Addition of Disinfectants (IZAL) and its Effects on the Strength of Concrete

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IZAL is a trade mark of a disinfectant used in homes and public building for cleaning and washing. IZAL is used as a disinfectant both in the homes and hospitals. It is splashed on concrete walls and floors of which the homes and hospital are made. It is also washed down the streams from where water for mixing concrete is gotten. The effects of the addition of IZAL on the strength of concrete were tested. For each percentage addition of the IZAL, three (3), seven (7), fourteen (14), twenty-one (21), and twenty-eight (28) days strength were recorded. The addition of this domestic alkaline product reduced the strength of concrete 96% to as low as 1.5 N/mm^2 for 1% addition of IZAL. The strength of concrete was reduced by 38% to 22 N/mm^2 when the concrete was cured in 1% solution of IZAL. When it was soaked for thirty days in 1% solution of IZAL its strength reduced by 30% to 24.89 N/mm^2. The paper concluded that there is significant effect of IZAL on the strength of concrete. Precautions should be taken when using the disinfectant on our buildings. Also, direction for use should be strictly adhere to so as to avoid excessive accumulation of IZAL on concrete building,

Keywords: Concrete, Disinfectant. Strength,

Introduction

Izal is a germicidal disinfectant made from oil that was patented in 1893. This product can be available in liquid form, powdery form and as soap, cream, or oil. Izal contain about 0.2% of phenol and 0.7% of 0 – phynyl-phenol. Phenol has an aromatic ring with an OH group. Phenol is a caustic poisonous crystalline acidic compound C_6H_5OH present in coal tar and wood tar that in dilute solution is used as disinfectant Thompson (2002).

IZAL is extensively used in the homes and hospitals for mainly hygienic activities. In the homes and hospitals IZAL is also splashed and dropped on concrete floors and walls. After washing and disinfection these chemicals are washed down into streams and river courses. In most parts of this country concrete is mixed with water from streams, rivers, and even sea water. This makes the interaction of concrete with these chemicals inevitable. These chemicals affect the properties and functionality of the concrete components on contamination with the water of which the concrete is mixed or when the chemicals come in contact with already made concrete member (Moskovin, 1983).

In this research, the effects of IZAL to the strength of concrete were considered. Izal is a popular domestic antimicrobial product that is applied on object and water to kill harmful microorganisms. It has the capability of destroying pathogenic bacteria thereby offering near complete sterilization to the home (Rao & Sittig, 2000). Apart from being toxic to human, it has shown to be corrosive on household metal and wooden products especially when used in excess (Ropke, 1982). Most of these activities on surfaces like walls or floor surfaces could be injurious to concrete. Protecting the walls and its components from these surface actions could be a worthwhile venture.

Izal was found to be alkaline in nature as it had PH value of above seven. That means it contains alkali and large quantity of alkaline salt may be injurious to concrete. Ordinary laundry soap and some locally made soap which contain sufficient free alkali have shown to adversely affect the surface of building walls and floors when used in wall and floor mopping (Zundahl, 1998).

Concrete is one of the most important materials in construction. It is made up of four main components. These are cement, coarse aggregate, fine aggregate and water. Other materials in the form of admixture may be added into concrete mix in production depending on the use and situation to which the concrete will be subjected (Neville, 1996). Apart from steel, concrete has no other rival as a construction material. It is used in construction alone as mass concrete, with steel rods as reinforced concrete, in combination with metal components as composite construction and compressed together as prestressed concrete. In these various forms concrete can be used in the fabrication of almost all the components of a structure. According to Neil and Dhir (1996), concrete could be used for production of beams, columns, slabs, staircases, roofs, retaining walls, shear walls, dams and even the pavement of highways. This shows how versatile the use of concrete is in construction works.

