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Investigating the Effects of Two Emulsion Mulch Types on Soil Properties: A Case Study of Aran and Bidgol Desert Areas

Hajar Merrikhpour[1*], Seyedeh Bahareh Azimi[2], Jalil Badamfirooz[3], Shahabadin Montazami[4]

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Extended Abstract

Introduction: Wind erosion and thunderstorms bring about significant adverse consequences, including air pollution, reduced visibility, wear and tear of industrial machinery, soil structure destruction, and adverse effects on soil fertility. In recent years, the aerosol pollution caused by sand storms has turned into a serious health threat for Iranian people. In addition to being detrimental to human health, the adverse consequences mentioned above will also cause many problems for ecosystem processes. That is why the fight against erosion has received worldwide attention. The application of mulch is a method widely used to control wind erosion and stabilize sand grit and dust hotspots. Mulch is defined as any natural and artificial material that is promoted and applied to the soil surface together with crop residues, plastic films, asphalt, emulsion mulch, oil, petroleum residue, nano-clay matters, and livestock manure. Therefore, this study sought to examine the chemical properties of soils covered by two emulsion mulches.

Materials and Methods: This experimental study was conducted in some parts of large desert areas located in Aran and Bidgol counties. The treatment items examined in this study were the type of mulch, time of mulch application, and soil depth. In addition to harvesting soil samples covered with mulch, control soil samples were also collected for comparison. PH, EC, concentration of cations (Ca, Mg, K and Na), and anions (NO_3, HCO_3, SO_4, Cl) were other parameters examined in this study.

Results and Discussion: The results showed that the application of emulsion mulch reduced the soil's pH and EC. In fact, reducing soil salinity leads to a decrease in soil cations and anions concentration, providing suitable conditions for plant growth and establishment by maintaining moisture and reducing evaporation. It was also found that moisture in soils covered by emulsion mulches was significantly higher than that of the control soil during the study period (12 months), reducing the concentration of cations. Considering the fact that the presence of emulsion mulch in the soil surface leads to a decrease in its concentration of cations compared to that of the

1 Assistant Professor of Soil Science, Agricultural group, Sayyed Jamaleddin Asadabadi University, Asadabad, Hamedan, Iran, hajar.merrikhpour@gmail.com

2 Assistant Professor of Research group of Environmental Assessment and Risk, Research Center for Environment and Sustainable Development, RCESD, Department of Environment, Tehran, Islamic republic of Iran

3 Associate Professor of Research group of Environmental Economics, Research Center for Environment and Sustainable Development, RCESD, Department of Environment, Tehran, Islamic republic of Iran

4 Research group of Biodiversity & Biosafety, Research Center for Environment and Sustainable Development, RCESD, Department of Environment, Tehran, Islamic republic of Iran

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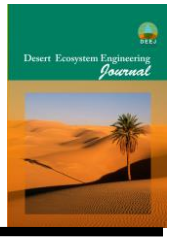

control soil, this study's analysis of the dominant sodium cation in soil showed a significant decrease in treatment mulch compared to that of the control mulch. Moreover, the concentration of chlorine and sulfate anions was found to have decreased after the application of emulsion mulch, resulting in the creation of suitable conditions for plant cultivation in the region. In contrast, the study found that bicarbonate concentration in the soil increased due to the presence of carbon in the emulsion mulch structure compared to that of the control soil sample.

Conclusion: There was a significant decrease in the amount of salinity in the soil treated with both types of mulch compared to the control soil that received no mulch, the amount of which increased over time. The main reason for the reduction of salinity in the soil treated with the two types of mulch could be the reduced water evaporation from the soil surface caused by an increase in the soil's moisture. Code 1 emulsion mulch was more efficient in maintaining the soil moisture than the other type of mulch. Increasing moisture affects the soil's aggregation by increasing the adhesion between particles and, therefore, the velocity of wind erosion threshold will be decreased. Furthermore, the study found a decrease in the pH of the soil covered by mulches. This decrease in pH was more evident in surface samples, indicating a relative decrease in pH than that of the subsoil. As soil salinity decreases after mulch application, the concentration of cations is also expected to decrease. Among the cations examined in this study, the soil's dominant sodium cation suggested a significant decrease in treated emulsion mulch compared to that of the control mulch. Possessing a lower sand percentage, Code 2 emulsion mulch was found to have a more decreasing effect on the cation concentration after 12 months of its application. The study's results also revealed a reduction in the concentration of all studied cations, which occurred 12 months after the application of Code 2 emulsion mulch, while the concentration of the cations had not changed after six months of the application of the mulch.

The study also found that chlorine and sulfate anions significantly reduced in the studied anions of the treated soils. The final results of this study suggested that both types of applied mulch could contribute to reducing the effects of harmful cations and anions on plant growth and that the application of the mulches would allow more plants to be grown in such areas. Moreover, the results of long-term tests showed the efficacy of the two applied mulches in terms of their stability.

Keywords: Soil Salinity; Soil Cations and Anions; Wind Erosion; Emulsion Mulch.