iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 11 **Issue:** V **Month of publication:** May 2023

**DOI:** https://doi.org/10.22214/ijraset.2023.52818

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 11 Issue V May 2023- Available at www.ijraset.com*

# An Assessment on the Effect of Lime in Atterberg Limits of Soil

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***Abstract:*** ***The study was aimed to find the effect of lime on Atterberg limits of soil. The experiment was carried out using clay as soil sample and tests were conducted on various proportions of lime ( i.e 2%,4%,6% of lime in addition by weight of soil sample). The experiment shows the increment in liquid limit and plastic limit of soil on addition of lime upto 6%. The experiment also shows the declination in plasticity index on increasing the proportion of lime.***

## I. INTRODUCTION

Soil exhibits a variety of characteristics leading to development of whole branch of study to understand in a better manner. In an endeavor for better understanding soil, several soil posing problems has been encountered to his development activity. Nature of soil and their properties are not always same making it difficult to handle in actual field conditions. Soil as such may not have desired engineering properties to be used suitably for various field conditions, hence for making it conducive and workable soil needs to be improved.

The Atterberg limits is one of the widely used parameters for defining states of finer soil particles .These limits may be used for analyzing the soil suitability for various agriculture and construction purposes such as small earth dams etc. These limits provide the moisture content at which soil changes its state. Atterberg limits are mainly comprises of Liquid limit, Plastic limit and shrinkage limit. As consistency of soil changes by presence of water, liquid limit may be found out. Classification of soil plays major role in using soil as a construction material, hence plastic limit is determined to classify the soil under various groups. Stabilization of soil is an important factor for using soil as an engineering material. Soil stabilization is done to improve the bearing capacity of soil, making it more resistive to weathering action and permeability. The long term stability of any construction depends on the stability of underlying soil as unstable soils are likely to deform on application of loads. Soil stabilization ensures the stability of soil to effectively sustain the applied loads .

## II. LITERATURE REVIEW

Herrin and Mitchel, 1961; Brandl,1981 : plasticity index of soil decreases on addition of lime. The reduction in plasticity index depends on the type of soil and quantity of lime used.

Mateos (1964) : Beyond the optimum lime content there was no further increase in plastic limit of soil. Liquid limit of highly plastic clays is reduced by lime while on low plastic clays it increases.

Rajbongshi (1997): observed that there is increase in plastic limit and subsequent decrease in liquud imit of soil with increasing lime content

Nilo et al (2009) : For the improvement of local soil addition of lime is an attractive technique. The use of lime in soil is useful in soil stabilization and in various construction purposes like pavement base, slope protection of earth dam and in shallow foundation too.

Negi et al (2013) : Lime has been successfully and widely utilized to improve the bearing capacity of soil if mixed in required proportion.

## III. MATERIAL AND APPARATUS

Lime: As an inorganic material lime mainly comprises of oxides of calcium and hydroxides having chemical formula CaO. Lime are used in large quantity as a building and engineering material. These are derived from limestone and chalk which are primarily composed of calcium carbonate. They are cut, pulverized and chemically altered. In agricultural context it is generally termed as agriculture lime which is usually a crushed limestone.

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Clay: It is a natural fine grained soil material comprises mainly of clay minerals, it is one of the oldest ceramic material and are still widely used in various agriculture and modern industrial process. Plasticity is the most governing property of clay when mixed with water with its ability to harden when dried.
Distilled water: It is a type of purified water that has been boiled into vapour and condensed back into liquid in a separate container.
Casagrande's Apparatus: the apparatus is commonly used for the determination of liquid limit of clay soil.
Glass plate: As glass is non-porous, the plate is used for making soil sample and in the determination of plastic limit.

## IV. EXPERIMENTAL PROGRAM

the program was conducted to understand the influence of lime on properties of clay soil. 120 gm of soil sample was used for determination of liquid limit and 50gm of soil sample was used for determination of plastic limit.The experiment were conducted on soil by adding various proportion of lime i.e 2%, 4% and 6% respectively in addition by weight of soil sample.

## V. TESTING OF SOIL

The soil were tested with and without addition of lime. Liquid limit and plastic limit were determined using standard procedure. Plasticity index were calculated using standard formulation.

