EXCELLENT PUBLISHERS

International Journal of Current Research and Academic Review

ISSN: 2347-3215 Volume 3 Number 2 (February-2015) pp. 104-109

www.ijcrar.com

Determination of EC50/LC50 for Aluminium oxide (Al 2O3) with germination parameters of *Vigna radiata* seeds

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KEYWORDS

Aluminium toxicity, Aluminium oxide (Al_2O_3), *Vigna radiata*

A B S T R A C T

LC50 value determination for Aluminum oxide (Al 2O3) with germination parameters of Vigna radiata seeds was carried out under laboratory condition to design the experiment for evaluating the possible phytotoxicity of the test chemical. The LC50 values for Aluminum oxide (Al 2O3) found to be 645mg/L with LC0 /MAC value was 2mg/L .The XLSTAT analysis showed a high level of significance of the parameters studied.

Introduction

Aluminium toxicity to plants is well known in agriculture and forestry (Wild, 1988). Direct and indirect effects of enhance aluminium availability in soil due to soil acidification may be cause of current problems in some European forests (Abrahamsen *et al.*, 1994). Numerous studies exist of plants exposed to aluminium in nutrient solution or sand culture. They show that exposure causes diminished root growth and development, reduced uptake of plant nutrients (notably phosphorus, calcium and magnesium) and stunted plant growth (Bartlett and Riego, 1972a,b; Göransson and Eldhuset, 1987; Boxman *et al.*, 1991; Keltjens and Tan (1993).

The effect of aluminium on plants is complex. It can act directly on plant cell processes (Taylor, 1991) or indirectly by interfering with plant nutrition (Roy *et al.*, 1988; Taylor, 1991).

The Effective concentration (EC50) and lethal concentration (LC50) are been extensively used to evaluate the suitability of the potential toxic chemicals for laboratories studies with various seeds of cereals, pulses etc. This will help to find out the concentration of toxic chemicals with which the seedling characteristics can be studied in laboratory conditions. The guidelines for accurate estimation of EC 50/

LC 50 are already available (Sebaugh, 2011).

A common way of defining LC 50/EC 50 is the 50% response of the test compound to the test organism under laboratory conditions. This is also against the control values where it does not contain any test compound and produces 100% activity studied in the test subject. The LC 100 (lethal concentration 100%) where there is absolute zero activity of the test organism leading to the death/inactivity.

In order to perform eco-physiological studies with Aluminium oxide (Al_2O_3) to the seedlings of *V. radiata* (green gram) the present study has made an attempt to find out the effective concentration.

Materials and Methods

Test chemical and concentration

The test chemical, Aluminium oxide (Al_2O_3) (was used in the experiment. 29 concentration of test chemical in range of 1.00mg/L to 1000mg/L (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 90. 100, 200, 300, 400, 500, 600, 700, 800,900 and 100mg/L) were selected to find out the EC_{50} and LC_{50} etc.

Test organism: The prime pulse seed *Vigna radiata*, var.PDM 139 Samart commonly used in eastern state of India, particularly Odisha State has been chosen for study. Healthy seeds of radiation were obtained from OUAT Extension, Ratnapur, Ganjam for the experimentation.

Parameter evaluated: The parameter used to find out the LC 50 is by the % germination of seeds. Experiments were conducted in petriplates (6") with cotton and blotting paper soaked with different concentrations of Aluminium oxide (Al_2O_3). 15 healthy seeds were used to each petriplate to study the % percentage of germination after 24 to 72 hours.

The control set was kept with Al_2O_3 free environment. In each concentration of pesticide, three replicate were taken to find out the % of germination of seeds. The seed germinator (Remi, C-6) was used in experimentation with 25+ 2^o C temperature 90% humidity and 12 hours light cycle exposure.

Results and Discussion

The results obtained from the experiment were given in figure 1 and the XLSTAT2015 analysis for regression analysis and ANOVA is given in table 1.

The control (0 mg/L Al_2O_3 treatment) was taken as 100% seed germination since they are grown with distilled water only. Figure 1 shows the % of germination of mung seeds with respect to mg/L of concentration of Al_2O_3. The LC 50 is calculated where there is 50 % germination of seeds and was found to be 645mg/L of Al_2O_3. The MAC (maximum allowable concentration) was found to be 2mg/L Al_2O_3, where it has shown 100% germination of seeds. Hence, here we have made an attempt to find out the EC_{50} concentration of Al_2O_3 in relation to agricultural crops like pulse seeds under laboratory conditions. The authors have used LC_{50} to determine the concentration of Al_2O_3 for further experimentation with those crops.

The correlation analysis between parameters studied showed r value to be -0.832.
With P>0.001 (df 26) showing high level of significance. Further, the ANOVA indicated high statistical significance with F value of 58.42 (P<0.0001).

