

# Research Progress of Composite Soil Formation Technology of Soft Rock and Sandy Soil

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## Abstract

**As a new sand control material, soft rock can effectively control the Mu Us sandy land. It can also plant economic crops while fixing sand, and has good economic benefits. In order to popularize the application of this technology, this paper summarizes and analyzes the research progress of the composite soil technology of Soft rock and sand from the material composition and structure research, water holding capacity research, ratio technology and sand fixation effect research, so as to point out the direction for further research.**

## Keywords

**Soft rock; sandy soil; compound soil.**

## 1. INTRODUCTION

The composite soil formation technology of soft rock and sandy soil is to reconstruct the pore and structure of sandy soil according to the scientific compound proportion by using the complementary characteristics of the structure and properties of soft rock and sandy soil, so as to make it a "new soil" suitable for crop growth. In 2008, Shaanxi land engineering construction group (formerly Shaanxi real estate development and Service Corporation) combined with Xi'an University of technology and other units, reversed the traditional thinking of preventing and controlling land desertification into soil. On the basis of traditional sand control, it carried out indoor experiments on particle size structure of soft rock and sandy soil, plot planting test in Fuping pilot base, and field test in dajihan Township, Yulin city The main contents of the study are sand grain size distribution, soil fertility, water-saving irrigation, integration of water and fertilizer, vegetation screening and cultivation, etc., to explore the scientificity of "the material structure and performance of soft rock and sandy soil are complementary, and the cultivated soil is compounded", and the comprehensive remediation and rational development and utilization mode of artificial rapid soil formation of sandy land are developed, and the utilization of Soft rock resources and the ecology of sandy land are realized government. In 2011, Shaanxi Provincial Science and Technology Department organized experts to identify the achievements of the project "core technology research and engineering demonstration of soft sandstone and sandy soil composite soil in Mu Us sandy land". The appraisal committee, composed of academicians Liu Changming and sun Jiulin, considered that the "two harms" of Soft rock and sandy soil have been changed into "one treasure", realizing the resource utilization of sandy

land, and forming a new mode of comprehensive soil and land consolidation integrating water-saving and high-efficiency high-standard farmland construction and modern management. The research results of the composite soil formation technology of Soft rock and sandy soil have been carried out in Mu Us sandy land. Up to now, 9300 hm<sup>2</sup> of Mu Us sandy land has been renovated with this technology, and 8700 new cultivated land has been added. The technology has the advantages of local materials, low engineering cost, high income and high public recognition. The colloidal quality and stability of soft sandstone transplanted to sandy land is excellent and stable, and the improvement effect of ecological environment is obvious, which promotes the scientific and technological progress in the field of land consolidation, and makes great progress in the ecological remediation of unused and sandy land and the resource utilization of Soft rock.

## **2. STUDY ON MATERIAL COMPOSITION AND STRUCTURE OF SOFT ROCK AND SANDY SOIL**

Soil is mainly composed of solid, liquid and gas. The solid phase includes various granular minerals, organic matter, soil organisms, etc. the liquid phase is mainly water (liquid material), and the gas phase is mainly the air in the soil pores. These three kinds of substances are interrelated and restricted each other, forming an organic and complex contradictory unity. They are the basis of soil characteristics and crop growth. Soil structure mainly includes soil particles and aggregate structure, among which soil particles are the basic material to form soil solid skeleton, and aggregate structure is the basic physical structure of soil fertility that can't be ignored. According to the characteristics of single particle structure and large pores of sandy soil, Han Jichang et al. based on the complementary characteristics of sandy soil such as poor structure, water leakage and fertilizer leakage, high clay content of soft rock and water swelling, they found that the particle structure of soft rock and sandy soil were complementary [1], and they compounded them according to different proportions. Zhang Lu et al. found that the composite soil presented different particle size range [2], it can improve the grain structure of sandy soil. In the experiment of crop planting, Chai Miao et al. analyzed the soil organic matter and yield after two seasons of planting. Before planting, the organic matter was less than 0.5[3]. Li Juan et al. studied the differences of the mixed soil after three seasons of planting, and found that the gravel content of the surface soil of the composite soil decreased, and the silt content increased [4]. Zhao Tong et al. studied the aggregate change of different proportions of soft rock and sandy soil after planting crops for 4 years 0.25 ~ 2.00 mm in 1:2, 1:5 were increased, and the compound ratio was more conducive to the formation of aggregates [5]. Zhang Haiou et al. Studied the changes of aggregate structure and organic matter of soft rock and sandy soil under freeze-thaw alternation, and found that freeze-thaw alternation can increase the content of small aggregates less than 0.5 mm and decrease the aggregates of more than 1 mm, and the change of organic matter content is extremely significant [6]. Luo Lintao et al. measured the heavy metal content of Soft rock [7], sand and the composite soil of soft rock and sandy soil by inductively coupled plasma mass spectrometry (ICP-MS). It was found that the content of heavy metals (Cr, Ni, Cu, Zn, as, CD, Pb) in soft rock was higher than that in sand. The heavy metal content was slightly higher in Soft rock and sandy soil, and the single pollution index of heavy metals in composite soil, soft rock and sand was less than 1. It is shown that Soft rock is an environmentally safe soil forming material.