TABLE 1: EXPERIMENT DETAILS

| TEST | | Percentage of Lime | No. of Test |
|---|---|---|---|
| Liquid limit | Plastic limit | | |
| L-0 | P-0 | 0% | 3 |
| L-2 | P-2 | 2% | 3 |
| L-4 | P-4 | 4% | 3 |
| L-6 | P-6 | 6% | 3 |

TABLE 2: LIQUID LIMIT OF SOIL

| S.No | Soil Sample detail | Percentage of Liquid limit |
|---|---|---|
| 1 | L-0 | 62.04 |
| 2 | L-2 | 65.18 |
| 3 | L-4 | 67.16 |
| 4 | L-6 | 71.20 |

Determination of Liquid limit

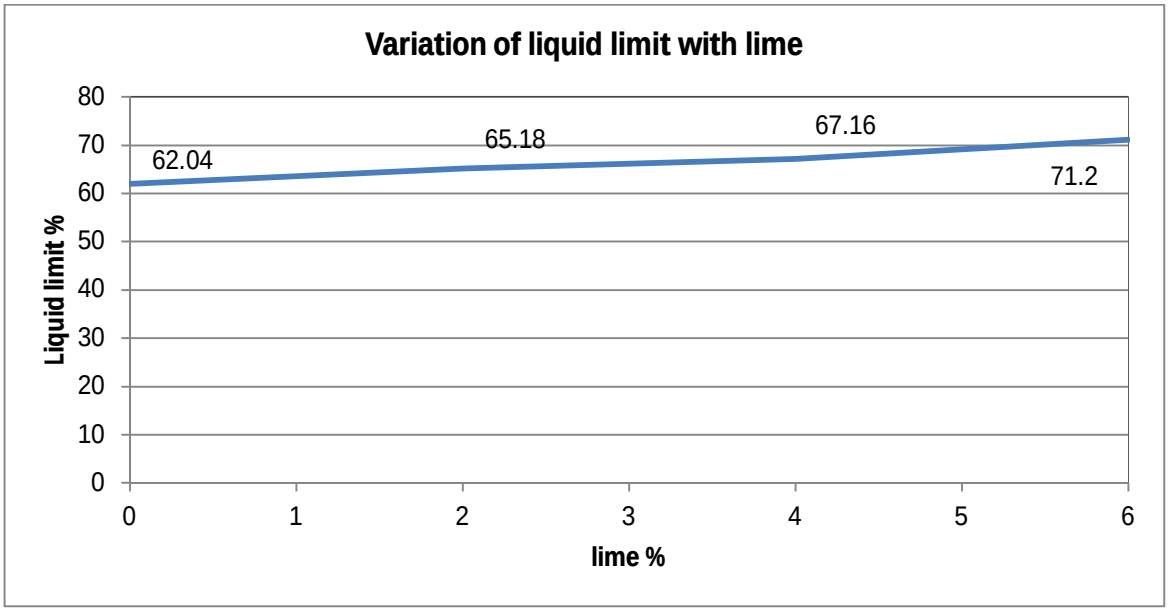
TABLE 3: PLASTIC LIMIT OF SOIL

| S.No | Soil Sample detail | Percentage of Plastic limit |
|---|---|---|
| 1 | P-0 | 28.53 |
| 2 | P-2 | 35.13 |
| 3 | P-4 | 38.98 |
| 4 | P-6 | 43.08 |

Determination of Plastic limit

TABLE 4: PLASTICITY INDEX OF SOIL

| S.No | Calculation of plasticity index | Plasticity index |
|---|---|---|
| 1 | (L-0) – (P-0) | 33.51 |
| 2 | (L-2) – (P-2) | 30.05 |
| 3 | (L-4) – (P-4) | 29.18 |
| 4 | (L-6) – (P-6) | 28.12 |