Concrete is said to stand mainly the compressive strength. Shetty (1999) study has been shown that to some extent and depending on the quality of the concrete it can also stand some extent of tensile or flexural strength. Strength is the most important of the properties of concrete, especially the compressive strength which is also used in some cases as a measure of tensile strength of concrete. Neville and Brooks (1987) asserted that a measure of the strength of concrete tends to give information relating to the other characteristics of concrete. Hence, the effect of IZAL on strength of concrete is tested when it is in contact with.

Methods and Materials

IZAL was added to the concrete mix. This was separately added in different percentages to the concrete mix before the mixes were moulded.

Before this, the concrete was mixed without the addition of IZAL, moulded in cubes. The laboratory tests were done in four stages. The mix of concrete for the experiment was at ratio of 1: 2: 4 with a water cement ratio of 0.6 as specified in BS 8110. Before the tests commenced, the chemical constituents of the IZAL were found and the acidic status of IZAL was determined (see Table 10). This was done by determining the $_{P}$H value of the IZAL. The first part of the test was the control test in which concrete was mixed without IZAL (see Table 3). Second part, IZAL was added to the concrete mix at various percentages before the concrete was moulded into cubes (see Tables 1 and 3). About a hundred cubes of concrete were produced using a water cement ratio of 0.6 as specified in BS 8110 of 1987. The cubes of concrete produced were cured for three, seven, fourteen, twenty-one and twenty-eight days and then crushed and their strengths at different percentage addition of izal recorded (see Tables 1 and 3). The third part, concrete cubes that were not mixed with izal were cured in izal solution for 3, 7, 14, 21 and 28 days, then crushed and their strength recorded (see Tables 4 and 6). In the fourth part, concrete cubes that were not mixed with izal were respectively soaked in izal solution for thirty days after being cure for 3,7, 14, 21 and 28 days. The strength of concrete was measured and recorded after soaking the cubes for thirty days (see Tables 7 and 9).

Table 1: Strength of Concrete Mixed with Different Percentages of Izal

Age	Identity	Percentages of izal (%)					
(days)	mark	0.2	0.4	0.6	0.8	1.0	2.0
3	3C	21.41	20.60	22.30	10.50	18.93	weak
7	7C	21.84	19.70	21.40	8.14	18.43	1.39
14	14C	18.92	17.30	16.30	6.66	15.47	0.89
21	21C	19.19	14.70	16.90	4.59	15.50	0.00
28	28C	16.95	10.0	15.50	4.26	1.50	0.00

Table 2: Percentage of Izal Water Value to the Control Value.

Percentage izal mixed with concrete (%)	Percentage value of the control strength	Percentage reduction in strength
0. 2	48	52
0.4	28	72
0. 6	44	56
0.8	12	88
1.0	4	96
2.0	0	100

Table 3: Strength of Concrete Mixed with Different Percentages of Izal

Percentages	Ages (days)				
(%)	3	7	14	21	28
mark	3C	7C	14C	21C	28C
0	23.69	27.78	30.71	34.07	35.56
0.2	21.41	21.84	18.92	18.19	16.95
0.4	20.60	19.70	17.30	14.70	10.00
0.6	22.30	21.40	16.30	16.9	15.50
0.8	10.50	8.14	6.66	4.59	4.26
1.0	18.93	18.43	15.47	15.5	1.50
2.0	0.00	1.39	0.89	0.00	0.00

Table 4: Strength of Concrete Cured with Different Percentages of Izal

Age (days)	Identity mark	Percentages of izal (%)/Strength(N/mm^2)					
		0.2	0.4	0.6	0.8	1.0	2.0
3	3F	20.30	15.62	13.78	12.24	11.47	weak
7	7F	20.96	19.55	18.22	16.89	15.55	8.69
14	14F	25.33	22.65	19.56	20.87	23.78	16.34
21	21F	25.45	23.15	20.89	19.71	17.11	13.33
28	28F	26.21	25.67	24.28	23.67	22.00	13.54

Table 5: Percentage of Izal Water Value to The Control Value.