## **3. STUDY ON WATER HOLDING CAPACITY OF SOFT ROCK MIXED WITH SANDY SOIL**

Soil water is one of the most important components of soil, which has a vital impact on the development and formation of soil and the flow of material and energy in soil. At the same time,

soil water is also an important material basis for crop growth. The characteristic of sandy soil is "leakage of water and fertilizer". The study on the water holding capacity of the mixture of Soft rock and sandy soil an important index for improving sandy soil. Through laboratory tests, Zhao Xiaoyan et al. studied the infiltration characteristics, saturated hydraulic conductivity and water characteristic curve of the mixed soil of soft rock and sandy soil under different bulk densities. It was found that when the ratio of Soft rock to sandy soil was 25:75, the water absorption and water retention of the composite soil were better [8]. Zhang Lu et al. Found that the higher the content of Soft rock, the better the soil water holding capacity after compounding [9]. Sun Yingying et al. found that the Soft rock can significantly improve the water holding and water storage capacity of sandy soil [10]. Wang Huanyuan et al. compared and analyzed the hydraulic parameters prediction of Soft rock and sandy soil composite soil with Hypres and Rosetta transfer functions, and found that Rosetta model has good prediction for the composite soil, which can optimize the farmland irrigation management mode [11].

#### **4. STUDY ON THE MIXING RATIO TECHNOLOGY AND SAND FIXATION EFFECT OF SOFT ROCK AND SANDY SOIL**

The results show that the mixed soil of soft rock and sandy soil has different physical and chemical properties, which affects the growth of crops. Han Jichang et al. compounded the Soft rock and sandy soil according to 1:0, 5:1, 2:1, 1:2, 1:5, 0:1. Through indoor, pot, plot and field experiments, the authors put forward that 1:2 is suitable for planting corn, soybean and wheat, and 1:5 is suitable for planting potato compared with technology [1]. In situ monitoring of soil moisture, crust, depth of frozen layer, surface roughness, snow melting and other indicators of sand fixation effect were observed by Tong Wei et al, when the ratio of Soft rock and sandy soil 1:1, the effect of sand fixation is particularly obvious. The crust thickness can reach 9.0 mm (sand < 2 mm), the depth of frozen layer is 116 cm (sand 98 cm), and the roughness is 0.174 (sand 0.031) [12]. Cheng Jie et al. have studied the particle size composition, water content change and crust thickness of Soft rock and sandy soil, and found that after the mixture of Soft rock and sandy soil, the water holding capacity of sand soil is enhanced, the formation of crust is enhanced, and the sand fixation effect is achieved [13]. Li Yurui et al. observed that there were rich clay groups on the surface of composite soil particles by using 1000 times scanning electron microscope, which improved the loose structure characteristics of sandy soil, so as to achieve the effect of water holding and sand fixation [14].

#### **5. CONCLUSIONS AND SUGGESTIONS**

To sum up, the study of using soft rock as sandy land restoration has also made great progress. The technology of composite soil formation of soft rock and sandy soil not only greatly improves the ecological environment of Mu Us sandy land, but also effectively increases the cultivated land area. However, in a long time series, the microstructure evolution, mechanical structure and ecological restoration effect of the composite soil need to be further studied.

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