Effect of Polypropylene Microplastics on Soil Water Characteristic Curve

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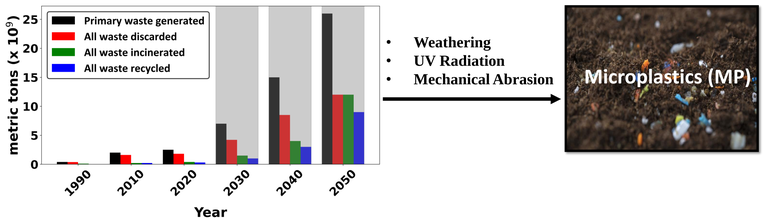
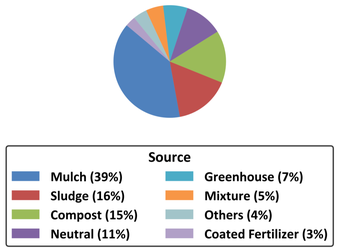
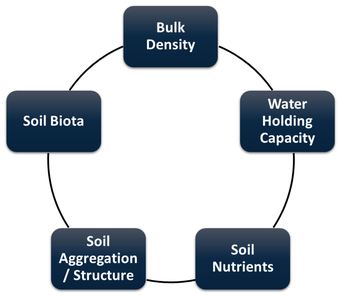
Introduction



Cumulative plastic waste generation and disposal[1]



Sources of MP in soil[2]



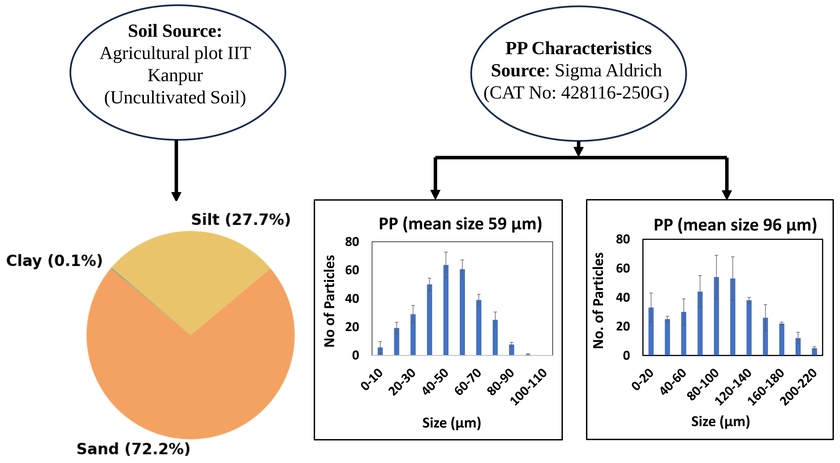
Effects of MP on soil environment[3]

- Studies on the effect of microplastics (MP) on soil water retention are limited.
- In **loamy sand**, **5 mm polyester** fibres **increased** field capacity by **~10%** at a concentration of **0.4%** (w/w)[3].
- In **sandy soil**, **5 mm polyethylene** showed **no effect** up to a concentration of **1%** (w/w) but **reduced** field capacity by **~2%** at a concentration of **2%** (w/w)[4].

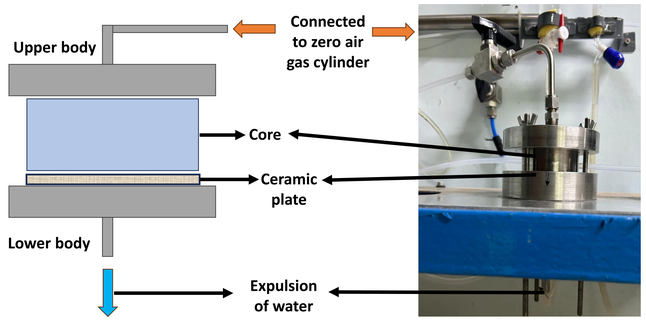
Objective

- To investigate the effects of **size** and **concentration** of **polypropylene (PP)** MP on the **soil water characteristic curve (SWCC)** of **silty sand**.

