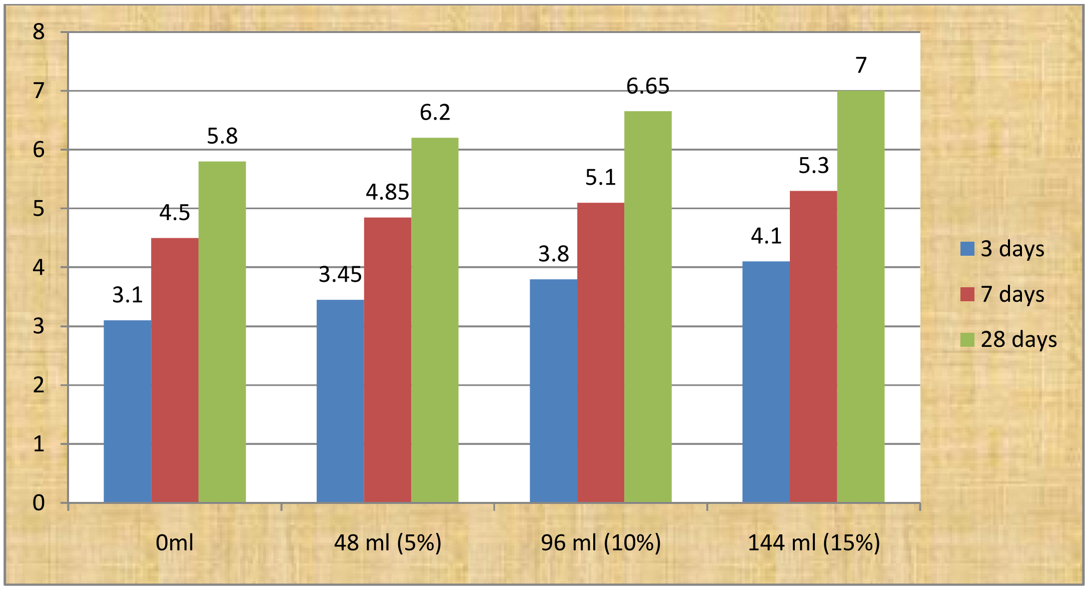

Graph No.4 Flexural Strength of Concrete beam (N/mm2)

V. CONCLUSION

- The addition of cypress plant extract increases the setting time of concrete, making it effective as a retarder, especially in hot climatic conditions.
- The extract enhances the workability of concrete at a constant water-cement ratio, thereby improving the fresh concrete properties without requiring extra water.
- It improves the compressive strength and overall hardened concrete performance when used at a constant slump.
- For M25 grade concrete, the compressive strength increased gradually from 0% to 10% extract dosage. However, at 15% dosage, a decrease in strength was observed — indicating that the optimal dosage is up to 10%.
- For M25 grade concrete, the split tensile and flexural strength increased gradually from 0% to 15% extract dosage. Indicating that the optimal dosage is up to 15%.
- The use of this eco-friendly plant extract reduces the need for chemical admixtures, contributing to sustainable and green construction practices.
- It supports the concept of utilizing biodegradable and renewable resources, promoting environmental conservation and reducing construction's carbon footprint.

REFERENCES

[1]. Anitha Selvasofia, Raj Kannan R., Sivashankaran R., Venkadesh K., Lakshmi Narayanan M. (2017). Utilization of Pervious Concrete in Rainwater Harvesting with Partial Addition of Glass Powder.

[2]. Abraham M. Woldemariam, Walter O. Oyawa, Silvester O. Abuodha, M. Wegmuller, J.P. von der Weid, P. Oberson, N. Gisin (2014). Cypress Tree Extract as an Eco-Friendly Admixture in Concrete.

[3]. M. Vidhya, S. Gobhiga, K. Rubin. Experimental Study on Self-Curing Concrete Using Biomaterials as Admixtures.

[4]. John Githakwa Chege. (2015). Green Plants' Extracts' Potential as Concrete Admixtures. Master's Thesis, Jomo Kenyatta University of Agriculture and Technology.

[5]. Kidist Bedada, Andrew Nyabuto, Ismael Kinoti, Joseph Marangu. (2023). Review on Advances in Bio-based Admixtures for Concrete. Journal of Sustainable Construction Materials and Technologies, 8(4), 344–367.

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[6]. Ambrose E.E., Ogirigbo O.R., Ekop I.E. (2023). Bio-Based Cement Concrete Admixtures for Green Recovery in the Construction Industry. Environmental Science and Pollution Research.

[7]. Li, Y., et al. (2017). Biomaterials-Based Concrete Composites: A Review on Biochar, Cellulose, and Other Natural Additives. Construction and Building Materials, 157, 105–127.

[8]. Hersh F. Mahmood. (2020). Natural Admixture as an Alternative for Chemical Admixture in Concrete Technology: A Review. Research Gate Publication.

[9]. Rafael Zarzuela, Manuel Luna, Luis M. Carrascosa, et al. (2024). Producing C-S-H Gel by Reaction Between Silica Oligomers and Portlandite: A Promising Approach to Repair Cementitious Materials. arXiv preprint arXiv:2401.14118.

[10]. Nationwide Engineering Research & Development (NERD). (2021). Concretene: Graphene-Enhanced Concrete for Sustainable Construction. Developed in collaboration with The University of Manchester's Graphene Engineering Innovation Centre.

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