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Biochar preparation from pistachio wastes: effect of temperature on its physicochemical properties

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Biochar is an effective soil amendment because of its potential to improve soil physical and chemical properties. Vast range of organic materials particularly the residual of plants can be use as feedstock of biochar. In this study, we investigated on the procedure of preparing biochar from pistachio´s wastes. An optimal biochar is a component that has more water holding capacity, biochar yield and stable organic carbon (OC) and with low electrical conductivity. Generally, the biochars produced at temperatures of 450$^{\circ}C$ or higher was most likely to improve soil drainage and make more water available to plants, while ones produced at lower temperatures could sometimes repel water.

A series of biochar were produced from pistachio wastes by slow pyrolysis at different temperatures (300, 450, 600 and 750$^{\circ}C$ and 2 h holding time). After preparation, following physicochemical properties including biochar yield (mass of biochar to mass of feedstock), ash content, stable OC, pH, electrical conductivity, water holding capacity were measured.

Our results showed that as temperature increased from 300 to 750$^{\circ}C$, biochar yield, bulk density and stable OC of the biochar decreased. In contrast, with increasing the temperature, pH, electrical conductivity, ash content and stability of OC increased. With increasing of pyrolysis temperature, the biochar yield ranged 30.47-50.32% of feedstock, and stable OC and pH in feedstock and biochars were ranged 29.5-96.5% and 6.4-13.15, respectively. Biochar prepared at the high temperature showed the highest water holding capacity as well transformed into a more stable biochar-OC.

In conclusion, our results suggest that in context of carbon sequestration and improving the capacity of soil to hold more water and nutrient, preparation of biochar at the temperature 450$^{\circ}C$ or higher should be recommended.