

REVIEW ARTICLE

Zeo Fertilizers and ZeO Soil conditioners an innovative tool for Management of Agriculture

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ABSTRACT

The advantages of network of micro porous structure of the zeolites can be utilized in the management of irrigation in the Agriculture field. In the present study they are successfully utilized in the manufacturing of "Zeo-fertilizers and Zeo-soil conditioners" in the farming sector for high agriculture yield. Zeo-fertilizers and zeo-soil conditioners are the boon to solve the present world's agricultural problems and hands in for solving the food demands. The Zeolite structures are everlasting host for micro nutrients and micro organisms and thus enhance the life of bio fertilizer when compared to the conventional fertilizers. Zeolites have high affinity for water, they contain water under normal conditions and release of wate takes place when pressure and/or temperature is high. India is a semi-arid country, hence the country in general and southern India in particular has very scarce rainfall. In Rayalaseema region of Andhra Pradesh situated adjacent to the east coast of southern India, the normal annual rainfall is around 93 mm, but every year deviation in the form of deficit is observed in this region. While Kadapa district of Rayalaseema region of Andhra Pradesh state has shown a deficit of -59% in annual rainfall in past few years. The present study is intended to minimize the water problem in the field of agriculture irrigation using micro porous zeolites. When the compost is mixed with the clinophyllitezeolite powder at a ratio of 70:30 and Zeolite Enriched Bio Fertilizer (ZEBF) is prepared, it extends the stability to the fertilizer for a long period and the nature of zeolite to hold water will provide humidity to the crop for a longer time during dry seasons resulting in plant survival, growth and extended crop yield.

Keywords: Zeolite, micro porous, adsorption, clinophyllite, bio-fertilizer

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INTRODUCTION

Natural zeolites are formed when volcanic rocks and volcanic ash react with alkaline groundwater. Zeolites crystallise in post depositional environments over periods ranging from thousands to millions of years in shallow marine basins. Open pit mining technique is used to mine the natural zeolites. During the processing the ore is crushed, dried and milled. The milled ore is classified based on the particle size and screened to separate fine material and granules, the fine material is pelletized for further utilization. In India Zeolites occur in deccan trap basalts in Maharashtra, Gujarat, Madhya Pradesh and Karnataka (Fig.1). Zeolites occur as secondary minerals in cavity filling, cracks, fissure, in rock like basalt lava flows. Zeolites have molecular dimension system of channels, windows or cages. The zeolite consists of framework of silicon, aluminium atoms and oxygen in the crystal lattice. If the crystal lattice is made up of aluminium atoms, it induces an electrical imbalance leading to a negatively charged framework. Zeolites are crystalline micro porous aluminosilicates with general formula of TO_4 , where T=Si, Al with 'O' atoms linking the adjacent tetrahedra. They have a uniform system of channels or windows or pores spaces of molecular size (Fig. 2). It depends largely on polarity of both adsorbent and adsorbate. In zeolites the ratio of Si:Al governs the polarity and the polarity determines the molecules that can be adsorbed. The polarity increases at Low Si: Al ratio and zeolite become hydrophilic. The zeolites are used for adsorption of variety of materials. These pore spaces measure an internal surface area of several hundred thousand square meters per kilogram. The pore size plays a major role in the separation of gases, ultra purification, storage and transport of unstable gases. Zeolites are multi application minerals due to their exceptional structure of molecular pores that show varied properties like adsorption, ionic exchange, catalysis, sieving, polarity, shape selectivity [1-4]. Some zeolites like "Clinophyllite" have a high affinity for water. This is shown by an adsorption capacity which may reach 30% by its weight without any volume

modification. Release of water takes place when pressure or temperature or both become high. In other processing conditions, adsorbed water naturally returns when the environment becomes too dry. This reversibility of water adsorption according to the hydric balance turns zeolites into some perfect humidity stabilizers. The conventional biofertilizers are prepared by inoculation of micro organisms along with 30% of moisture content for the survival of the micro organisms. But exhaust of biofertilizer depends on the life of micro organisms which in turn linked with the moisture content. Zeolite biofertilizer with included water content will help bacteria survive longer as much as three times of the regular period its life. Further, by using zeolites mixed with the fertilizers or with the soil will provide water supply to the agriculture three times more than the traditional methods of irrigation.

