Effect Geochemical Using (Admixture) Such As Applied Soft Soil Stabilization: A Review

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Abstract: In recent years, the search for the best additive material to stabilize soft soil for the purpose of overcoming the persistent soil problem, has been in progress. Not only in order to obtain the required engineering properties in the soil. But this material has also been taken into consideration and its obvious environmental impact. This research presents a review of previous practical studies on stabilization of soft soils. Using the many commonly used chemical additives that include cement, inflorescence and fly ash. Geometrical properties of the soil and its great impact. Adding these chemicals to the soil. It leads to a marked improvement in both operability, resistance, permanence, and soil mechanical behavior. On the other hand, it has been found to reduce shrinkage, plasticity, and compression and swelling properties of this soil. It has also been observed that the ripening duration has a pronounced effect in improving the resistance properties of the stabilized soil. This is done to show it that chemical mixture that is used in research is better if it is materials within the bounds of regard to economic viability.

Key words: cement, lime, fly ash, chemical additives, under the soil

1.INTRODUCTION

Since the mid-eighties of the last century, the world was dominated by a wave of urban development. But problems of structure soil were a related constraint, at a high cost for dealing with these problems soil is one of the most basic demands that must be taken into cost. In construction work as the resistance and permanence of the structure depend mainly on the resistance of soil of structure. In recent years, the process of constructing the base layer of roads has become the process of replacing weak soil layers with loose gravel material, or what is known as mountain teak. The cost of replacement is high, so this issue led researchers to find alternative ways to solve this problem and reduce the cost. This is by improving the characteristics of weak engineering soils present at the site without the need to replace the lost gravel. This is done by using mechanical methods to monitor the soil and improve its properties, or by using chemical additives that interact with the soil and change its engineering properties, and this is known as the soil stabilization process, Zaliha et al. (2013), and Nath et al. (2017). Soil stabilization is widely known as a new and effective method for improving the properties of engineering soil by linking soil particles together. This process may be either mechanical or chemical methods. Whereas, mechanical fixation is the process of increasing soil density using 'mechanical stack'. As for chemical fixation, it includes mixing or injecting the soil using active chemical compounds such as cement. Norah, fly ash, calcium, and sodium chloride, or by using flexible and sticky materials such as laurel, are among the most widely used. It is cement, inflorescence, and fly ash [3] that the use of the appropriate material to stabilize a specific area depends mainly on the type of soil, the type of product to be established and the availability of this substance to be used, Pandey and Rabbani (2017), The chemical reaction at which the addition of a particular chemical occurs improves the physical and engineering properties of the soil. Such as volume stability, acceleration of the drop and increased resistance. The permanence of reducing the compression and bloating that occurs in the soil. Also, chemical additives depend on working to meet the particles flocculation and enhancing chemical bonding between the molecules. Sintering leads to the attraction of electrical clay particles with each other. And their collection of what works to increase the actual size in The clay particles demanding a result from it to that to a sufficient size of the alluvial as well as the strength of the chemical bond between the individual soil particles. Evolve over time as the strength of the resulting chemical bond depends on the type of chemical fixator used. The aim of this research is to review the findings of practical studies The previous and the last, especially in fixing the soil by the most commonly used chemical additives, which are cement, light and fly ash, and a study and discussion of their effect on the physical and engineering properties of different soils.

2.BIOCHEMICAL ADMIXTURES

OF SOIL STABILIZATION

1.Cement

cement is one of the oldest materials used to stabilize the soil in the 1960's, especially in the construction of roads such as the base soil layers under Multiplication, ground levels, ground dams, and ground dams. Cement can be counted as I told you a basic house, or what is the association link, where it is used alone in the soil without any second additive giving us the required result. You can use a new address cement from the soil as shown in (Table No. 1).

Table (1); *chemical admixture of using stabilization soil*

Stability Material	Type soil
1. cement	Used of It is generally used to stabilize granular soil with good graduation and soft soils with plasticity, few, it is mainly used to improve the soil resistance and hardness.
2. lime	It is used in stabilizing the soil with high plasticity in order to reduce plasticity and works to increase the operability and reduce the swelling as well as increase the resistance
3. Fly ash	Pozzolane material interacts with the inflorescence or cement, so it is not used alone but as an additional material with cement or inflorescence to stabilize the soft, high-elastic soil volatile
4. Cement, lime and Fly ash	It is successfully used to install various types of soils such as fine and fine soils.

