JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

# CORN STARCH CONCRETE

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***Abstract:*** This research explores the use of corn starch as an admixture in cement concrete, aiming to improve performance and reduce environmental impact. The study evaluates the mechanical properties, workability, and durability of concrete with varying corn starch proportions. The research also explores the environmental implications of using corn starch, highlighting potential reductions in carbon footprint and energy consumption. The findings provide valuable guidance for engineers, researchers, and policymakers in developing eco-friendly concrete formulations.

***Index Terms*** **- Corn Starch, Admixture, Cement Concrete, Workability, Durability, Strength and Eco-friendly**

## I. INTRODUCTION

Cement concrete with corn starch as an admixture is a type of concrete that incorporates corn starch to enhance properties or achieve specific characteristics. Admixtures are utilized in concrete to enhance its properties, impacting both fresh and hardened concrete. Factors such as functional groups, chemical configuration, and molecular weight play a role in influencing these properties. With the growing demand for high strength and durability, research is now focusing on recycled materials and bio-based admixtures such as starch. Starch, an abundant and cost-effective material, has found applications in various industrial sectors, including film-forming agents, super absorbents, adhesives, and drug carriers. Nevertheless, the behavior of polymers in cementitious systems can vary based on different parameters. Research has indicated that cellulose ethers can enhance flow and prevent segregation and bleeding in concrete, whereas corn starch lightweight concrete exhibits improved dispersing stability and minimal flow loss. Further exploration into the role of polysaccharides in the hydrating properties of cementitious systems is essential, as their behavior in such systems remains inadequately understood.

## II. LITERATURE REVIEW

1) **Abalaka A.E et al. (2011):** The study compared the effects of cassava starch and simple sugar on cement mortar and concrete. Results showed that cassava starch had the highest compressive strength at 0.05% after 28 days, with a reduced initial setting time. Sugar, on the other hand, had the highest strength at 0.06% after 28 days, but increased initial setting time.

2) **Akindahunsi A.A et al. (2012):** The study explores the use of corn starch modified concrete as a repair material, focusing on its impact on concrete properties like compressive strength and permeability. The research involves testing samples with varying starch additions, including 0%, 2.5%, and 5% by weight of cement.

3) **Akindehinde Ayotunde Akindahunsic et al. (2013):** Starches and their derivatives have been recognized for their ability to alter the viscosity of concrete, thereby affecting its compressive strength, heat of hydration, and creep. To investigate this influence, concrete mixes were prepared in the laboratory with different weight percentages (0.0, 0.5, 1.0, 1.5, and 2%) of starches added to the cement.

4) **George Rowland Otoko et al. (2014):** This article discusses the use of cassava powder as a admixture to reduce hot weather effects on concrete. High temperatures during hot weather can increase the temperature of fresh concrete, requiring more water and causing it to set faster. However, cassava powder can enhance the concrete's workability and delay its setting time. Laboratory experiments show that cassava powder can prolong setting time, improve workability, and enhance concrete's strength, making it an environmentally-friendly solution.

5) ***Akindahunsi A et al. (2015):*** The study explores the impact of cassava and maize starch on the strength and durability of concrete cubes. The researchers added various proportions of starches to cement, including crushed granites as coarse and fine aggregates. The results showed that the starches delayed the cement setting time, which is beneficial for longer casting times. However, cassava starch reduced slump and increased viscosity compared to maize starch. The addition of both starches improved the concrete's durability, suggesting that these starch admixtures can enhance the overall performance and longevity of concrete structures.

6) **E.A. Lima et al. (2020):** This paper explores the dual nature of Oobleck through the study of Oobleck with video analyses, utilizing both microscopic and macroscopic analysis techniques.

7) **Tanmay Mhatre et al. (2021):** This article examines the development and building process of a contemporary oobleck speed bump utilizing the principles of non-Newtonian fluids. The objective is to minimize vehicle damage and decrease the occurrence of fatal accidents by addressing the limitations of traditional concrete speed breakers. The utilization of oobleck mixture is favored due to its ability to thicken under shear stress, known as dilatant shear thickening properties.

Additionally, an emergency vehicle detection system is incorporated to cater to high-speed vehicles.