Percentage izal mixed with concrete (%)	Percentage value of the control strength (%)	Percentage reduction in strength (%)
0.2	74	26
0.4	72	28
0.6	68	32
0.8	67	33
1.0	62	38
2.0	38	62

Table 6: Strength of Concrete Cured with Different Percentages of Izal

Percentages		Ages (days)			
(%)	3	7	14	21	28
mark	3F	7F	14F	21F	28F
0	23.69	27.78	30.71	34.07	35.56
0.2	20.30	20.95	25.33	25.45	26.21
0.4	15.62	19.55	22.65	23.15	25.67
0.6	13.78	18.22	19.56	20.89	24.28
0.8	12.24	16.89	20.87	19.71	23.67
1.0	11.47	15.55	23.78	17.11	22.00
2.0	0.00	8.69	16,34	13.33	13.54

Table 7: Strength of Concrete Cured in Different Percentages of Izal for 30 Days after Various Ages of Curing in Water

Age	Identity		Percentages of izal (%)				
(days)	mark	0.2	0.4	0.6	0.8	1.0	2.0
3	3I	23.44	19.89	17.02	17.11	14.47	weak
7	7I	25.24	24.89	22.33	19.88	15.95	10.88
14	14I	27.88	23.33	20.19	20.87	24.42	17.22
21	21I	30.08	29.12	25.33	25.01	24.36	16.67
28	28I	30.55	29.89	26.12	25.22	24.89	15.23

Table 8: Percentage Strength of Izal Water Value to the Control Value.

Percentage izal mixed with concrete (%)	Percentage value of the control strength	Percentage reduction in strength
0.2	86	14
0.4	84	16
0.6	73	27
0.8	71	29
1.0	70	30
2.0	43	57

Table 9: Strength of Concrete Cured in Different Percentages of Izal for 30 Days after Various Ages of Curing in Water

Percentages	Ages (days)				
(%)	3	7	14	21	28
mark	3I	7I	14I	21I	28I
0	23.69	27.78	30.71	34.07	35.56
0.2	23.44	25.24	27.88	30.08	30.55
0.4	19.89	24.89	23.33	29.12	29.89
0.6	17.02	22.33	20.19	25.33	26.12
0.8	17.11	19.88	20.87	25.01	25.22
1.0	14.47	15.95	24.42	24.36	24.89
2.0	0.00	10.88	17.22	16.67	15.23

Table 10: Constituents of Izal Disinfectant

Constituents	Part per million (ppm)	kg/l
Phenol	490500	0.49
Cresol	130800	0.131
Sodium hydroxide	109000	0.109
glycerol	54500	0.055
fat	87200	0.087
water	218000	0.218

Analysis and Discussion of Results

The fine and coarse aggregates used in this research were found to be well graded as the fine aggregates were within the zone two in BS 882 of 1992 and the coarse aggregates fell within well graded aggregates in the sieve graph. Izal was found to be alkaline as its PH value was found to be 9.6. The addition of the izal to concrete affected the strength of the concrete cubes. The addition generally reduced the strength of concrete. The extent of this is seen in the tables and graphs.

Table 2 showed that at 0.2% the controlled strength reduced by 52% while at 2% it reduced by 100%. Concrete strength reduced when the concrete cubes were cured in izal solution. This is illustrated in table 6 and figure 4. Table 5 shows the percentage reduction in the strength of concrete as the cubes were cured in different percentages solution of izal. At 0.2% of izal the strength of the concrete cubes reduced by 26% while at 2 % it reduced by 62%. Soaking of concrete cubes in izal solution also resulted to the reduction in the strength of the concrete. This is shown in table 9 and figure 6. Table 8 shows the percentage reduction in the strength of concrete. At 0.2% izal the concrete strength reduced by 14% while at 2% it reduced by 57%. These reductions in strength of concrete could be attributed to the toxic nature of izal to concrete.

