



Investigating the Effects of Petroleum Mulching on Soil's Physico-Chemical Properties

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Extended Abstract

Introduction: Considered the habitat of a large number of living organisms, the soil is regarded as one of the most significant resources for fulfilling the essential needs of human beings, whose destruction brings about lots of damage to various aspects of the organisms' life.

As a natural phenomenon occurring in soils with sparse vegetation where the wind blows at high speed, wind erosion is a highly influential contributing factor to soil degradation, covering one-third of the world's lands. On the other hand, wind erosion-induced detachment of the surface soil and the movement of quicksand causes enormous damage to various aspects of human life. Meanwhile, arid and desert areas are more subject to the damage incurred by wind erosion and the influx of quicksand.

Various methods have already been used to contain wind erosion and prevent its damage, including biological, mechanical, and soil fixation methods. However, in some areas where biological operations are difficult to perform, mulching is initially used to temporarily stabilize the region. In this regard, petroleum mulching has been the most commonly used method in Iran since 50 years ago. Nonetheless, some experts believe that petroleum mulching increases soil temperature, raises heavy metals and hydrocarbons, intensifies groundwater and environmental pollution, decreases permeability, and inflicts harm on plants and animals. On the contrary, some other scholars argue that not only does petroleum mulching pollute the soil but also increases vegetation, animal population, and consequently the soil's microbial population by raising the soil's temperature and increasing its moisture. However, adding petroleum mulch to soil raises concerns about polluting the soil with petroleum materials and altering the soil's physicochemical properties.

Materials and Methods: This study used the soil samples collected in three replications from the 0-5 cm and 5-10 cm depths of both the control area and Hamidiyeh city's sand dunes, Khuzestan province,

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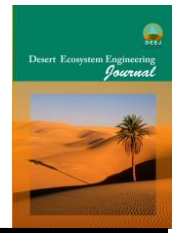
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that had been mulched for short-term (less than 5 years), medium-term (5-20 years), and long-term (more than 20 years) to investigate the physicochemical properties of the soil. The samples were then transferred to a laboratory where the soil's physical properties, including the texture, true specific gravity, temperature, and humidity, and its chemical properties, including EC, pH, chlorine, carbonate, bicarbonate, calcium, magnesium, lime, phosphorus, sodium, potassium, and the sodium adsorption ratio were examined and analyzed using the SAS software.

Results and Discussion: The results revealed that while petroleum mulching caused significant changes in the soil's temperature, moisture, chlorine, bicarbonate, potassium, EC, and pH, it exerted no influence on the soil's texture, calcium, lime, and sodium absorption ratio. It was also found that due to its black color, petroleum mulch absorbs sunlight and increases the soil's surface temperature, decreasing the soil's permeability and moisture with its greasy hydrophobic nature. Moreover, the study found that compared to the control area, petroleum mulching increased the amounts of the soil's EC, bicarbonate, phosphorus, and potassium, and reduced its magnesium, chlorine, true specific gravity, and sodium in some areas.

Taking the above-mentioned results into consideration, it could generally be argued that in addition to influencing the soil's physicochemical properties, petroleum mulching makes significant changes in the moisture, temperature, true specific gravity, pH, EC, bicarbonate, chlorine, potassium, and phosphorus of the soil. Furthermore, the investigation of the effects of petroleum mulching in the region suggested that most of the restrictive changes made in the region occurred during the short term, with the changes turned towards the improvement of the soil's quality and fertility and the increase in the soil's temperature by the establishment, improvement, and growth of vegetation over time.

Therefore, if mulching does not help improve vegetation due to the special conditions of the region (for instance, non-exclosure of the region and preserving it throughout the first mulching years), petroleum mulching is not recommended as it increases the temperature, decreases the moisture, and restricts some properties of the soil in the short-term. However, should there be any chances for the improvement of vegetation, petroleum mulching will increase the soil's quality.

Keywords: Petroleum Mulch, Soil Quality, Soil's Physico-chemical properties; pH, EC.