Table no.1 Statistical Analysis with XLSTAT 2015

XLSTAT 2015.1.01 - Linear regression - on 1/28/2015 at 5:41:41 PM
Y / Quantitative: % of Mung Seed Germination
X / Quantitative: Concentration of $Al_2 O_3$ in mg/L
Confidence interval (%): 95
Tolerance: 0.0001
Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
100	28	0	28	45.000	93.300	68.379	15.783
0	28	0	28	1.000	1000.000	214.107	310.031

Correlation matrix:

Variables	0	100
0	**1.000**	-0.832
100	-0.832	**1.000**

Regression of variable 100:
Goodness of fit statistics:

Observations	28.000
Sum of weights	28.000
DF	26.000
R^2	0.692
Adjusted R^2	0.680
MSE	79.666
RMSE	8.926
MAPE	11.024
DW	0.110
Cp	2.000
AIC	124.505
SBC	127.169
PC	0.355

Analysis of variance:

Source	DF	Sum of squares	Mean squares	F	Pr > F
Model	1	4654.181	4654.181	58.421	< 0.0001
Error	26	2071.326	79.666		
Corrected Total	27	6725.507			

Computed against model Y=Mean(Y)

Model parameters:

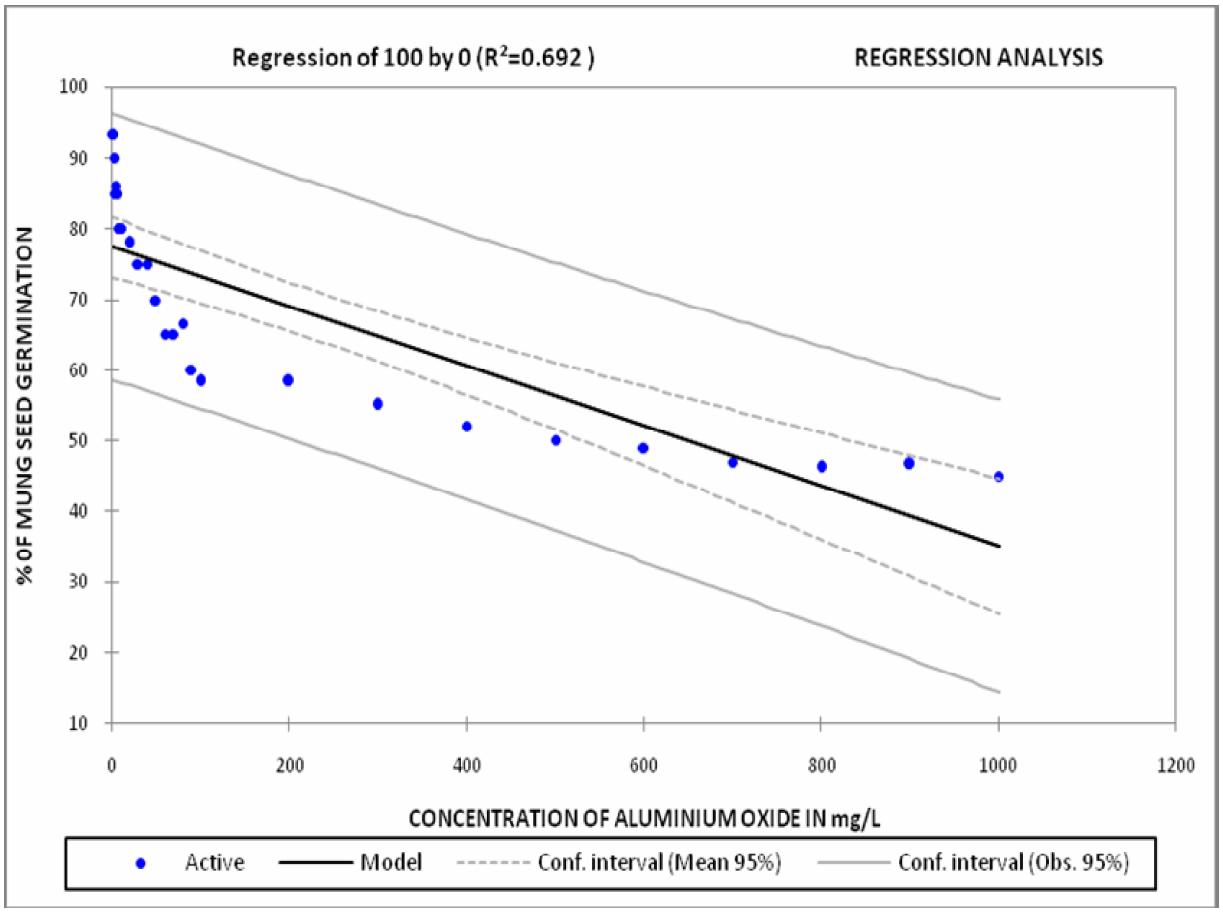
Source	Value	Standard error	t	Pr > |t|	Lower bound (95%)	Upper bound (95%)
Intercept	77.446	2.062	37.556	< 0.0001	73.207	81.684
0	-0.042	0.006	-7.643	< 0.0001	-0.054	-0.031