In the first addition of izal the strength reduced normally and gradually. Further addition led to clear fluctuation between 0.5 and 1.5% addition. The strength eventually came further down at 2% addition after which the cubes could no longer stand.

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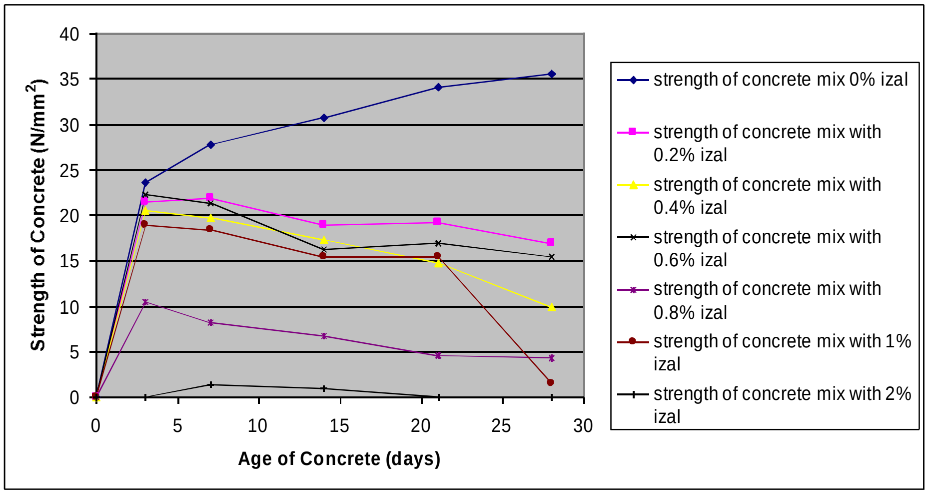