## III. DESIGN:

### 3.1. M20 Grade Corn Starch Cement Concrete:

Creating corn starch cement concrete (CSCC) of M20 grade involves formulatinga concrete mixture that meets the desired strength and durability requirements specified by the M20 grade classification. M20 grade concrete typically refers toa concrete mix with a characteristic compressive strength of 20 mega Pascal (MPa) after 28 days of curing.

- Cement: 53 grade of cement.
- Corn Starch: As the primary binder, typically ranging from 0.1% to 5% by weight of the total mix.
- Coarse Aggregates: Use clean and well-graded aggregates such as sand andgravel in appropriate proportions.
- Fine Aggregates: aggregates having size less than 4.75 mm.
- Water: Necessary for hydration and workability of the concrete mixture.

### 3.2 Mixing Procedure:

- Measure the required quantities of corn starch, aggregates, and water according to the desired mix proportions.
- Mix the corn starch with water to form a slurry or paste, ensuring thoroughdispersion and uniform consistency.
- Mix the ingredients thoroughly until a uniform and workable concrete mixture is obtained. Adjust the water content as needed to achieve the desired consistency and workability.
- Once the concrete mix is prepared, it can be poured, placed, and compactedinto moulds or formwork for casting into desired shapes and structures.


**Figure No: 1, "Ingredients of corn starch concrete"**

### 3.3. Curing and Testing:

After casting, corn starch cement concrete should cure under specific conditions,typically moist, for 7 to 28 days to achieve desired strength. Compressive strengthtests on cured concrete samples using standard procedures are conducted to verifycompliance with M20 grade requirements.

## IV. ANALYSIS:

In the examination of M20 grade of concrete, tests were conducted for the following:

1. Test for initial setting time
2. Slump cone test
3. Compaction factor test
4. Compressive strength test.

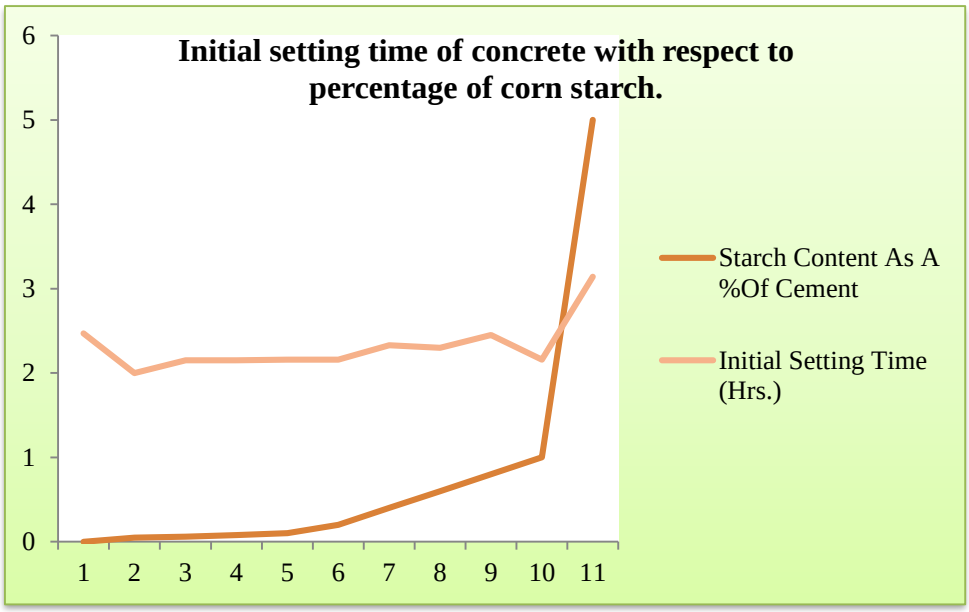


**Figure No: 2, "Initial setting time of concrete with respect to percentage of corn starch"**

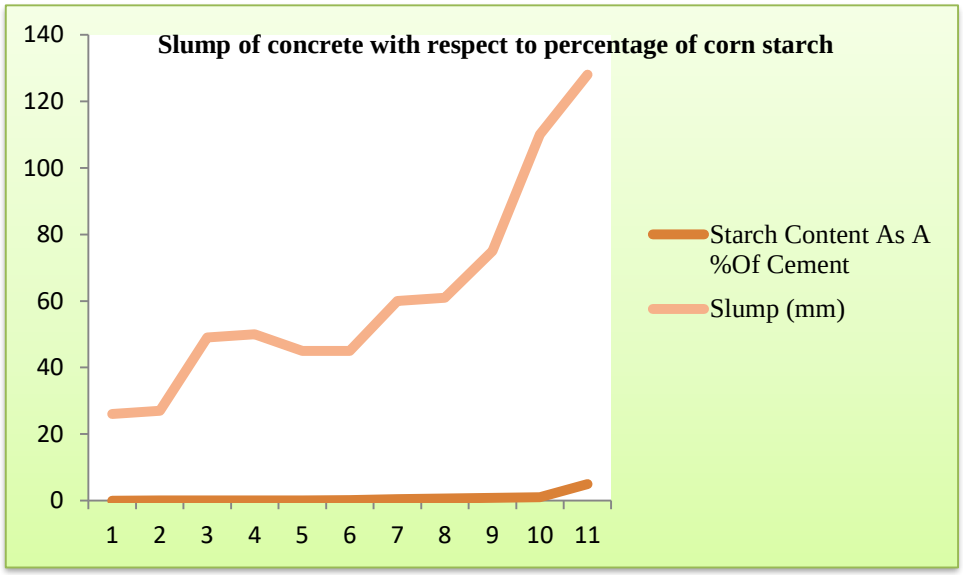


**Figure No: 3, "Slump of concrete with respect to percentage of corn starch."**

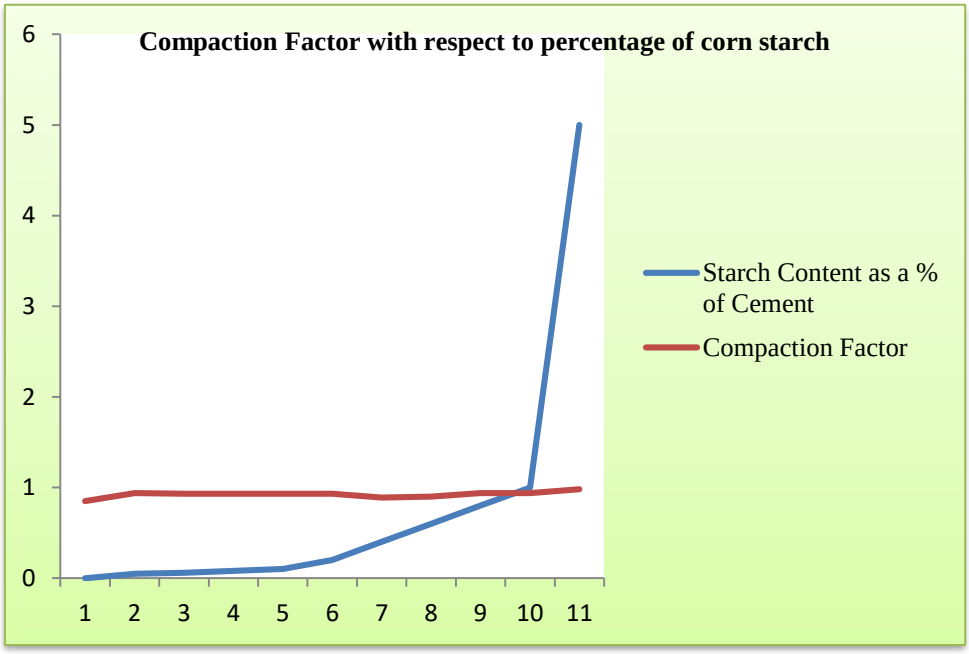


**Figure No: 4, "Compaction Factor with respect to percentage of corn starch"**

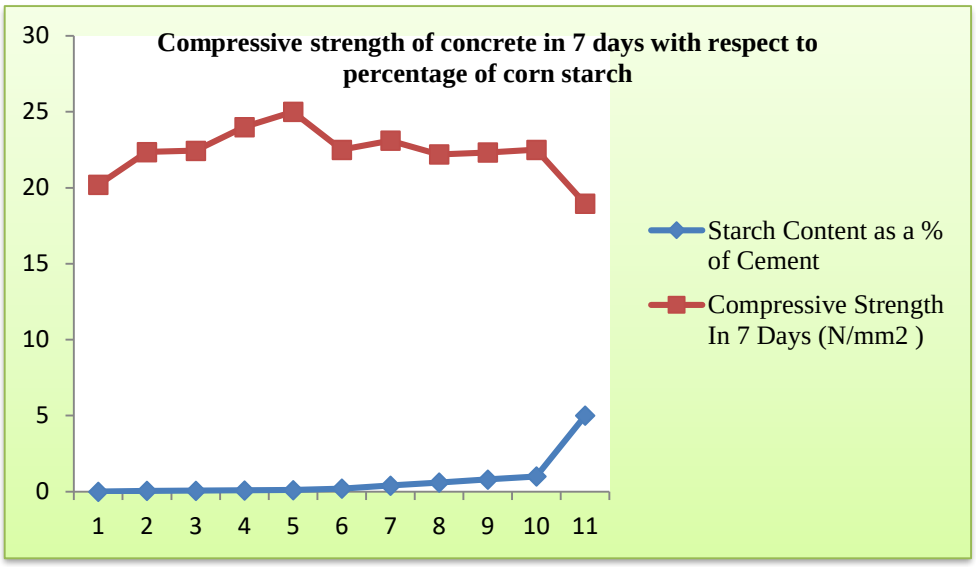


**Figure No: 5, "Compressive strength of concrete in 7 days (N/mm$^2$ ) with respect topercentage of corn starch"**

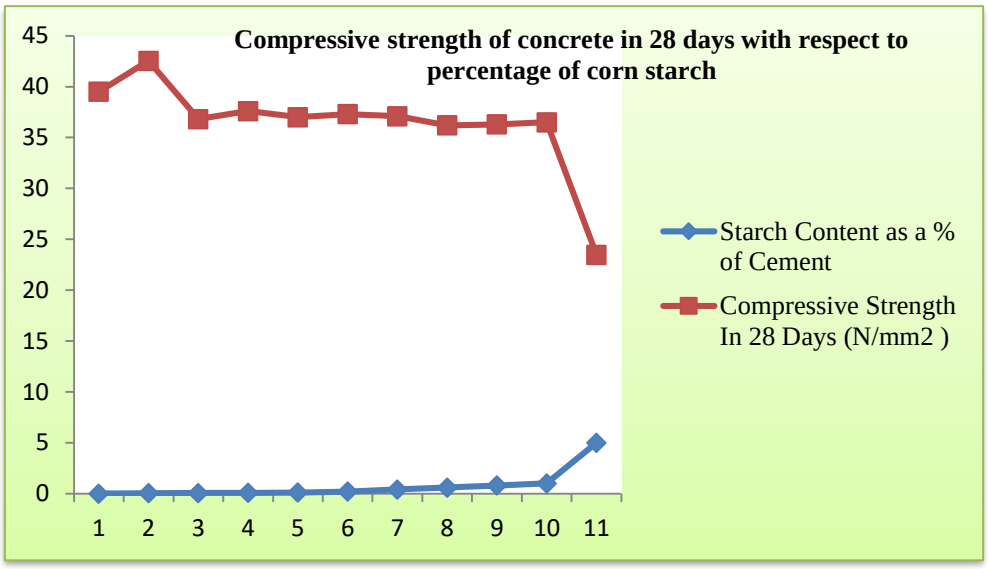


**Figure No: 6, "Compressive strength of concrete in 28 days (N/mm$^2$) with respect topercentage of corn starch"**

## V. RESULT:

- The minimum initial setting time is 2 hours when 0.05% of starch is added to cement, while the initial setting time is 3.14 hours when 5% of starch is added.
- Addition of 1 % corn starch to cement concrete increases compressive strength.
- After 28 days of curing, the compressive strength of corn starch cement concrete is 36.50 N/mm$^2$
- 1 % corn starch provides a slump of 110 mm, suitable for column, beam, and slab casting.
- Corn starch act as a water reducer, helping to decrease the water content ofthe concrete mix while maintaining workability. This can improve the strength and durability of the concrete by reducing porosity and increasing density.
- Corn starch can also influence the setting time of concrete. By adjusting the amount of corn starch added to the mix, it may be possible to control the rate at which the concrete sets and hardens