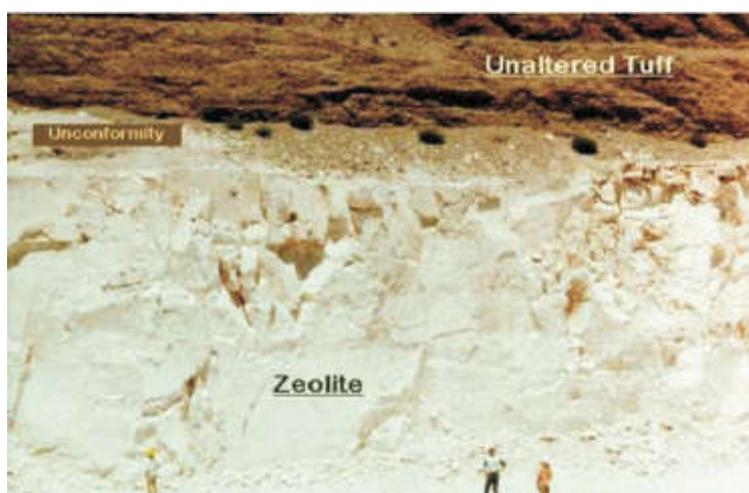
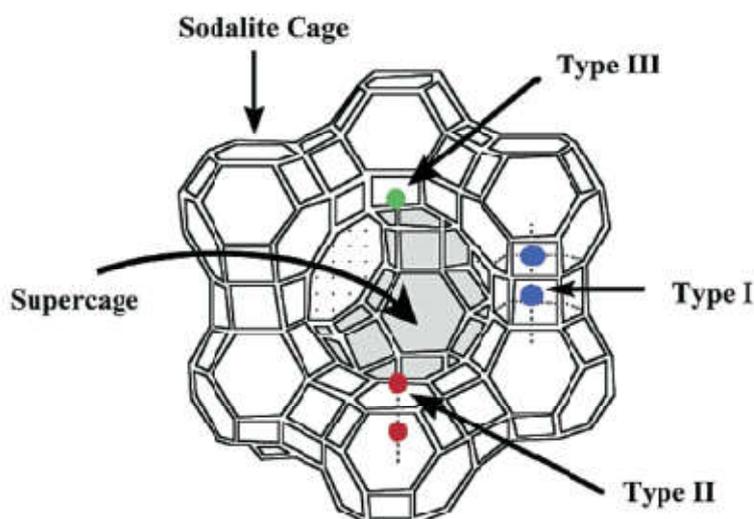


Fig.1 Zeolite in the Field

Fig. 2 Showing zeolite structure



RESULTS AND DISCUSSION

The conventional biofertilizers are prepared by inoculation of micro organisms along with 30% of moisture content for the survival of the micro organisms. The exhaust of these biofertilizer depends on the life of micro organisms which in turn linked with the moisture content. Zeolite biofertilizers of different micro organisms can be prepared by addition of cultured bacteria at the rate of 9×10^5 cells/ml with 1 Kg. wet bio-waste, 200 gm of zeolite powder of 20 mesh. The zeolite in this context will act as host for bacteria, nutrients of bacteria and to keep moisture content for longer period. The micro organisms such as Chlorella, Anabaena, Nots, Rhizobium, Azitobacteria, Azospirilum and Ecomycorrhiza are used to prepare respective biofertilizer. The presence of zeolite powder helps in storing and maintaining the moisture content for a longer period nearly more than 3 months when compared to the conventional biofertilizer. In general alkaloids and fatty acid salts are natural pest repellents used by the plants. The

addition of zeolite, clinophyllite powder and micro organisms like Trichoderma, Psuedomonas, Bacillus, Paecilomyces to bio-waste increases the strength of bio pest repellent. The zeolite will act as host for bacteria, nutrients of bacteria and to keep moisture content for longer period. The zeolite biopesticide can be prepared in the form of liquid or solid for better application. The zeolite bio pesticide is prepared by in the ratio of 1 Kg wet bio-waste with cultured micro organisms at a count of 9×10^5 cells/ml and 200 gm of zeolite clinophyllite powder. In case of dry bio-waste water should be added to attain 30% of moisture to the mixture. The zeolite bio-pesticide is diluted in the ratio of 1:5 with water and sprayed on the crops as pest repellents. Further the existence of zeolite prevents the runoff of the nutrients during rains [5].

CONCLUSION

Zeolites occur as secondary minerals in cavity filling, cracks, fissure, in rock like basalt lava flows. In India Zeolites occur in Deccan trap basalts in Maharashtra, Gujarat, Madhya Pradesh and Karnataka. Zeolites have molecular dimension system of channels, windows or cages. The zeolite consists of framework of silicon, aluminium atoms and oxygen in the crystal lattice. If the crystal lattice is made up of aluminium atoms, it induces an electrical imbalance leading to a negatively charged framework. Zeolites are crystalline micro porous aluminosilicates with general formula of TO_4 , where T=Si,Al with 'O' atoms linking the adjacent tetrahedra. They have a uniform system of channels or windows or pores of molecular size. The conventional irrigation system requires seasonal rainfall and continuous supply of water. Natural biofertilizers require moisture for its long term subsistence and for the survival of micro-organisms for their survival for longer period. In developing countries like India, where the semi-arid conditions exist, an alternate system is needed to overcome these problems. An efficient and unique system to overcome these problems is to use zeolite biofertilizers and zeolite soil conditioners. Addition of zeolite powder to the biofertilizers keep moisture remain for longer period and thus keeping the micro organisms live longer than they do in natural biofertilizers. The zeolite bio pesticide is prepared by zeolite clinophyllite powder and diluted in the ratio of 1:5 with water, sprayed on the crops as pest repellents. Further the existence of zeolite prevents the runoff of the nutrients during rains. Zeolite powder mixed with soil to prepare soil conditioners. These zeolite soil conditioners have high affinity for water. Their adsorbing capacity may reach 30% by its weight without any volume modification. Release of water takes place when pressure or temperature or both become high. In other processing conditions, adsorbed water naturally returns when the environment becomes too dry. This reversibility of water adsorption according to the hydric balance turns zeolites into some perfect humidity stabilizers. Such advantages of zeolites thus mirror that zeo-fertilizers and zeo-soil conditioners are the boon to solve the present world's agricultural problems and hands in for the solving of food demands.

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