Materials

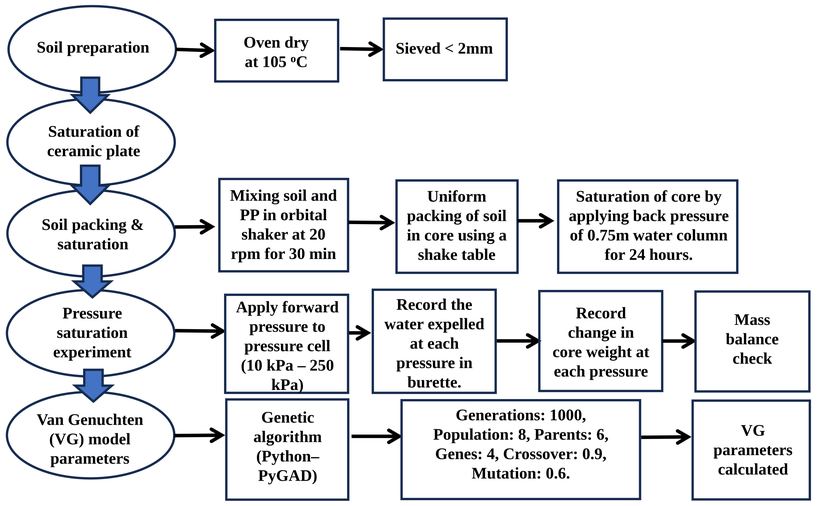


Pressure Cell Experimental Setup

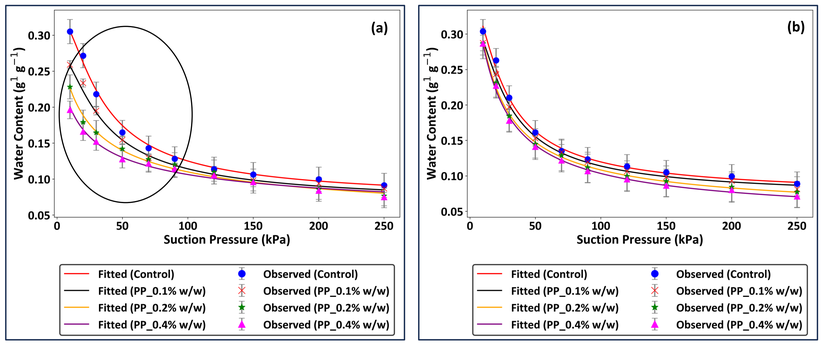


- **Mass balance** of water imbibition and exudation can be verified at each stage of applied pressure.

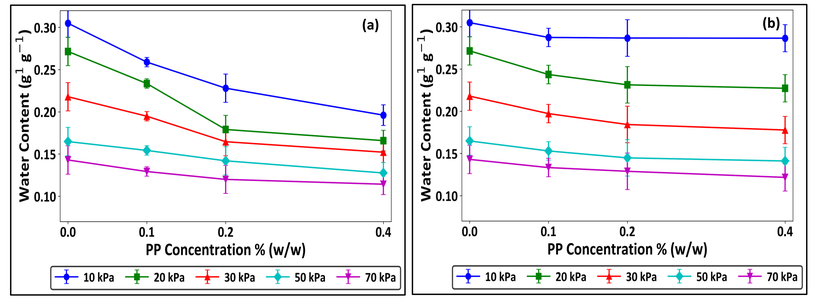
Methodology



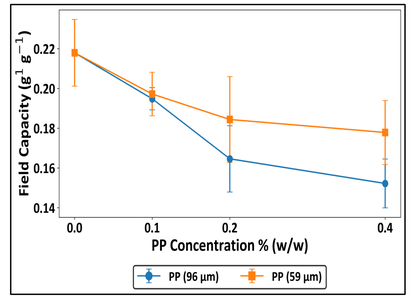
Results



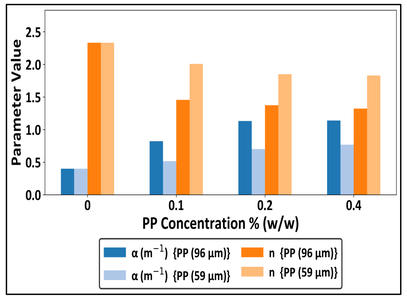
SWCC with PP of mean size (a) 96 µm and (b) 59 µm



Variation in soil water content with concentration of PP of mean size (a) 96 µm and (b) 59 µm up to suction pressure of 70 kPa



Variation in field capacity with PP concentration



Variation in VG model parameters

Conclusions

- ✓ PP of mean size 96 µm reduced soil water holding capacity up to a suction pressure of 70 kPa; beyond this, no reduction was observed compared to control soil.
- ✓ Increasing PP content decreased the water holding capacity of soil.
- ✓ Field capacity decreased with increasing PP content with a maximum decrease of 5.8% for mean size 96 µm at a concentration of 0.4% (w/w).
- ✓ PP of mean size 59 µm had no effect at a concentration of 0.1% (w/w), but at higher concentrations, it reduced soil water holding capacity, though the effect was less than PP of mean size 96 µm.

References

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4. Zhang, G. S., Zhang, F. X., & Li, X. T. (2019). Effects of polyester microfibers on soil physical properties: Perception from a field and a pot experiment. Science of the Total Environment, 670, 1–7.