干拓農地における高分子凝集剤を用いた土壌侵食低減に関する研究

Implementation of Polyacrylamide to control wind erosion and dust generation from the reclaimed agricultural lands

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Introduction

Reclaimed agricultural lands are vulnerable to wind erosion due to geological characteristics, such as the coastline location and mostly sand and silty sand soil texture. Particularly, during the winter with no vegetation, much topsoil is eroded and eventually causes environmental pollution. Therefore, this study aimed to apply Polyacrylamide as a soil conditioner to topsoil and assess its effect on soil erosion control through wind tunnel experiments.

Materials and methods

1. Description of study area

The study area is Gwangwal district which locates in Western area of South Korea. This district was developed for the purpose of agriculture in 2017 and it belongs to the fifth reclaimed district within the biggest reclaimed area in South Korea. Its soil texture is loamy sand (Sand 76.7%, Silt 20.3%, Clay 3.3%).

Fig1. Location of study

2. Polyacrylamide

Polyacrylamide (PAM) is well known for its effects on increasing soil aggregation, increasing aggregate and structure stability of soils thus leading to stabilization of the soil surface against wind. Due to its favorable characteristics, it has been implemented in agricultural area to improve soil physics, reduce soil erosion and protect agricultural infrastructure. In this study, two types of PAM product (D, R), which were selected through the Jar test, were used to treat to topsoils and evaluate its effect on wind erosion control through wind tunnel experiment.

3. Effect of wind erosion

Soil collected from the Gwangwal district was filled in soil containers of the same size and different concentrations and amounts of PAM were treated. The wind tunnel experiment was carried out under the wind condition of 12 m/sec which was the maximum wind speed monitored for the past two years.

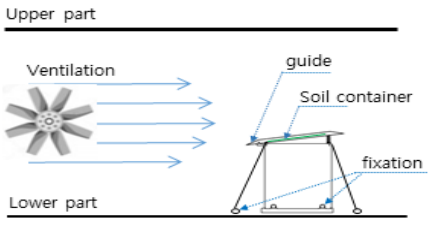

Fig2. Wind tunnel experiment

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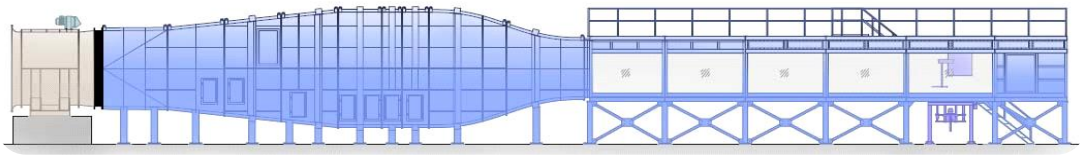
The timely dependent soil samples detached from the soil surface were collected and measured the weight changes for five minutes. A series of experiment under the different condition were repeated.

· Size of soil container: 50×50×2cm, · PAM concentration: 30, 50ppm
· Amount of PAM spraying: 0.1, 0.5, 1.0mm
· Wind speed: 12m/sec(highest wind speed for the past two years)



· Type: Eiffel type boundary layer wind tunnel
· Test Section size: 3m(width)×2m(height)15m(length)

Fig3. Schematic of wind tunnel

Results and Discussion

1. In case of PAM treatment of 0.1 mm (30, 50ppm), the amount of soil eroded was 39.80~41.46%, which was no difference with the control (no PAM treatment).
2. However, the amount of soil eroded under the conditions of 0.5mm treatment with PAM 50ppm and 1.0mm treatment with PAM 30ppm did not show the significant difference.
3. The comparison between 0.5mm and 1.0mm of PAM treatment showed that the difference of soil eroded were ranged from 0.18 to 0.54% (less than 1.0%), which indicates that they are very effective to reduce the amount of soil eroded from the soil surface. Therefore, this study concluded that optimal treatment of PAM in reclaimed land is above 0.5 mm.

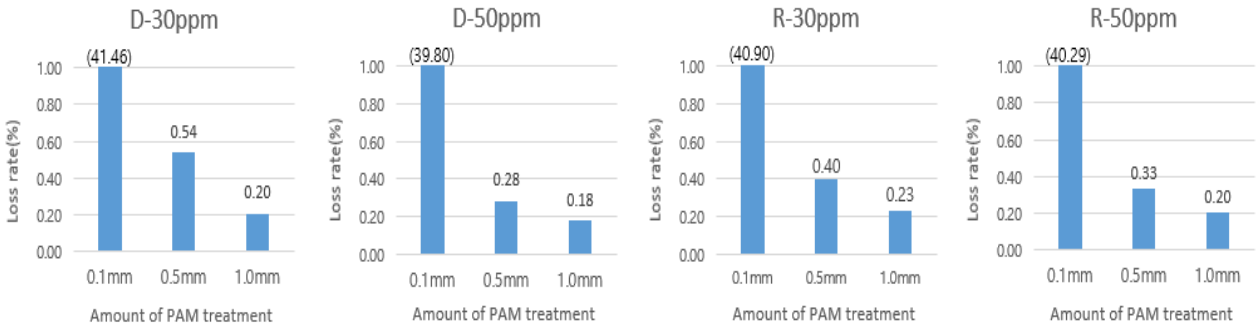


Fig4. Results of wind tunnel experiments

Conclusion

This study investigated the implementation of PAM to reduce wind erosion occurred in reclaimed land. Overall, the findings of this study showed that it was very effective to control wind erosion only by spraying 0.5mm of PAM with the concentration of 30ppm. Further study will continue to conduct additional experiments in actual reclaimed area to enhance its applicability.

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