

# Study on mechanical properties of self healing concrete by using Ethylene Di\_Amine

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**Abstract—** Crack formation is very common phenomenon in concrete structure which allows the water and different type of chemical into the concrete through the cracks and decrease their durability, strength and which also affect the reinforcement when it comes in contact with water, co2 and other chemicals. For repairing the cracks developed in the concrete, it requires regular maintenance and special type of treatment which will be very expensive. So, to overcome from this problem autonomous self-healing mechanism is introduced in the concrete which helps to repair the cracks by using ethylene di-amine which block the micro cracks and pore in the concrete and also act as a curing agent. The concrete is laid for curing and after the curing process when the cracks develop in the concrete, the healing agent is released. The released healing agent that gets reacts with the concrete and releases the calcium carbonate when it is contact with atmospheric air. When calcium carbonate decreased, the bonding strength of the concrete increased. The EDA regain its strength upto 79%-97%. The main objective of the project is to observe the influence of Self Healing agents in the hydration process of concrete.

**Keywords—**Ethylene di-amine (EDA), Self healing agent, calcium carbonate, strength

## 1. INTRODUCTION

Concrete is very good material to resist the compressive load to a limit but if the load applied on the concrete is more than their limit of resisting load, it causes the strength reduction of concrete by producing the cracks in the concrete and the treatment

of the cracks in very expensive. Some of the property like durability, permeability, ad strength of the concrete structure is also decreases. Doe to increase in the permeability of the concrete the water easily pass through the concrete and come in the contact with the reinforcement of the concrete structure and after some time corrosion start due to this strength of the concrete structure will decreases so it will be necessary to repair the cracks[1]. By introduce the chemical in concrete it producing calcium carbonate crystals which block the micro cracks and pores in the concrete[2]. In concrete micro cracks are always avoiding but to some extent they are responsible to their failure in strength.

## OBJECTIVE

- To fill the cracks with the help of Ethylene di-Amine(by adding various % of Ethylene Di-Amine).
- To improve the mechanical properties such as compressive strength and split tensile strength of self healing concrete by Ethylene Di-Amine.

## 2. Preliminary Test on Materials



**Fig 2.1 Ethylene Di- Amine**

Table 2.1 Properties Of Ethylene Di\_Amine

S.No	COMPOSITION	ETHYLENE DI AMINE
1	Chemical Formula	C2H8N2
2	M	60.10g/ml
3	Assay	≥ 99%
4	Density	0.896 to 0.898
5	water	≤ 1%

2.2 properties of material

S.No	NAME OF THE MATERIAL	PROPERTIES OF MATERIAL	RESULT
1	Opc 53 grade	Specific Gravity	3.15
		Fineness modulus	3.6%
		Consistency	32%
		Initial setting time	30 min
		Final Setting time	10 hrs
2	Fine Aggregate	Specific Gravity	2.74
		Water Absorption	0.85
		Fineness modulus	3.33
		Bulk density a) loose state	1661.614 kg/m <sup>3</sup>
		b) rodded state	1843.09 kg/m <sup>3</sup>
3	Coarse Aggregate	Specific Gravity	2.74
		Fineness modulus	0.56%
		Water Absorption	84
		Bulk density a) loose state	1553.464 kg/m <sup>3</sup>
		b) rodded state	1693.15 kg/m <sup>3</sup>
		Impact test	15%

Table 2.2: Properties of material

3. MIX DESIGN

Proportion:

Cement = 1

F.A = 0.913

C.A = 2.61

Water = 0.45

Therefore ratio = 1 : 0.913 : 2.61

4. MECHANICAL PROPERTIES OF SELF HEALING CONCRETE

4.1 COMPRESSION TEST

Table 4.1 Compressive strength test of concrete

S.NO	TYPE OF SPECIMEN	COMPRESSIVE STRENGTH (Mpa)		
		7 <sup>th</sup> day	14 <sup>th</sup> day	28 <sup>th</sup> day
1	Control	14.6	17.65	24.44
2	0.5% of ethylene di-amine	15.56	21.22	26.33
3	1% of ethylene di-amine	16.89	23.45	29.11
4	1.5% of ethylene di-amine	19.56	26.01	30.89
5	2% of ethylene di-amine	22.22	28.67	32.55

