International Core Journal of Engineering Volume 8 Issue 3, 2022
ISSN: 2414-1895 DOI: 10.6919/ICJE.202203_8(3).0007

Mechanism of Sand Fixation by Arsenic Sandstone Compounded with Sand

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Abstract

In order to deeply study the soil formation mechanism of arsenic sandstone and sand compound, to better reveal the scientific theory of soil formation, and to provide stronger theoretical support and scientific basis for the sustainable and stable development of compound soil. In this study, we explored the mechanism of soil formation from physical, chemical, biological and microscopic levels. The sand fixation mechanism of arsenic sandstone and sand compound soil mainly includes mechanical, particle surface modification sand fixation, crustal sand fixation and biological sand fixation, mainly through increasing the surface roughness, reducing the shear force of erodible bed surface, reducing the direct action area of wind and sand, cohesive particles themselves and organic material to produce cementation, changing the water film on the surface of sand particles to continuous film water, reducing wind disturbance and promoting vegetation growth, etc. Sand consolidation effect.

Keywords

Mechanism; Sand Fixation; Arsenic Sandstone.

1. Introduction

With the growth of population and economic development, the intensity of land development and utilization has been increasing, and the contradiction between human and land has been accentuated, so the task of expanding arable land and building high-yield farmland is imminent. Since the land in Guanzhong Plain of our province has been developed to a large extent, there is little potential to enhance the arable land area, and it is difficult to cultivate the hilly areas in southern Shaanxi, so we set our eyes on the Loess Plateau in northern Shaanxi, which has a vast area. There, the land area is vast, but due to the effects of wind and sand erosion, soil erosion, etc., the land is barren and the food production is not high. [1] For local people, the land is infertile because of two hazards: first, the land is mainly sandy; second, arsenic sandstone, known as "environmental cancer", is widely distributed in the area [2-4]. The sandy land leaks water and fertilizer severely; the arsenic sandstone is hard as stone without water and soft as mud with water, which is easily lost by water and wind erosion. However, combining the two, using the good water and fertilizer retention property of arsenic sandstone and the strong permeability of sandy land, the research proposed the core technology of arsenic sandstone and sand compound soil construction and its engineering application, which not

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only solved the problem of "two hazards", but also made the sandy land into a rich back resource for arable land development in our province, with good social, economic and ecological benefits [5]. It has good social, economic and ecological benefits [5-7]. In order to deeply study the mechanism of soil formation of arsenic sandstone and sand compound, to better reveal the scientific theory of soil formation, and to provide stronger theoretical support and scientific basis for the sustainable and stable development of compound soil. In this study, the exploration of soil formation mechanism of compound soil was carried out at physical, chemical, biological and microscopic levels.

2. Mechanism of Sand Fixation

2.1 Mechanical Sand Fixation

After crushing, the size of arsenic sandstone clods still reaches the level of gravel, and after covering it on the surface of sand, it is equivalent to adding a layer of gravel protection, which is an effective sand fixation measure. Arsenic sandstone increases the surface roughness, absorbs and dissipates the surface wind momentum, reduces the shear force on the erodible bed surface, and the arsenic sandstone covers the surface layer of wind-sand soil, reduces the area of direct action of wind and sand, forms protection for the surface, and finally enhances the wind erosion resistance of the compound soil.

2.2 Sand Fixation by Particle Surface Modification

The cementation process of soil particles is related to the formation of soil agglomerate structure. The multilevel agglomeration process of soil agglomerates includes various chemical and physicochemical interactions, such as colloidal cohesion, bonding and cementation, as well as the complex action of organic-mineral colloids, with the participation of organisms (plant roots, microorganisms and some small animals). Colloidal grains stick to each other and form microagglomerates, and single grains and microagglomerates can form compound grains, microagglomerates at various levels (microagglomerates) as well as agglomerates (agglomerates) by various cementation interactions.

Arsenic sandstone minerals are mainly quartz, feldspar, montmorillonite, etc., and a small amount of calcite, dolomite, illite and kaolinite. Among them, clay minerals such as montmorillonite, calcite, illite and kaolinite are the main inorganic cementing materials of arsenic sandstone. When arsenic sandstone is mixed with sand, the cementing materials such as carbonate minerals and calcium montmorillonite present in arsenic sandstone will attach to the surface of sand grains and fill in the pores of sand grains, promote the adsorption between sand grains and clay and powder grains in arsenic sandstone, and form a better agglomerate structure [10-12]. The cementation between arsenic sandstone and sand includes the chemical bonding of inorganic substances, the bonding of the clay grains themselves and the cementation of organic substances (humus, root secretions, mycelium, etc.).

2.3 Biological Sand Fixation

Biological sand fixation is an important part of the sand fixation effect of arsenic sandstone and sand compounded into soil. With the gradual improvement of soil quality, the improvement of vegetation conditions on the surface of the compounded land, the enhancement of soil biological activities, the reduction of surface wind speed by surface plants, the exertion of external stress on soil aggregation by underground root systems, the further improvement of soil structure by root secretions and soil organisms, and the enhancement of soil stability, together constitute the biological sand fixation effect.

Cultivation activities in the field make a large number of root tissues form in the newly formed soil, exerting external stress for soil aggregation, and forming inter-root microdomains, which are conducive to enhancing soil biological activity, constituting a stable and sustainable biological sand fixation effect. According to the erosion characteristics of the project area, the protective forest adopts a "net-like" arrangement, forming a vertical and horizontal protective forest belt, supplemented by shrubs such as sea buckthorn and salal, forming a three-dimensional wind and sand fixation system.

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3. Conclusion

The sand fixing mechanism of arsenic sandstone and sand compounded into soil mainly includes mechanical, particle surface modification sand fixing, crustal sand fixing, biological sand fixing aspects, mainly through increasing the surface roughness, reducing the shear force of the erodible bed surface, reducing the direct action area of wind and sand, clay particles themselves with organic material to produce cementation, changing the surface water film of sand particles into continuous film water, reducing wind disturbance, promoting vegetation growth and other ways to reflect Sand consolidation effect. After compounding, the interaction between arsenic sandstone and sand soil particles, soil agglomerates are formed, and the stable agglomerate structure can greatly enhance soil stability, while giving the soil good air permeability and water retention, which is conducive to vegetation growth. At the same time the enhanced water holding capacity leads to a large number of hydrogen bonds after freezing, and the single grains of sand are glued into a protective shell, separating the direct contact between airflow and loose sand surface, thus playing a role in preventing wind erosion. With the improvement of soil structure, the improvement of vegetation condition on the surface of the compound land, the enhancement of soil biological activities, the reduction of surface wind speed by surface plants, the application of soil agglomeration external stress by underground root system, the further improvement of soil structure by root secretions and soil organisms, and the enhancement of soil stability, together constitute the biological sand fixation effect.

Acknowledgments

The authors are grateful for financial support from The Opened Fundation of the Shaanxi Provincial Key Laboratory of Land Consolidation (2019-JC07); Natural Science Basic Research Program of Shaanxi (2021JZ-57).

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