DAMAGING EFFECTS OF DIELDREX-20 ON THE COMPRESSIVE STRENGTH OF CONCRETE

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ABSTRACT
Destruction of properties by termites is a serious concern to the construction industry in Nigeria. Various insecticides are in use notably the dieldrex-20, used in aqueous solution by impregnation or the soil with repellent around the periphery or foundations. But local contractors do not apply the chemical as recommended: rather they mix it with concrete. This inappropriate use of Dieldrex-20 by local contractors has prompted this investigation to highlight the dangers inherent in such practice. Analysis of the results showed that as the percentage of aqueous solution of dilclrex-20 increases, the compressive strength of concrete decreases. This decrease is independent of concrete grade and age. It also showed that the 5 per cent aqueous solution of dieldrex-20 recommended dosage should be strictly adhered to in the production of termite resistant concrete, as dosage in excess of this could adversely affect the compressive strength of concrete.

Key words: Dieldrex -20; compressive strength; concrete; termite

INTRODUCTION

There is a great need to reduce and limit damages caused by termites especially in developing countries. Termites can penetrate lead-sheathed cables to seek the cellulose in woody materials. Irrigation, leaking pipes, condensation from air conditioners and the normally higher humidity levels found under foundations provide moisture. a necessary requirement for termites tack. This and changes in building practices, new techniques and new building materials, can be the reasons why termite damages have been reported from previously unaffected areas like the middle cast [1].

This growing problem or termite damage due to human development makes reliable protection against termite attack increasingly important. The best solution is construction using passive termite control methods that are safe for the environment [2, 3]. One cannot totally termite proof buildings by construction method alone. Regular inspections and vigilance by the owner are essential [4].

The four main termiticides: dieldrin, aldrin, heptachlor and chlordane are chlorinated hydrocarbons and are very persistent in the environment. They are known as cyclodines and arc highly toxic [1, 5].

The best protective measures against termites have been proved to be the impregnation or timber structures with appropriate compounds, the addition of some chemicals to plastics the impregnation of the soil with repellents around the periphery of foundations. Others include the installation of mechanical barriers (such as termite shields) preventing termites from crawling into rooms and laying of drainage systems to lower the ground water level [6].

Termites cannot destroy ordinary concrete, but they cannot completely prevent termites from attacking other building components like timber. It is known that flesh concrete is prone to termite attack and this has led to the introduction of insecticides in the production of concrete by some local building contractors. dieldrex - 20 is one of such insecticides used by the local building contractors in Nigeria.

Visit to local construction sites showed that the use or dieldrex-20 is being abused. The manufacturers or dieldrex-20 specified that the aqueous solution (one litre or dieldrex-20 to 39 litres of water) should he sprayed in the foundation trenches [7]. But local contractors do not use the recommended procedure. They rather add the aqueous solution to the mixing water. This is a serious concern as excess dosage may impair the desired strength of concrete, which will be detrimental to concrete structural elements of the building.

Also, local contractors lack the necessary tool, and equipment to measure the correct amount of water required for the production of good quality concrete. Mixing is predominantly done by hand. This will invaluably affect the amount of aqueous solution of dieldrex-20 added to the mixing water. Local contractors find it difficult to maintain the specified water/cement ratio in sites.

The other alternative of impregnating the soil with the repellent around the periphery of foundations before placing the concrete should be encouraged. Insecticides when applied in such a

manner will not affect the compressive strength of concrete.

This inappropriate application of aqueous solution of dieldrex-20 in the production of concrete by the local building contractors has prompted this study to highlight the dangers inherent in such practices. In view of the fact that strength is one of the important properties of concrete, this paper sets out to examine the effects of aqueous solution of dieldrex-20 on the compressive strength of concrete.

MATERIALS AND TESTING

The materials used in the production of concrete are crushed coarse aggregate with a maximum size of 20mm, specific gravity of 2.61, water absorption capacity of 3.98 per cent and crushing value of 26 per cent. Fine aggregate sieve analysis showed that the sand belongs to zone 3 and has specific gravity of2.63. Tap water and ordinary Portland cement (Benue Cement) were used to produce three different concrete grades of 20MPa, 25MPa, and 30MPa. Mix design method was employed to proportion the quantity of cement, coarse aggregate, fine aggregate, and water for each grade of concrete.

150mm x 150mm x 150mm concrete cubes were prepared for group A (control mix) and group B (specimen with 5 per cent, 20 per cent. 40 per cent and 60 per cent aqueous solution of dieldrex-20). They were cured by immersion and tested for 7-day, 14-day and 28-day strengths, in order to examine the effect of Dieldrcx-20 on the strength of concrete with age. Dension 2000kN-compression machine was used to determine the load bearing capacity of the specimens.

RESULTS AND DISCUSSION

The results are summarized in table I. In general, the results indicate that the addition of aqueous solution of dieldrex-20 decreases the strength of concrete. It shows that about 92 per cent of concrete with aqueous solution of dieldrex-20 showed decrease in strength when compared with concrete without the repellent. Table 2, shows the variation of percentage reduction in strength of the various grades of concrete with time at different levels of the repellent. It shows that the reduction in the strength of the three concrete grades with time ranges from 1.76 per cent to 38.33 per cent. The result indicates that about 44.4 per cent of the concrete with 5 per cent repellent have their strength reduced by about 5 per cent.