When increasing the ratio Clay in the soil becomes educational more difficult for health in such a case, its soil needs additional quantities of more than cement to reach the desired result that the interaction that takes place between cement and soil does not depend on the basic minerals that make up the soil and this is the interaction of cement that occurs with the water that is present in

any Soil This explains the reason for the poor use in installing a number of soils on a large scale In this technique, cement is mixed with water and soil using special devices at the site. Aftermarket cement leads to chemical reactions. Cement placement leads to the transformation of the soil to its sunset without affecting the constituent structure of the soil. This process of communication on several factors, the most important of them;

a. Quantity and type of cement used in stabilization method
b. Compacting and admixture
c. Time to ripen the nature of the soil components
d. Moisture content of the soil

The most suitable soil for cement stabilization in soil consisting of a mixture of sand and gravel of good grade. Also, many researchers have found that cement is more suitable for Granular soil mud, which has evidence of low plasticity, [4]. It can be used for any type of different types of cement, but the most commonly used in the installation is ordinary Portland cement (OPC) due to the ease of obtaining it anywhere and the quality control features available in it. Table (2) shows the chemical composition of Portland cement.

***Table (2)**: chemical compound of cement*

Chemical Compoun	%Ratio
Alumina(Al_2O_3)	9-5
Silica(SiO_2)	25-19
Calcium oxide	60-64
Ferric Oxide(Fe_2O_3)	4-2
C_3S &C_2S	9-5

As for the amount of cement used for fixing, it is generally between 4-14% as a percentage of the weight of dry soil. The researchers also found that the presence of organic matter or sulfate in the soil generally tends to prevent cement from solidification and good bonding with soil particles, Huat et al. (2005), The acquisition of soil resistance when cemented by cement occurs as a result of a number of interactions, which include hydration, ion exchange, creative and Pozzolani reactions, Little et al. (2000), and below illustrate these interactions

a) Hydration, the distinction process begins when adding water to the cement. The process of Hydration cement is relatively fast and leads to gain resistance to the stabilized soil. During hydration, this hydrated lime produces the ability to interact with soil. When the soil pH value is high. As a result of this reaction, binder materials such as calcium silicate wire and extinguished calcium aluminate are produced which provide close bonding between soil particles.
b) Ion exchange: When cement is added to the soil, some interactions occur between the extinguished inflorescence that results from the first reaction and the soil grooves. Some of these reactions occur simultaneously, while others are slow. Ion exchange (Ion exchange) is one of the fastest reactions taking place. The surface of clay particles is known to have a negative charge, which causes the positively charged ions to attract on its surface such as sodium, magnesium, potassium and hydrogen. The positive calcium charge present in the cement is stronger than the charges of the aforementioned elements, so calcium replaces the weak positive charges of the above elements, thus the surface of the slurry particles is charged with the positive calcium ion. As a result, this process reduces the plasticity of the clay soil.
c) Pozzolani reaction: After the completion of the previous reaction, any additional amount of cement will chemically react with the clay minerals present in the soil. The cement in Turkey contains chemical calcium and silica (shown in Table No. 2) and these compounds are the primary factors in the occurrence of Pozzolani reactions. Unlike the inflorescence, the cement contains mainly the necessary silica element in the Pozzolani reactions without the need for the silica element found in the clay soil particles. Therefore, fixation using cement does not depend on the properties of the soil components as is the case when fixing with the revolution, the existing alumina and silica materials interact in clay soil with the revolution found in cement and when there is water to be a baking gelatinous substance that increases the resistance and durability of the mixture. These Pozzolani reactions are slow to occur and may take a long period of time to complete the reaction, sometimes up to several years.
d) Carbonization reactions: Carbonization reactions occur in soil stabilization with cement. When the cement is exposed to the open air, this lead to its reaction with the carbon dioxide present in the atmosphere. This reaction produces insoluble calcium carbonate. Therefore, care must be taken to store cement and ensure that it is not exposed to the open air to avoid such reactions, Zumrawi (2015).