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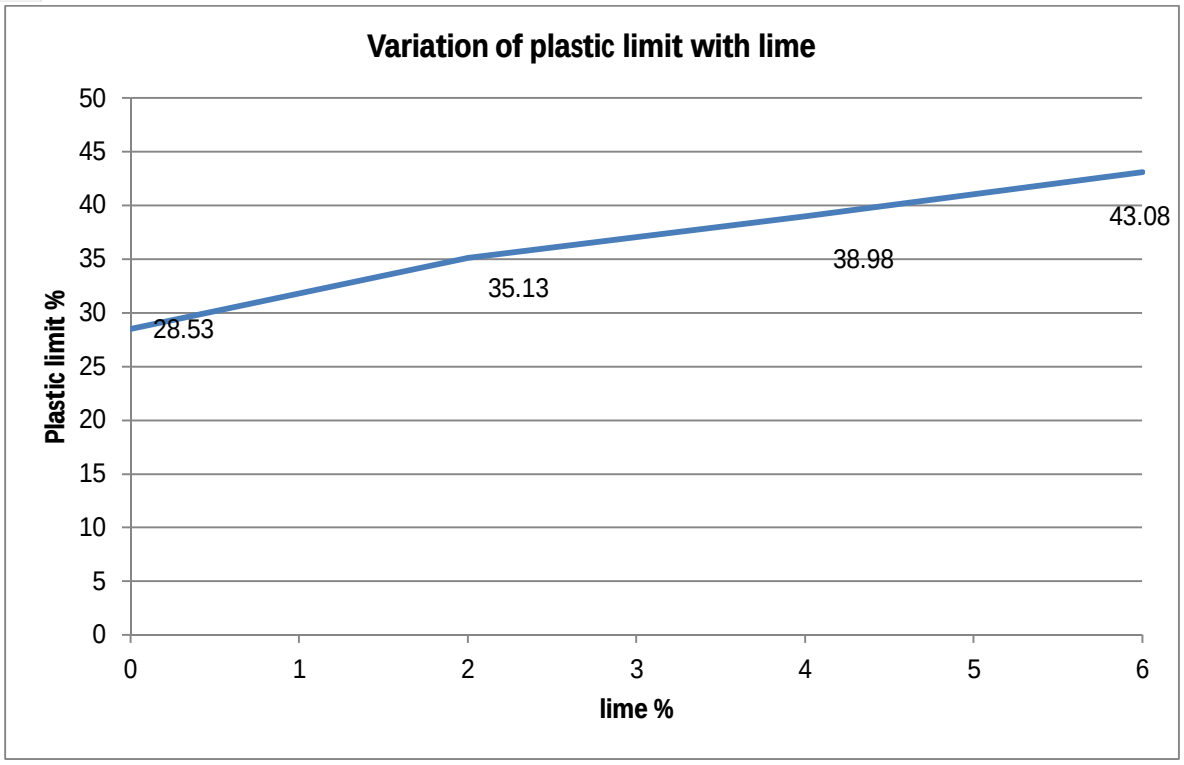


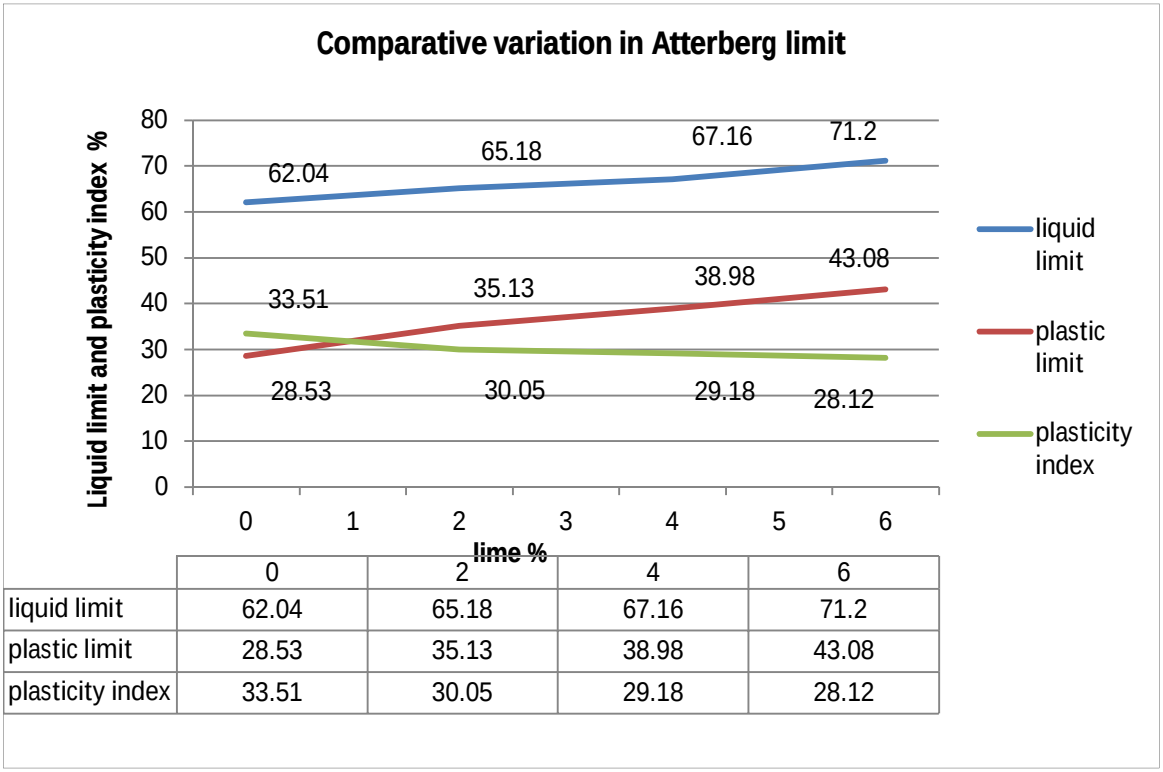


| | 0 | 2 | 4 | 6 |
|---|---|---|---|---|
| liquid limit | 62.04 | 65.18 | 67.16 | 71.2 |
| plastic limit | 28.53 | 35.13 | 38.98 | 43.08 |
| plasticity index | 33.51 | 30.05 | 29.18 | 28.12 |

## VI. RESULT AND DISCUSSION

1) The test showed the subsequent increase in liquid limit on addition of 2% ,4% and 6% of lime
2) The plastic limit of clay increases on addition of lime as 2%,4% and 6%
3) The plasticity index of clay decreases on addition of lime 2%,4% and 6%

## VII. CONCLUSION

The experimental program shows variation in Atterberg's limits on addition of different percentages of lime but at 6% of lime by weight of soil sample it proves to be more effective in liquid limit as well as plastic limit.