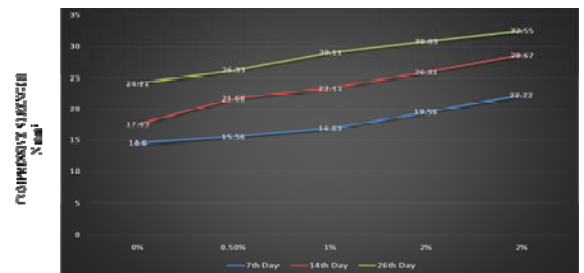
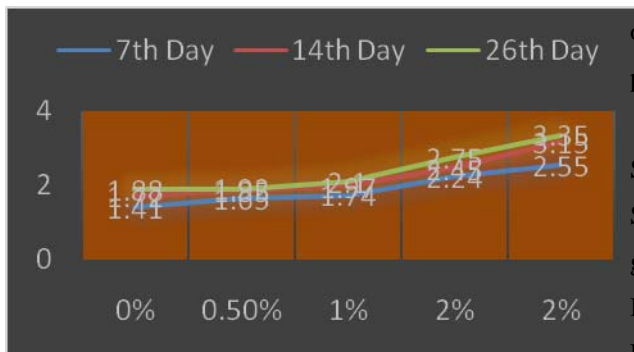


Figure 4.2: Compressive strength of comparison of various % of Ethylene Di Amine

**4.2 Split tensile strength**

**Table 4.2** Split Tensile strength test of Concrete

S.NO	TYPE OF SPECIMEN	SPLIT TENSILE STRENGTH (Mpa)		
		7 <sup>th</sup> day	14 <sup>th</sup> day	28 <sup>th</sup> day
1	Control	1.41	1.72	1.88
2	0.5% of ethylene di amine	1.65	1.85	1.92
3	1% of ethylene di amine	1.74	1.97	2.10
4	1.5% of ethylene di amine	2.24	2.45	2.75
5	2% of ethylene di amine	2.55	3.15	3.35



**Figure 4.2:** Split tensile strength comparison of various % of Ethylene Di Amine

**5.Result and discussion**

The basic properties of materials were tested and tabulated the results. In this project used two admixtures is healing agent. The casted cylinder and cube were tested and then the mechanical Properties were found out, such as compressive strength and split tensile strength on various self-healing concrete mixes with ethylene di amine (0.5%, 1%, 1.5%, 2%) at 7, 14 and 28 days. In this project, the test results show that

**6.Conclusion**

SEM Analysis shows that, the increase in the EDA solution that increases the smoothness of the structure. Compression Test shows that it regains its strength from 79% to 97% after the healing of concrete.

- From the compressive strength of the cube & cylinder regains its strength upto 96.88% to 79.9% for sample
- From the compressive strength of the cube & cylinder regains its strength upto 89.92% to 71.8% for sample2.
- From the compressive strength of the cube & cylinder regains its strength upto 79.12% to 63.88% for sample 3.

**7.References**

Tae - Ho Ahn & Toshiharu Kishi., “Crack Self-healing Behavior of Cementitious Composites Incorporating Various Mineral Admixtures”. , Journal of Advanced Concrete Technology, 2010, vol 8, pp171-186

2. SNIL.S, PRATAP REDDY, SESHAGIRI.M.V, RAO, APARNA.P AND SASIKALA.CH Feb 2010, “Performance of ordinary grade bacterial (Bacillus subtilis) concrete” International journal of Earth Sciences and Engineering vol.03, NO. 01.

3. Yang Ying-Zi et al, “Self healing of engineered cementitious composites under cyclic wetting and drying”. , Durability of Reinforcing Concrete under Combined Mechanical and Climatic Loads, 2005, pp231-242

4. Wenhui Zhong, wu Yao. “Influence of damage degree on Self-Healing Concrete”. , Construction and Building Materials, 2008, 22, pp1137-1142

5. Pipat Termkhajornkit et al., “Self healing ability of fly ash cement system”. , Construction and Building Materials, 2009, 31, pp195-203

6. Zhengxian Yang et al., “A self healing cementitious composite using oil core/silica gel shell microcapsules”. , Cement & Concrete Composites, 2011, 33, pp506-512

7. Michelle M et al., “Self healing concrete with a micro capsulated healing agent”.

8. K.Sisomphon et al., “Self healing of surface cracks in mortars with expansive additives and crystalline additives”. , Construction and Building Materials, 2012, 34, pp566-574

9. Min Wu et al., “Self healing in cementitious materials and engineered cementitious composite as a self healing material”., Construction and building Materials,2012,28,pp571-583

10. IS 10262-2009 “Is Method of Mix Design”, Bureau of Indian Standards, New Delhi.

11. IS 383: 1970 “Specification for coarse and fine aggregates from natural source for concrete”.