2.Lime

Lime is the second chemical additive commonly used to stabilize clay soils. The process of selecting the appropriate amount of revolution in stabilizing clay soils depends mainly on the PH value of that soil. Anchor fixation may be ineffective when the concentration of the additive is insufficient to complete the reaction and produce tangible results. The amount of inflorescences used to stabilize clay soils usually ranges between 4-10% as a percentage of the weight of dry soil. It is possible to add the inflorescence to the soil either in the laboratory or at the work site or by converting Lime into foam and then injecting it into the soil, which leads to Improve the properties of that soil Gaafer et al. (2012). The inflorescence is produced from limestone or marble when heated to high temperatures (about 900 C °). There are several types of inflorescences available

1. live inflorescence Cao
2. Amortized inflorescence Ca(OH)2. Mgo
3. lime containing magnesium oxide Ca(OH)2
4. live inflorescence dolomite

Live inflorescence is the most effective in causing a change in soil resistance compared to extinguished inflorescence, but it is considered health. When the inflorescence is added to the soil, a series of chemical reactions will take place which include ion exchange, gathering, sintering and Pozzolani reactions. Ion-exchange, gathering, and sintering reactions are the result of a change in soil texture, where clay sheets combine together to form larger particles. As a result of these interactions, the liquidity limit value of the soil market decreases, while the plasticity limit will increase. As a result, the plasticity index will

decrease and the shrinkage limit will increase, so the operability in the soil will improve as well as soil resistance to deformation. Pozzolani reaction included the interaction between the revolution with silica and enamel elements present in the clay soil to form a result. Binding material This reaction may take a long period of time, and this reaction produces high heat and leads to an increase in resistance to soil installed in the inflorescences.

3.Fly ash

In the past few years, many researchers have investigated the possibility of using natural resources and industrial minerals to stabilize the soil, the aim of which was to reduce the economic cost of the soil stabilization process, Amirian et al. (2012). Where fly ash has been used as a chemical additive in soil stabilization, fly ash is defined as fine particles resulting from the pulverized coal burning process, where it is produced as a cross-section of the coal burning process that is used in power plants, unlike the azimuth and light which are materials Manufactured, fly ash is generally used as a material for soil stabilization. As the Pozzolani material is rich in silica or silica and alumina where these elements interact with the presence of water with calcium hydroxide under normal temperatures cramping the bonding substance that binds the soil particles with each other, the fly ash particles are smoother than the cement and lime molecules, where it is spherical in shape as shown in Figure (3).

Table (3); *chemical compound of Fly ash*

Chemical Compound	%Ratio	
	Class (C)	Class(F)
Alumina(Al_2O_3)	16	26
Silica(SiO_2)	40	55
Calcium oxide(CaO)	24	9
Ferric Oxide(Fe_2O_3)	6	7
Magnesium oxide(SO_3)	2	2
Sulfate oxide (SO_3)	3	1
Loss of ignition(LOL)	6	6