## VI. CONCLUSION:

- Water Reduction: Corn starch acts as a water-reducing agent in concretemixes, improving strength and durability.
- Improved Workability: Acts as a lubricating agent, facilitating easierplacement and compaction of concrete.
- Reduced Permeability: Helps reduce concrete's permeability, improvingresistance to water penetration and durability.
- Enhanced Adhesion: Improves bonding between cement paste andaggregates, reducing segregation or bleeding during placement and curing.
- Environmental Benefits: Renewable and biodegradable, supporting sustainable construction practices.
- Cost-Effectiveness: Cost-effective compared to commercial admixtures.
- Non-Toxicity: Non-toxic and safe to handle, minimizing health and safety concerns.

## REFERENCE:


1) Khayat K.H, "Viscosity-Enhancing Admixtures for Cement-Based Materials and Overview of Cement & Concrete Composites", 171–188 (1998).
2) C.F. Ferraris, L.Brower, C. Ozyildirim, J. Daczko, "Workability of Self- Compacting Concrete", PCI/FHWA/FIB International Symposium on High Performance Concrete, pp. 25-27, (Sep. 2000).
3) Chung, D. D. L, "Review Use of Polymers for Cement-Based Structural Materials". Journal of Materials Science, 39, 2973–2978, (2004).
4) Xing G, Zhang S, Ju B and Yang J, "Microwave-Assisted Synthesis of Starch Maleate by Dry Method", Starch/Strake, Vol.58, pp. 461-467,(2006).
5) B. Felekoğlu, S. Türkel, B. Baradan, "Effect of Water/Cement Ratio on theFresh and Hardened Properties of Self-Compacting Concrete", Building and Environment, vol. 42, pp. 1795–1802, (2007).
6) Okafor F O, "The Potentials Of Cassava Flour As A Set- Retarding Admixture In Concrete", Nigerian Journal of Technology, Vol. 27, No. 1,pp. 5-11, (2008).
7) Baroghel Bouny, Nguyen T. Q., & Dangla P, "Assessment and Predictionof RC Structure Service Life Bemeans of Durability Indicators and Physical/Chemical Models of Cement & Concrete Composites", 31, 522–534, (2009).
8) Folic R, "Durability Design of Concrete Structures" Part1: Analysis fundamentals. Architecture and Civil Engineering, 7(1), 1–18, (2009).
9) Elahi A, Basheer P. A. M, Nanukuttan S. V & Khan Q.U. Z, "Mechanical And Durability Properties Of High-Performance Concretes Containing Supplementary Cementitious Materials", Construction and Building Materials, 24,292–299, (2010).
10) Abalaka A E, "Comparative Effects of Cassava Starch and Simple Sugar in Cement Mortar and Concrete", ATBU Journal of Environmental Technology, Vol. 4, No. 1, pp. 13-22, (2011).
11) Akindahunsi A A, Uzoegbo H C and Iyuke SE, "Use of Starch Modified Concrete as a Repair Material", In Proceedings of the3rd International Conference on Concrete Repair, Rehabilitation and Retrofitting, Cape Town, South Africa, (2012).
12) D. Singh, S.P. Singh, R. Khan, S. Kumar, "Workability of Self CompactingConcrete Containing Rice Husk Ash", UKIERI Concrete Congress - Innovations in Concrete Construction, pp. 196-200, (2013).
13) Akindehinde Ayotunde Akindahunsi, Wolfram Schmidt, Herbert C Uzoegbo and Sunny E Iyuke, "The Influence of Starches on Some Properties of Concrete", (2013).
14) George Rowland Otoko, "Minimising Hot Weather Effects On Fresh AndHardened Concrete By Use Of Cassava Powder As Admixture", EuropeanInternational Journal of Science and Technology, Vol. 3, No. 2, pp. 1-8, (2014).
15) Akindahunsi A and Uzoegbo H C, "Strength and Durability Properties of Concrete with Starch Admixture", International Journal of Concrete Structure sand Materials, July (2015).
16) E.A. Lima, R.S. Dutra, P.V.S. Souza, "Study Of Oobleck With Video Analysis", March (2020).
17) Tanmay Mhatre, Sumit Maji, "NON-NEWTONIAN FLUID SPEED BUMP" (IRJET) Volume: 08 Issue: 07, July (2021).