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Impact of Wildfire on Soil Retention Capacity and Contaminant Transport in the Bhimtal Region

PANKAJ PATIDAR[1] AND NITIN KHANDELWAL[2]

[1]Indian Institute of Technology Roorkee
[2]Indian Institute of Technology (IIT) Roorkee

Wildfires considerably change soil physicochemical properties, affecting contaminant transport and bioavailability. In this research study, we have collected fresh and burned soil samples from the Bhimtal Lake watershed area. Soil colloids were extracted, and their stability and sedimentation were tested in soil-pore water to understand fire-imposed changes in soil-colloids stability. Varying charged dyes (Methylene blue, MB, and Methyl orange, MO) interacted with both fresh and burned soil to understand the changes in the contaminant retention capacity of soil after a wildfire. For this analysis, we have prepared the aqueous solutions of Methylene Blue (MB) and Methylene Orange (MO) at concentrations of 10, 20, 40, and 80 mg/L, and 50 mg of both the soil was introduced to each solution to assess soil retention capacity. The results indicate around 100% adsorption of MB in both the soil, whereas in case of MO burned soil adsorbs around 10% higher than fresh soil at each concentration as shown in Fig.1. Additionally, for soil colloids stability analysis, we have prepared a soil suspension of 10mg/ml and analyzed changes in optical absorbance for 48 hours in which we found that 42% of colloids remained in suspension in fresh soil, compared to 29% in burned soil as shown in Fig.2. The findings show that the colloidal suspension stability is greater in fresh soil than in the burned soil that will enhance the contaminant transport through surface runoff and groundwater percolation. In contrast, burned soil has greater colloidal stability, which would lead to the retention of contaminants within the soil matrix and potentially their uptake by vegetation. This insight is very important in understanding post-fire soil dynamics and effective land management to mitigate environmental risks.

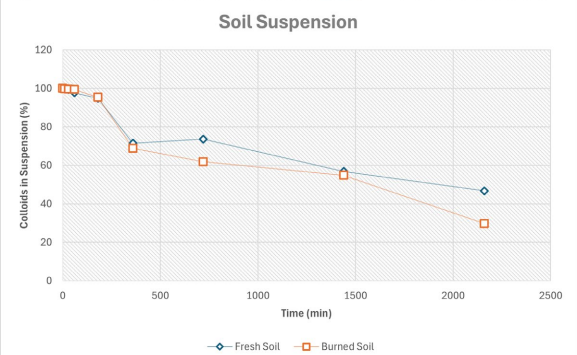

Fig 1: Colloidal Suspension Stability With Time

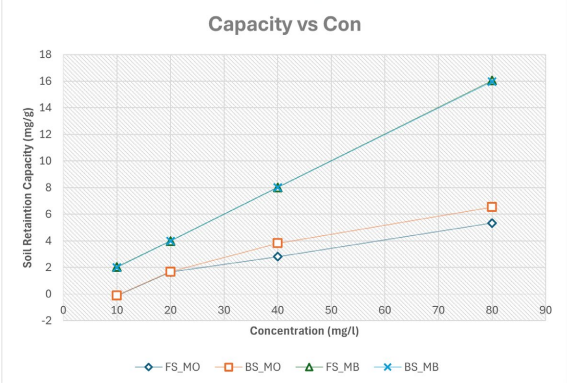

Fig 2: Soil Retention Capacity in Methyl Orange (MO) and Methylene Blue(MB), FS = Fresh Soil, BS = Burned Soil