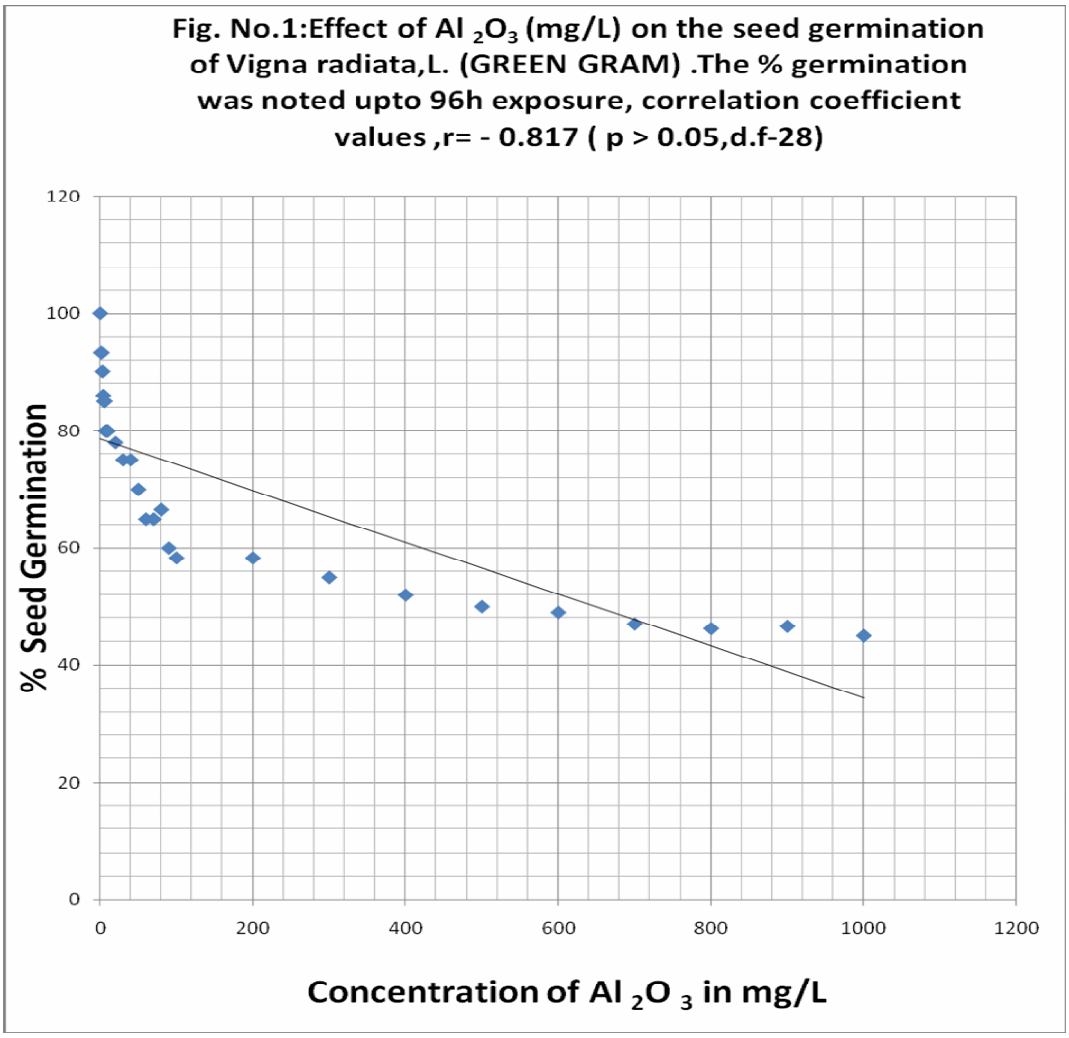
Equation of the model:

100 = 77.4456276739224-4.23482193277443E-02*0

Standardized coefficients:

Source	Value	Standard error	t	Pr > |t|	Lower bound (95%)	Upper bound (95%)
0	-0.832	0.109	-7.643	< 0.0001	-1.056	-0.608





Acknowledgements

Authors are thankful to HOD and Principal, Khallikote Autonomous College, Berhampur for necessary laboratory facilities and encouragement for research activities.

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