

# Influence of Urea on Concrete

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## ABSTRACT

This research represents an experimental study on influence of urea on concrete through various tests on urea, cement, concrete and water. Test of finesses modulus, slump test, carbonation test, pH test, urea ingress test and increase in strength with urea percentage. This study deals to overcome three major problems in the concrete namely heat of hydration, permeability, and corrosion of steel bar embedded in concrete. Urea can generally reduce the temperature of concrete both at casting phase and during the procedure of hydration. Urea does not opposite effect the durability of reinforced concrete, except where there is an accumulation of urea crystal growth.

**Keywords:** carbonation test, slump test, compressive strength test and urea

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## I. INTRODUCTION:

This study deals with two major problems in concrete namely corrosion and setting time improvement. The Study give information of their chemical and physical interactions which have a significant effect on the durability and hence on the service life of the concrete. Many structures deteriorated much before the stipulated time causing a lot of financial damage and public inconvenience; High strength concrete may or may not be high-performance material.

Durability is thus attracting more and more world attention and is becoming more important. Causes of concrete deterioration such as the influence of pollution, alkali-silica reaction, freezing and thawing, design errors, miscalculations, and bad workmanship are discussed in this paper. Some case studies are also illustrated. The reduction of concrete thermal crack using endothermic property of Urea has been reported. In these studies, various physical performance tests of Urea mixed concrete.

Namely Reduction of concrete hydration of heat, reduction of drying shrinkage and recovery of Compressive Strength on 28th day was performed. However, there is no interpretive study for the Urea mixed concrete.

Compressive test of Urea mixed concrete using substitution mixing method are progressed like previous researches

MATERIAL	MEANING
P	0% urea mixed with concrete by weight ratio of cement
UX	X% urea mixed with concrete by weight ratio of cement

Table1 meaning of P and UX

## II. EXPERIMENTAL WORK

### A. Overview

Compressive strength test, fineness modulus, specific gravity, carbonation test, urea ingress test, pH test, slump test of urea mixed concrete using substitution mixing method were carried out. The meaning of p and UX are shown in table -1. urea was mixed with concrete by weight ratio of cement 3%, 5%, 7% and 10%. When urea is mixed into concrete volume of cement increase therefore volume of mixing cement was reduced by the volume of urea.

### B. Materials used

**CEMENT:** - Portland Pozzolana cement of Jaypee brand is used for the experiment. It is tested for its physical properties in accordance with Indian Standard

- (i) Normal Consistency: 33%
- (ii) Setting Times: Initial Setting Time: 85 minutes and Final Setting Time: 485 minutes
- (iii) 28-day Compressive Strength: 48 MPa
- (iv) Fineness: 1 gm. retained in 90 micron sieve

**WATER:** - Ordinary tap water is used for concrete mixing in all the mix.

**FINE AGGREGATE:** - The fine aggregate passing through 4.75 mm sieve is used. The grading zone of fine Aggregate is zone III as per Indian Standard specifications.

**COARSE AGGREGATE:** - Two grades of coarse aggregates are used one retained on 10 mm size sieve and the other grade contained aggregates retained on 20 mm sieve. Both the grades of coarse aggregates had equal weightage.

**SAND:**-Sand used because it easily available in my site.

**C. Experimental Method**

**1. INITIAL AND FINAL SETTING TIME TEST**

initial setting time is consider as the time passes middle of the water is adding in the cement, to the time at paste begins lose its plasticity and the final setting time is the time passes middle of the water is adding in the cement, also the time when the paste has wholly lose its plasticity also has attain the enough firmness to hold out some exact pressure. we use Vicat's tools for the reason that it lie an arranging to control the plunger of 10 mm diameter in addition of two other needles that are manufacture to without controlled drop into a container filled in addition of the cement paste also the quantity of penetration of the needles of plunder may be note down through using the vertical gradation from 0 mm to 50 mm.



**Fig.1 Vicat's apparatus**

**2. SPECIFIC GRAVITY TEST OF FINE AGGREGATE (IS: 2386 (Part- III) - 1963)**

Specific gravity  $G_s$  is the proportion of the weight of an already stated volume of soil at already stated temperature to the weight of a same volume of condensed waters at that temperature one as well as other weights existing in air. It's used in design and estimation the concrete mixes. Specific gravity of the fine Aggregates is 2.61. Figure 2 show specific gravity of fine aggregate by pycnometer



**Fig.2 testing by pycnometer**

**3. Compressive strength test of urea mixed concrete**

Compressive strength test of ordinary concrete and urea mixed concrete Specimens are made and tested according to IS 516 (1959) while IS 10262 is used for concrete mix design. Curing of specimens was done in water maintained at a temperature of  $27 \pm 2^\circ$  Compressive strength of urea on concrete at different proportion like 3%, 5%, 7% and 10%. Figure3 shows compressive strength.