Fig 1: Strength Development for Different Percentages of Izal

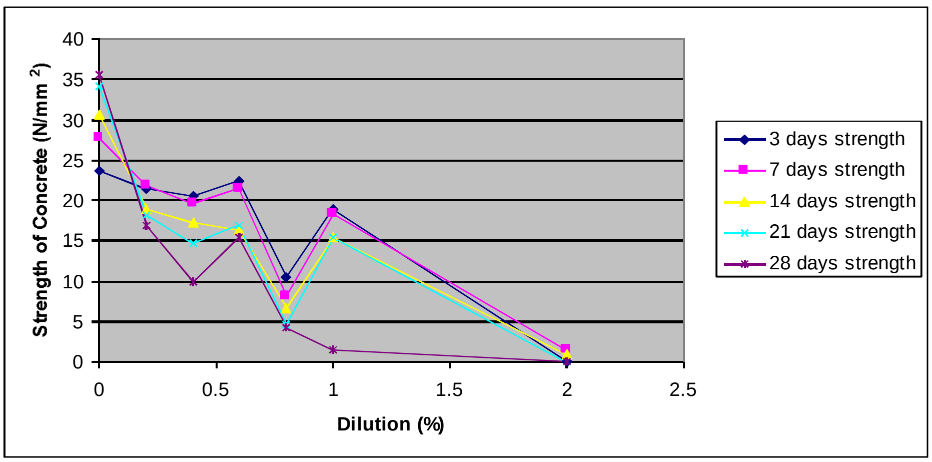

Fig 2: Strength of Concrete Mixed with Different Percentages of Izal

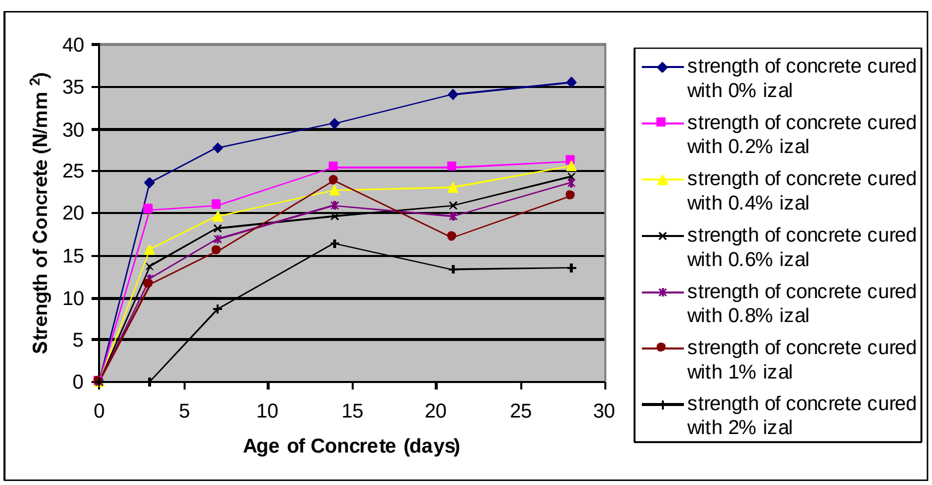

Fig 3: Strength of Concrete Cured with Different Percentages of Izal

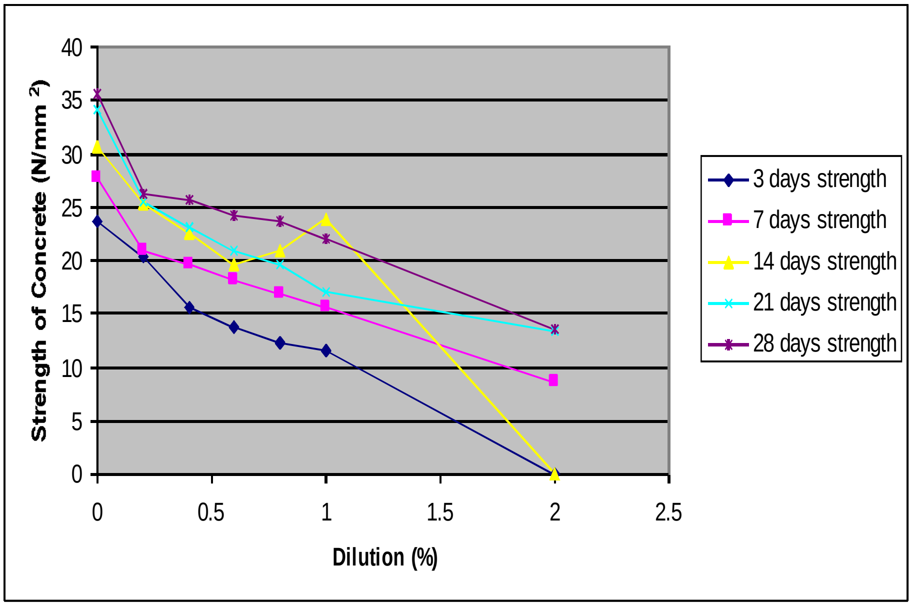

Fig 4: Strength of Concrete Cured with Different Percentages of Izal

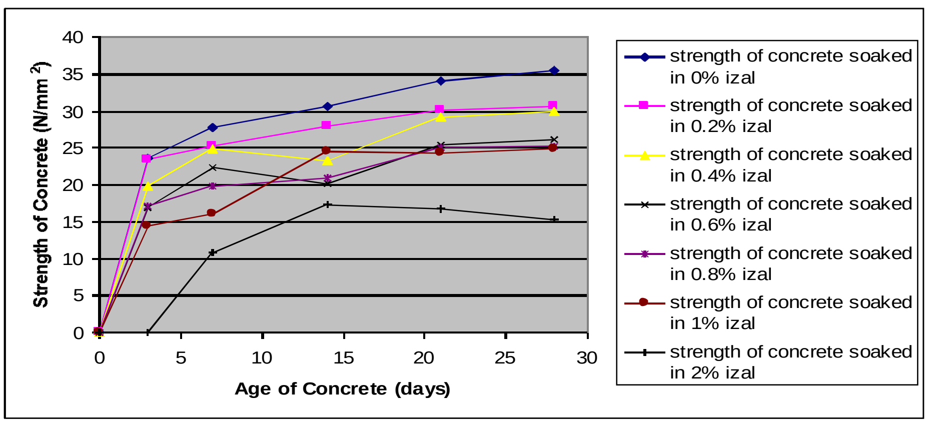

Fig 5: Strength of Concrete Cured in Different Percentages of Izal for 30 Days after Various Ages of Curing in Water