And has a size close to the size and ranges between (100-10) microns, Potassium, sodium, sometimes and to a small degree American Coal Ash (2016). The fly ash used in the process of stabilizing the soil based on its chemical composition is classified into two main classes. (Non self-cementing) It is a non-self-cementing substance (F) It is a self-cementing material (C), C618 (2003) ASTM proposed the chemical composition of each variety, which is shown in Table No. (3). Class C contains an adequate amount of Ca0 no less than 20%, and the remainder of its chemical composition consists of silica and alumina in addition to other chemical compositions. In small proportions, therefore, when mixed with water, the hydration reaction will occur similar to that which occurs for cement when mixed with water, and this reaction produces an ammonia that will in turn interact with the Pozzolani materials present in the fly ash, which is silica and alumina for the events of the Pozzolani reaction. The clay (F) contains a small amount of inflorescence (Ca) less than 10%, and the remainder of its chemical composition is mostly composed of silica and alumina in addition to other chemical compositions in small proportions. The interaction of these Pozzolani materials requires this to be strained A chemical provides the nucleus Ca0 for the events of the Pozzolani reaction. Therefore, it is necessary to add lime or the cement with this type of fly civet to complete the Pozzolani reaction, the art of hydration reactions and Pozzolani reactions that occur about mixing time. Volatile with water will produce the bonding material that links the soil particles with each other to improve the properties of resistance. The reactions that occur when fixing the soil with fly ash varies greatly and depends mainly on the type of fly ash used in its chemical composition in general, the class (C) reacts quickly after a process Hydration, while classifying (F) and added with cement or inflorescence produces slow reactions compared to the use of inflating or cement in fixation, [6]. Table (3) shows the chemical composition of fly ash in its two varieties, ASTM Anal Book of ASTM Standards (2003), From the table it can be seen that the CaO content as an alternative material in soil stabilization is more economical, due to its Pozzolani properties which gives an opportunity for practical applications to use it as an alternative, Senol et al. (2006), The amount of fly ash used in research ranges from 5-20% as a percentage of dry soil weight.

3. MOST IMPORTANT RESULT OF PREVIOUS STUDIES

1.Cement

Huat et al., (2005), conducted studies on the effect of cement and lime additives on mechanical properties) soil (Peat) is a soil that contains a high content of organic matter. The researchers studied the effect of extending the ripening, cement content, and lime in addition to the organic matter content and its effect on the compact properties and resistance to unconfined compression, different percentages of Portland cement prep and the extinguished inflorescence were added between (5-15% and 5-25%) of the weight of dry soil, respectively. The liquidity limit of the soil, but with regard to the compacting properties, they found that the dry bone density (MDD) increases, while the optimum moisture content (OMC) decreases. The percentage of organic matter is high in the soil, it negatively affects the positive effect of chemical additives (cement and lime) on improving the mechanical properties of the soil.

Sas and Gluchowski,. (2013), showed that the effect of cement fixation on the mechanical properties to show it coherent clay. Different percentages of cement ranged between 2-8% of the weight of the silty soil containing clay on sandy silt and sand. Dry and study their effect on the soil compacting properties. Likewise, the compression resistance of soil cement-cement models was studied in different ripening periods (7 and 28 days) for submerged and non-submerged models. The researchers found that the maximum dry density increases from (2.25-2.18) g /cm^3, and the moisture content from (7.10-11.5%) when increasing the ratio Cement of 82%. Likewise, the ripening period has a significant effect on the soil compression resistance, especially for the ones not restricted to water. The compression resistance of these models increased from (1047-2838) kpa when the ripening period changed from (7-28) days. Pandey and Rabbani, (2017), also showed that The effect of cement on sandy soil containing silt and clay on some geotechnical properties, which included the characteristics of plasticity, compactness, and resistance to unconfined compression, and the effect of different integration times on properties of resistance, various percentages of features ranged from Between (51%) of the weight of the catching soil. The researchers noted that there is an increase in the limits of the strength with the increase in the percentage of added

cement, while the guideless of the plasticity remains roughly constant. They also found that the soil resistance increases clearly with the increase in the ratio of cement and the ripening period of the models fixed by cement. The value of non-tidal compression resistance increased from (700-80) kPa, when the cement ratio changed from (5-1%) for one-day ripening, while the value became (1070 kPa) when the models were examined after (14 days) of ripening.