**Fig.3 Compressive Strength**

**4. Slump test of urea mixed concrete**

Slump test is the most commonly used method of measuring the consistency of concrete which can be employed either in the laboratory or in the field. It is used conveniently as a control test and gives an indication of the uniformity of the concrete from batch to batch. Figure4. Show slump test working.



**Fig.4 Slump Test**

**5. carbonation test of urea mixed concrete**

This test is carried out to determine the depth of concrete affected due to combined attract of atmospheric carbon dioxide and moisture causing a reduction in the level of alkalinity of concrete at different amount of urea 3%,5%,7% and 10%. Figure 5 show carbonation test material.



**Fig.5 Phenolphthalein**

**6. UREA INGRESSION TEST**

This test is determine the concentration in gram per cubic meter of urea ingresses in various mixes of cement concrete by measuring the concentration of urea in crushed concrete solution. Figure 6 shows different percentage of urea mixed water.



**Fig.6 Different % of Urea mixed water**

**7. PH TEST**

It is determined through an instrument by electrolysis and dissociation of H+ and OH- radical, and the millivolts generated give on the scale either by movement of an analog pointer or digital recording. Known pH value is a too necessary parameter for the examination of concretes also its treatment. Certain chemicals and biological actions act except that at a special ph.

**III. RESULTS**

**1. INITIAL AND FINAL SETTING TIME TEST**

Initial setting and final setting time of U30 and with 30 kg/m<sup>3</sup> of urea is detain for 155 minutes and 185 minutes compared to plain mixture , resp. Initial setting and final time of setting mixtures U60 with 60kg/m<sup>3</sup> of urea are detain for close to 9 hours and 11 hours compared to plain mixture , respectively.

**2. SPECIFIC GRAVITY TEST OF FINE AGGREGATE (IS: 2386 (Part- III) - 1963)**

The Specific gravity of a soil is finding the relation among of air, solid and water in a considering volume of soil.

S. No.	Determination the specific gravity	Reading (gm.)
1	Pycnometer weight = $W_1$ gm	585
2	pycnometer weight + dry soil = $W_2$ gm	985
3	Pycnometer weight + dry soil + water = $W_3$ gm	1741
4	pycnometer weight + water = $W_4$ gm	1494
5	Specific gravity by formula $G_s = \frac{W_3 - W_2}{(W_3 - W_1) - (W_4 - W_1)}$	2.61

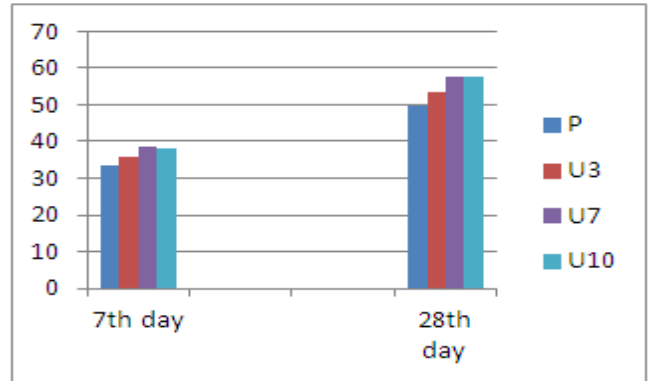
**Table2 Readings of Pycnometer test**

Result- the Specific gravity of Fine aggregate = 2.61.

