

Effect of disparate fractions of polylactic acid on hydraulic properties of the saturated sandy loam soil

Lucia Toková, Natália Botková, Lenka Botyanszká, Peter Šurda

Institute of Hydrology, Slovak Academy of Sciences, Dúbravská cesta 9, 841 04 Bratislava, Slovakia

Abstract

In recent years, there has been a growing recognition of microplastics as significant pollutants, however, our understanding of the ecological effects of microplastics (MP) in soil ecosystems is still limited. Some studies on the effects of microplastics on soil hydraulic properties confirm that the effects are related to the proportion and size of microplastics in the soil. Here, we have compiled impact of polylactic acid (PLA) in different fractions (small <100, medium 100–200 and large >200 μm) on saturated hydraulic conductivity of the sandy loam soil. An automatic laboratory system KSAT (METER Group GmbH, Munich) was used to measure saturated soil hydraulic conductivity of the soil. The results show, that small PLA particles mixed with soil reduced saturated hydraulic conductivity by 46%. On the contrary, large particles increased saturated hydraulic conductivity in the soil by 71%. Medium PLA fractions (100–200 μm) have no significant impact on the hydraulic properties of the soil.

Keywords: microplastics, polylactic acid, saturated hydraulic conductivity



Figure 1 a) KSAT equipment for saturated hydraulic conductivity measurement, b) disparate fractions of polylactic acid (PLA): from right small <100, medium 100–200 and large >200 μm .

Conclusions

Changes in hydraulic properties of the soil can lead to an ecological implications. Soil hydraulic characteristics can be indicators for soil health and can have a direct influence on plant root growth. Studies on the effects of MP confirm, that when small MP particles are mixed with soil, the soil structure changes, leading to a reduction in the pore-size distribution, which further decreases the hydraulic conductivity of saturated soils (Guo et al., 2022). The results show a large reduce in the saturated hydraulic conductivity of sandy loam soil after the application of small PLA particles.

References

Guo et al. 2022: Soil texture is an important factor determining how microplastics affect soil hydraulic characteristics. Environment International, 165, 107293.

Acknowledgement

This study was supported by the Scientific Grant Agency VEGA 2/0037/24.

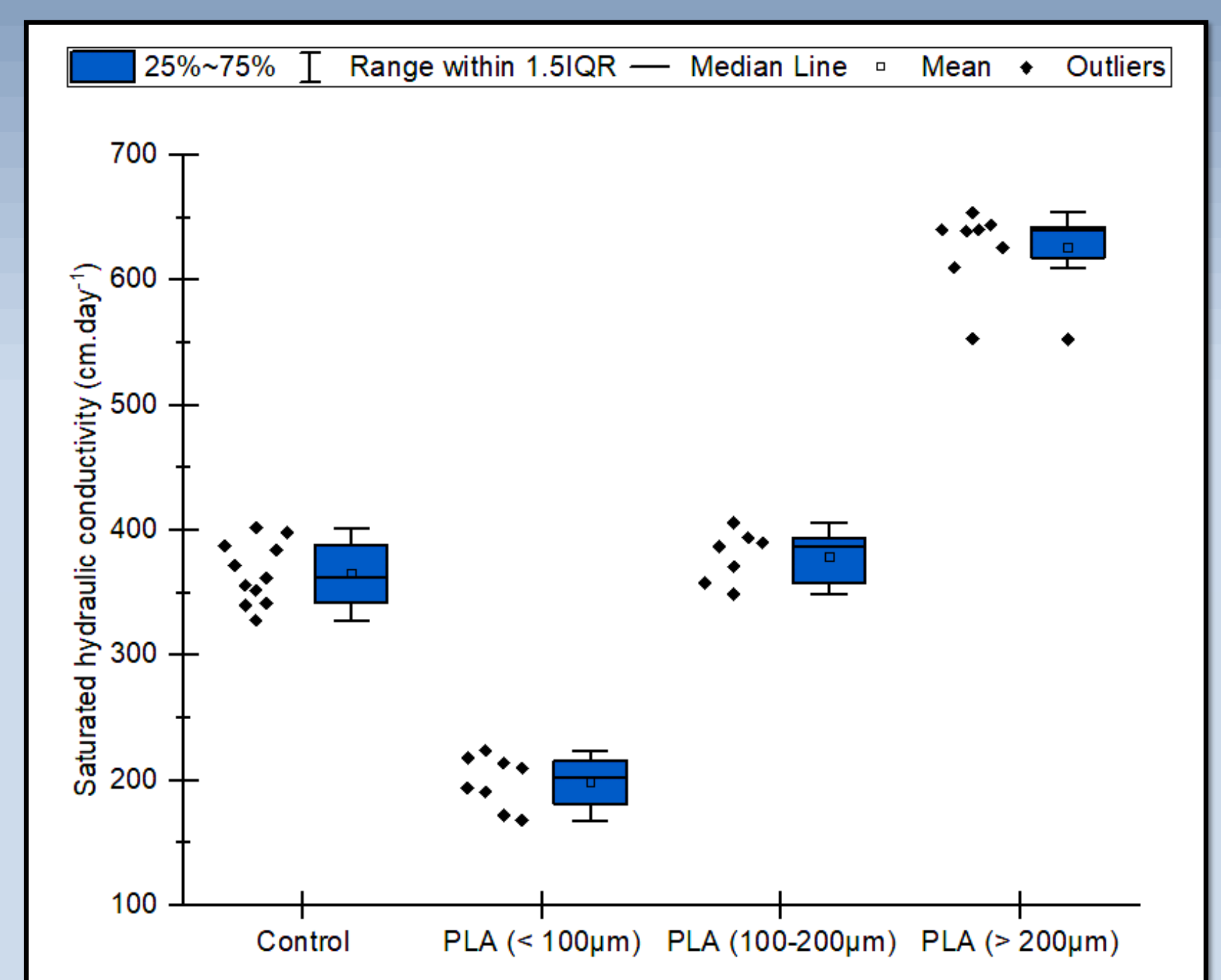


Figure 2 Effect of disparate fractions of polylactic acid (PLA) on saturated hydraulic conductivity of sandy loam soil.