2 .Lime

Hegde and Nadgouda,. (2010), and Vasaikar and Singh,.(2015), also found that swelling soil using different ratios of lime additives on the engineering properties of it, represented by the strength and compactness index and checking the caloric tolerance ratio and the percentage of bloating and bloating pressure. Also found that with the increase in the ratio of the added lime to the soil, the evidence of the strength of the soil and the plasticity index decreased. While the hardness of the soil increases with the increase of the percentage of added inflorescence. While the soil hardness increases with an increase in the percentage of inflorescence, while the optimum moisture content decreases slightly. As for the percentage of endurance cost, it was found that it increases clearly with increasing the percentage of added inflorescence and the duration of ripening, while the rate of swelling and pressure decreased significantly. The researchers also found that the optimum percentage of revolution used for this type of soil ranged between (4 – 3.5%) of the weight of dry soil .Sahoo and Sharma, (2012), founded that Effect of Addition of Both Inflorescence and Fly Ash on Resistance and Chemical Properties of Soil Clay at Molecular Level. The researchers found that the optimum ratio of fly ash was 20% by weight of dry soil. The researchers also found that the addition of fly ash adapts to the revolution and the possibility of using it together to stabilize clay soils. The researchers found that the optimum lime ratio was 8.5% of the dry soil weight to obtain the best resistance results. Like those, the researchers found that using fly ash alone to stabilize clay soils improves its geotechnical properties, but with less efficiency than using the inflorescence. Ahmed al et,. (2013), conducted studies on Improving the resistance properties of clay soils by using cement and lime additives together. Different proportions of cement and lime were added, ranging from (9-1) % of the weight of dry soil for a period of ripening (7.3 days). Soil compression resistance was examined Stabilization and shear resistance to soil, the researchers found that the shear resistance of soil cemented with cement or lime has increased significantly. They also found that shear resistance factors increase with an increase in the ratio of additives and ripening period. The seminal same for an additive, it was found that the first results were higher. Ochepo and Joseph, (2014), the researchers studied the contribution of a compound Oil to the properties of clay resistance. Different percentages of the inflorescences were added, ranged between 80% of the weight of the effect. The effect was studied: California percentage of period of ripening (4days), as well as the effect on the resistance of unconfined compression of different levels (7, 14 and 28). It was clear from the increase in the ratio of added revolution and the period of ripening. Respectively, while the percentage of decrease in the examination of California percentage was 35%, the researchers also noted that the negative effect of compounds on the resistance of clay soils stabilized with inflorescence decreases with increasing of the added percentage of ripening.

3.Ash Fly

Most of the fly ash that is added in stabilizing the soil is a secondary bonding material, as this single substance is not sufficient to give the desired results from improving the different engineering properties, therefore it is necessary to use an additional material such as or with chemical reactions on the required results. For example, class (F) fly ash is an inactive chemical substance unless cement is added or mixed with the mixture as a source of calcium previously . Shah et al., (2003), found that provoking the fixation of clayey soil containing the low-lying greenness and plasticity of different proportions of the inflorescence, cement or fly ash, as well as the contribution of vehicle oil to the engineering properties of it. The researchers found that using the fly ash cement mixture to fly ash clearly leads to an improvement in its engineering properties, the best results obtained when using the proportions of (10% -5% -5%) of the fly ash cement from dry soil weight, respectively. Likewise, the researchers have noted that the contribution of compound oil has improved the engineering properties of the soil, and the researchers have explained that the researchers have reasoned that the compound oil has facilitated the ion exchange, gathering and sintering reactions of soil particles with each other, in addition to Pozzolani interactions. Jongpradist et al,. (2012), showed that effect of adding different proportions of fly ash to cement and using and mixing in stabilizing clay soils and noticing their excitability on engineering soil properties by performing a series of unconfined compression and physical tests. The researchers noted that using an appropriate amount of cement, adding the fly ash to the cement and then using the mixture to stabilize the soil works efficiently to secure the resistance properties and other physical properties of the soil as the resistance frequency exceeds both the moisture content of the soil to a certain extent and the bonding material represented by cement. Ash Fly as well as the ripening period. But you have noticed researchers between the efficacy of fly ash added to the mixture depends on the proportion and that percentage of added cement and the moisture content of the mixture. Kalyanshetti and Thalange,. (2013) and Thomas et al., (2015) conducted studies on The effect of adding fly ash on the engineering properties of clay soils. The researchers note that adding fly ash improves soil properties. Likewise, the maximum soil density, and consequently its resistance, has increased, while the optimum moisture content and puffiness properties have decreased with an increase in the proportion of fly ash added to the soil. Kumar and Preethi,. (2014), studied that the effect of adding Nora and rice husks on the characteristics of stacking, and the resistance to a weak clayey soil base layer. Different percentages of the inflorescence and fly ash were added and their effects studied in addition to the different ripening times (4, 7 and 14 days). The researchers found that adding the fly ash inflorescence mix significantly increases the soil resistance properties represented by unconfined compression resistance tests and the Californian endurance ratio. The optimum percentage of fly ash inflorescence that the researchers found that gives the best results of resistance was 6% -10% by weight of dry soil respectively, and the researchers concluded that the thickness of the underlying soil layer could be reduced under the roads. Zuawi,. (2015), studied that the effect of stabilizing clayey soil with its use of both fly ash and cement on its geotechnical properties. Soil stabilization was studied using different percentage of F fly ash with a specified percentage of cement. The researcher found that adding the fly ash cement mixture to the soil has a significant impact on the properties of this soil. Where the researcher concluded that the optimum forgiveness of fly ash was 15% added to a percentage of cement, which is 5%