It also indicates that all the specimen with 20 per cent, 40 per cent and 60 per cent repellent have their strength reduced. The probability that high volume fraction of the repellent would cause greater reduction in the strength is very high. For volume fraction of 20 per cent and above, the probability that the strength can be reduced by about 10 per cent and above is about 85 per cent. For the 40 per cent and 60 per cent volume fraction of the repellent, the probability that the strength can be reduced by about 20 per cent is about 66.67 per cent for both. This reduction in strength due to the presence of repellent is not constant, but varies with age, volume fraction of repellent and concrete grades. Addition of dielclrex-20 in excess of 5 per cent dosage will greatly decrease the strength of concrete as indicated by the results.

It can be observed from table 2 that the reduction in the 7-day, 14-day and 28-day compressive strength is not solely as a result of the addition of aqueous solution of dicldrex-20. It has been observed that material imperfection may result from water/cement ratio; climatic conditions, workmanship, testing techniques and rate of loading contribute to the reduction in the strength of concrete. This is because the reduction in strength of concrete at different levels of the repellent is not constant for all the concrete grades. The reduction is not also constant for the same grade of concrete at different testing times. For instance, at 5 per cent repellent, the reductions in strength for the concrete grades 20M Pa. 25M Pa and 30M Pa arc 5.15 per cent. 1.76 per cent and I 1.00 per cent respectively for 7-day strength. Also -10.85 per cent, -24.0 per cent and 5.57 per cent for 14--day strength; and -6.25 per cent, 5.0 per cent and 3.33 per cent for 28-day strength (see table 2).

Also figure 1 shows that the trend shown by the specimens with repellent is the same as that of the control specimens. These are an indication that the observed reduction in the specimen strength is not caused by the repellent alone, but also by the material imperfections. This is so, because concrete cubes without aqueous solution of dieldrex-20 show the same trend in strength with time.

From table 2, the ranges in strength decrease are 1.76 per cent to 28.33 per cent for 7-day strength: 5.57 per cent to 38.33 per cent for 14-day strength: and 3.33 per cent to 33.90 per cent for 28-day strength. On the average, the decrease in the strength is 15.88 per cent for 7-day strength, 18.74 per cent for 14-day strength, and 16.27 per cent for 28-day strength. It could be argued that the repellent does not cause appreciable reduction in the compressive strength of concrete with time.

The three concrete grades maintain the same behavioral pattern as indicated by the

control specimens (see figure I). Table 2, shows that the repellent reduces the strength of concrete and it is not dependent on the concrete grades. Therefore, the repellent has the same effect on all concrete grades.

It has been observed that in a hot climate, the early strength gain is high and the ratio of the 28-day to 7-day strengths tends to be lower than in cooler weather [8]. Similarly, in tropical countries an apparently lower strength of concrete has been observed [9].

Figure 2 shows that the effect of dieldrex-20 on strength of concrete is non-linear. The strength decreases as the volume fraction of the aqueous solution of dieldrex-20 increases. It seems that the presence of aqueous solution of dieldrex-20 reduces the amount of water required for the proper hydration of cement paste, which would result in strength decrease. Another way by which dieldrex-20 can reduce strength is by not allowing for the proper hydration of cement paste and in this case it serves as an inhibitor.

In any case, it seems that weak zones are created in concrete by the presence of aqueous solution of dieldrex-20 in the gel-pores.

CONCLUSION

It is observed that as the percentage of volume fraction of aqueous solution of dieldrex-20 increases, the compressive strength of concrete decreases. Also, the 5 per cent aqueous solution of dieldrex-20 recommended by the manufacturer to be added to the water that is used in mixing the concrete should strictly be observed. For local construction hand mixing of concrete is predominant, addition of aqueous solution of dieldrex- 20 should not be encouraged, but rather the impregnation of the soil with repellent around the periphery of foundations.

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Table I: Effect of dieldrex-20 on the characteristic strength of concrete

Concrete Grades [MPa]	Aqueous Solution Dicldrex -	7-day strength [MPa]	t4-day strength [MPa]	2X-day strength [MPa]
20	0	19.33	21.00	19.75
	5	18.30	23.17	2 I .00
	20	16.67	19.50	17.50
	40	15.90	15.50	16.83
	60	13.77	16.50	13.00
	0	24.50	21.50	20.50
30	0	29.83	28.50	29.50
	5	26.33	26.83	28.50
	20	24.70	25.17	22.00
	40	22.67	19.33	19.33
	60	21.33	17.00	21.50

Table 2: Percentage Reduction in the Strength of Concrete at different levels of aqueous solution of dieldrex - 20

Dieldrex-20 aqueous solution(%)	Reduction in 7-day Strength (%)			Reduction in 14-day Strength (%)			Reduction in 28-day Strength (%)		
	20	25	30	20	25	30	20	25	30
5	5.15	1.76	11.66	-10.8	-2.40	5.57	6.25	5.00	3.33
20	13.30	13.48	17.10	7.500	17.3	11.10	11.25	9.44	25.00
40	17.15	22.00	23.86	27.50	24.0	30.57	14.60	12.00	33.90
60	27.80	9.08	28.33	22.50	3.00	38.33	33.75	4.00	26.66

❖ **Negative values indicate strengths greater than the strength of control specimen**

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