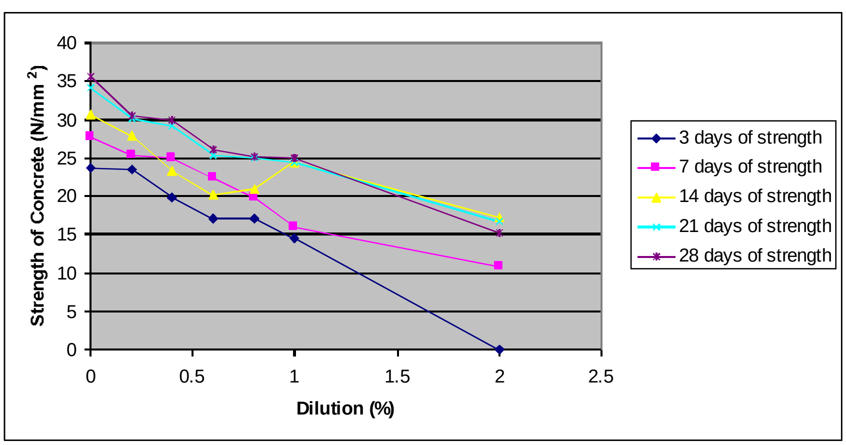

Fig 6: Strength of Concrete Cured in Different Percentages of Izal for 30 Days after Various Ages of Curing in Water

Conclusion

The strength of concrete was adversely affected by the addition of izal to concrete. The strength continued reducing until the concrete cubes collapsed. At 0.2 percent izal used as a measure of mixing water, the twenty-eight days control strength of 35.56N/mm^2 is reduced by about fifty two percent to 16.95N/mm^2.

Similarly, 0.4, 0.6, 0.8, 1.0 and 2.0 percent measure reduced the twenty-eight days strength of 35.56N/mm^2 by seventy-two, fifty-six, eighty-eight, ninety six and hundred percent to a value of 10.0, 15.50, 4.26, 1.50 and 0.00N/mm^2 respectively.

Izal- water used as mixing water in concrete is injurious to concrete. At 0.2 percent izal used as a measure of curing water, the twenty-eight days control strength of 35.56N/mm^2 is reduced by about twenty-six percent to 26.21N/mm^2. Similarly, 0.4, 0.6, 0.8, 1.0 and 2.0 percent measure of curing water reduced the twenty-eight days strength of 35.56N/mm^2 by twenty-eight, thirty-two, thirty three, thirty eight and sixty two percent to a value of 25.67, 24.28, 23.67, 22.00 and 13.54N/mm^2 respectively. Izal solution used as curing water is injurious to concrete. At 0.2 percent izal used as a measure of soaking water after curing, the twenty-eight days control strength of 35.56N/mm^2 is reduced by about fourteen percent to 30.55N/mm^2. Similarly, 0.4, 0.6, 0.8, 1.0 and 2.0 percent measure of soaking water after curing reduced the twenty-eight days strength of 35.56N/mm^2 by sixteen, twenty-seven, twenty-nine, thirty and fifty seven percent to a value of 29.89, 26.12, 25.22, 24.89 and 15.23N/mm^2 respectively. Izal solution used as soaking water after curing is injurious to concrete.

Recommendation

Precautions should be taken when using the disinfectant on our buildings. Also, direction for use should be strictly adhere to so as to avoid excessive accumulation of izal on concrete building,

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