achieved as a result of a significant improvement in resistance and durability and reduce the allocation of swelling and plasticity similar to this type of soil. Mir,. (2015) , studied that the effect resulting from fixing puffy clay soil using both fly ash and lime on the physical and mechanical properties of it, where soil stabilization was studied using different percentages of fly ash type (C) and (F) with A specific percentage of the revolution, which was 85% of the weight of dry soil, and noting its effect on both the guiding properties and the characteristics of compactness, compression, permeability, and resistance. The researcher found that the soil properties improved significantly when adding the inflated mixture - the conjunctivitis to the soil as well as the operability of the soil. He also noticed that adding 10% of the fly ash to the inflorescence reduces the inflation rate by 40%. As well, the evidence of swelling and adhesion coefficient decreases with the increase of the ratio of fly ash added to the mix. Also, the uncountable compression resistance has increased significantly with the addition of the added fly ash percentage and production period. Finally, the researcher has noted that adding the first type of fly ash - class (C) is very useful in reducing soil permeability. Nath et al., (2017) showed that the effect of the addition of fly ash (C) and (F) on proving high-resilience organic clay soils. The researchers found that adding fly ash reduced the plasticity index for this soil. While liquidity limit and plasticity has increased, but to varying degrees. Likewise, both the resistance of unimagined compression and the maximum dry density of the soil have increased, while the optimum moisture content has decreased with the increase in the ratio of added fly ash, so the use of the first type of fly ash (Class C) gives a better resistance result compared to the second type (Class F) This is due to the ratios of the chemical composition of each type SiO2, CaO. Kaiet al,. (2020), conducted studies on the effect of MgO content in cement on improving unconfined compressive strength of unstable soils. The researchers used different levels of MgO in the cement content (7%, 10%, 13%, 17% and 20%) The researchers found that the MgO content had an effect on the strength of the stable soil, except for stress and strain stress capacity. Also, the researchers found that the optimum content of MgO cement content is 15 ‰.

3.CONCLUSIONS AND RECOMMENDATION FOR FUTURE WORKS

In this research, a quick review was presented of the most important findings of previous studies related to adding some chemical additives to the soil, which included the Nora, cement and fly ash in its two varieties. Accordingly, some observations are included and listed below.

1. Fly ash can be used to make a noticeable improvement in the chemical and engineering properties of soft soils. However, fly ash is a strong bonding material that cannot make a noticeable improvement in the soil properties individually, as it lacks calcium, especially in relation to violence (F). Therefore, an additional bonding substance such as lime or cement must be used to cause real chemical reactions between soil particles
2. Most of the researchers whose results were reviewed examined the effect of these additives on the chemical properties and the properties of stacking and resistance represented by examining unconfined compression and the cost tolerance ratio and its effect on the soil puffing properties. As for the effect of additives on joining properties, shear strength, hardness and hydraulic conductivity coefficients, it was not discussed by most researchers.
3. Research has limited the effect of additives on soft soils, but their effect on coarse soils is very limited.
4. As for the behavior of the soil that is proven with these chemical additives and the effect of their exposure to repeated loads, they are not addressed
5. ..5There are no field studies, but all studies are limited to laboratory tests only.
6. The current study recommends a researcher or a geotechnical engineer in looking at the main goal of using the chemical additive and using the most appropriate and most effective in improving the properties of engineering soil.

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