**3. compressive strength of urea mixed concrete**

Day /U%	7 <sup>th</sup> day	28 <sup>th</sup> day
U0	33.45	49.76
U3	36.02	53.67
U5	37.44	55.36
U7	38.66	57.8
U10	38.06	57.7

**Table3. Result of compressive strength test of concrete of M40grade in MPa**

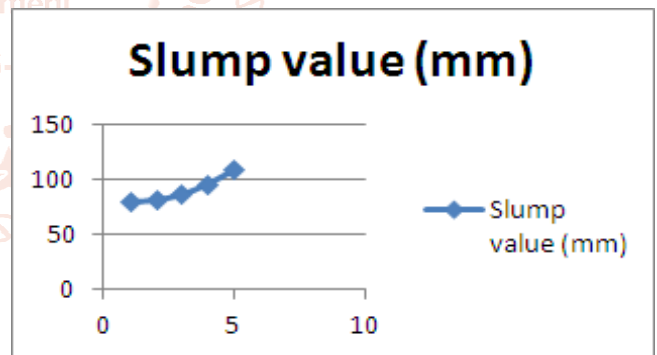


**Graph1 Test of urea mixed concrete at different curing condition**

**4. Slump value of urea mixed concrete**

Division	Slump value(mm)	Water	Urea
P	80	166	----
U3	82	166	9.93
U5	87	166	16.55
U7	94	166	23.17
U10	110	166	33.1

**Table4 Result of slump value**



**Graph2 slump values at different urea amount**

**5. Carbonation test of urea mixed concrete**



**Fig7 Result of carbonation test**

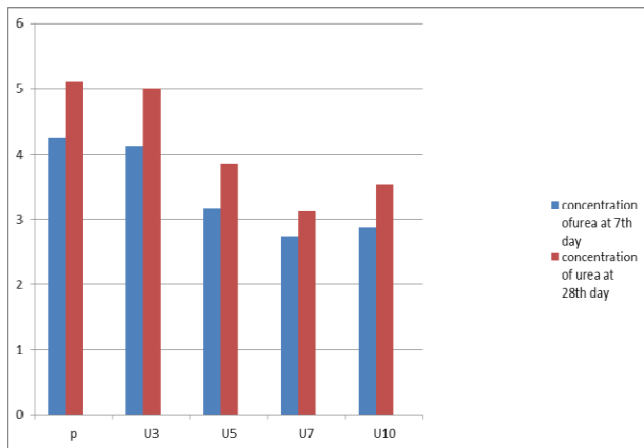


**6. UREA INGRESSION**

As the percentage of Urea increases, the ingressed urea decreases due to decrease in volume of voids

s. no.	7 <sup>th</sup> day concentration	28 <sup>th</sup> day concentration
P	4.244	5.112
U3	4.110	5.003
U5	3.165	3.843
U7	2.738	3.115
U10	2.880	3.543

**Table5 Concentration of Urea**



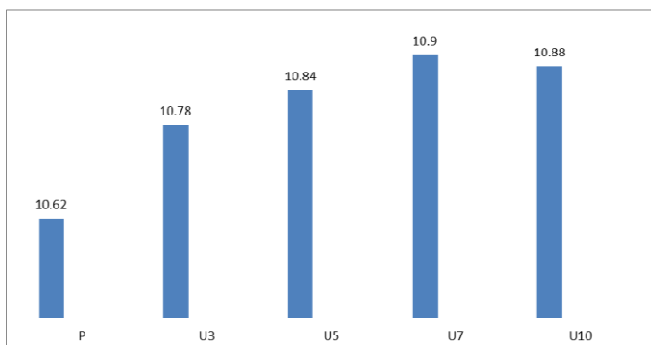
**Graph3 Urea Ingression in Kg/m³**

**7. PH TEST OF TEST SAMPLE**

As the concentration of urea rise the value of PH also rise inside the concrete which takes a longer time to come down as the carbonation of concrete takes place. So, more the concentration of urea inside the concrete lesser will be the chance of carbonation.

s. no.	Description of sample	PH meter value
1	P	10.625
2	U3	10.78
3	U5	10.84
4	U7	10.90
5	U10	10.88

**Table6 Result of PH test**



**Graph4 PH Value of urea & water solution**

**IV. CONCLUSION**

1. This experiment shows an increase in strength of concrete cubes in 28 days by 7.85% in U3, 12.78% in U5, 16.157% in U7 and 15.95% in U10 under mix with urea.
2. Change in color of concrete show that the PH of concrete is out of range of phenolphthalein indicator that PH of concrete is greater than 10. Concrete samples shows that there is not any sign of carbonation in test samples.
3. As the concentration of urea increases the value of PH increases inside the concrete which takes a longer time to come down as the carbonation of concrete takes place. So, more the concentration of urea inside the concrete lesser will be the chance of carbonation.
4. As the percentage of Urea increases, the ingressed urea decreases due to decrease in volume of voids
5. Slump value show urea makes concrete more workable.

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