Future Scope: the study can be used to found out further analysis of lime in clay such as use of lime in soil stabilization. Strength properties of clay can be determined. Suitability of soil as a subgrade material can be determined.

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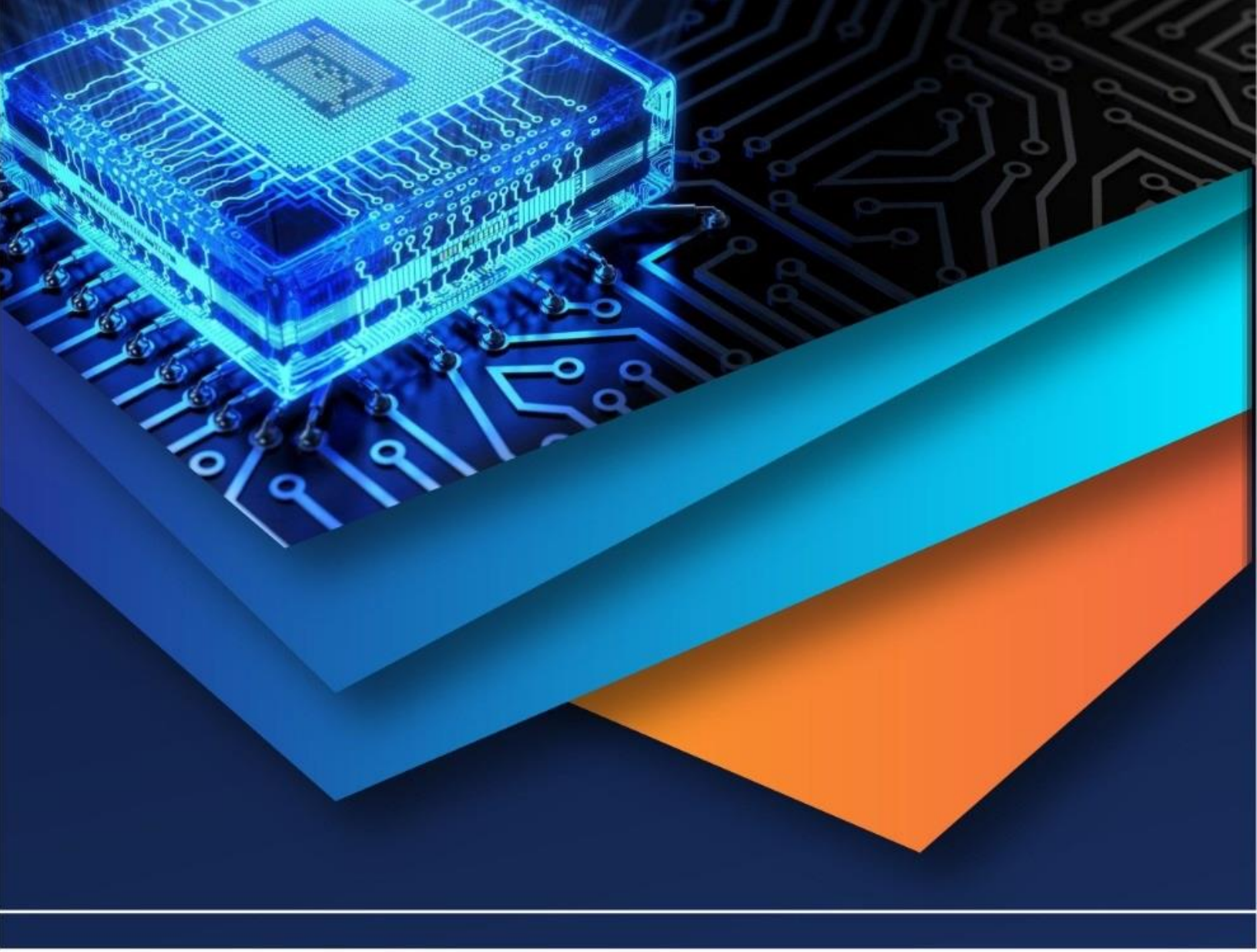

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