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Lignocellulosic Waste from Fruit Processing Industries – Valuable Resource with Wide Applications

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Abstract

With its substantial production volume, Serbia's fruit industry is one of the leading sectors of the Serbian economy, with the total production of approximately 1.5m tons per year (www. serbiadoesfruit.com). Serbia is one of the top plum-producing countries in the world with the average production of 450 thousand tons per year. Also, there is an increasing trend in the production of sour cherries (with average annual production around 145 thousand tons), and peaches, where the average annual production was about 40 thousand tons) (www.stat.gov.rs). However, fruit processing industry generates significant amounts of waste (peels, rind, seeds, core, stones, pods, shell, pomace, etc.) which represents 25-30% of processed raw materials (Lopičić et al., 2022). Mostly, this type of waste is landfilled; raising the greenhouse gases (GHGs) and pollutant leachates, wasting of food commodities, land, water, fertilizers, chemicals, energy and labour. The complex bio-structure of this waste type together with various conversion and modification allows their multi-scale application. It can be applied to produce various types of biomaterials (bioplastics, biocomposites), biofuels, resins, adsorbents and sustainable fertilizers with lower carbon footprint than the conventional ones (Izydorczyk et al, 2024). In this paper three waste biomasses (peach - PS, sour cherry - CS and plum stones - PmS) obtained from Serbian fruit processing industry were analysed and pre-evaluated as a potential starting material for soil treatment to enhance soil fertility. According to chemical analysis this type of waste contains lignocellulosic matrix (LC) made of cellulose (C), hemicellulose (HC) and lignin (L). Proportions of these constituents in each of LC biomass are: PS: 62.94% C, 5.42% HC and 17.93% L (Lopičić et al., 2013); CS: 58.18% C, 2.71% HC and 18.57% L and PmS: 22.93% C, 21.42% HC and 25.41% L (Pap et al., 2017). The results of elemental organic analysis showed the following proportions: PS: 47.42% C, 0.27% N, 6.06% H, 0.21% S and 45.58% O; CS: 47.90% C, 0.0% N, 6.28% H, 0.0% S and 45.82% O and PmS: 48.51% C, 1.48% N, 6.28% H, 0.15% S and 43.57% O. This implies the positive impacts on soil structure by enhancing organic matter. In addition, this type of waste contains macro and micro elements, of which K, Ca, P, Mg are dominant. The content of available (water-soluble) elements in samples

ashes, performed by AAS analysis showed that the content of soluble phosphorus was the highest in PmS (93% is water soluble) followed by the PS (78%), and CS (70%) while potassium is almost completely water-soluble in PS (97.2%). Therefore, this is an abundant and affordable source of soluble phosphorus and potassium in the final product, which could affect soil health by enhancing the soil texture, moisture retention, nutrient availability and cation exchange capacity.

Keywords: lignocellulosic waste, peach stones, sour cherry stones, plum stones, characterisation, soil fertilizer,

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