FOOD WASTE HYDROCHAR AND BIOCHAR AS SOIL AMENDMENTS: EFFECT OF HYDROCHAR POST-TREATMENTS

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INTRODUCTION

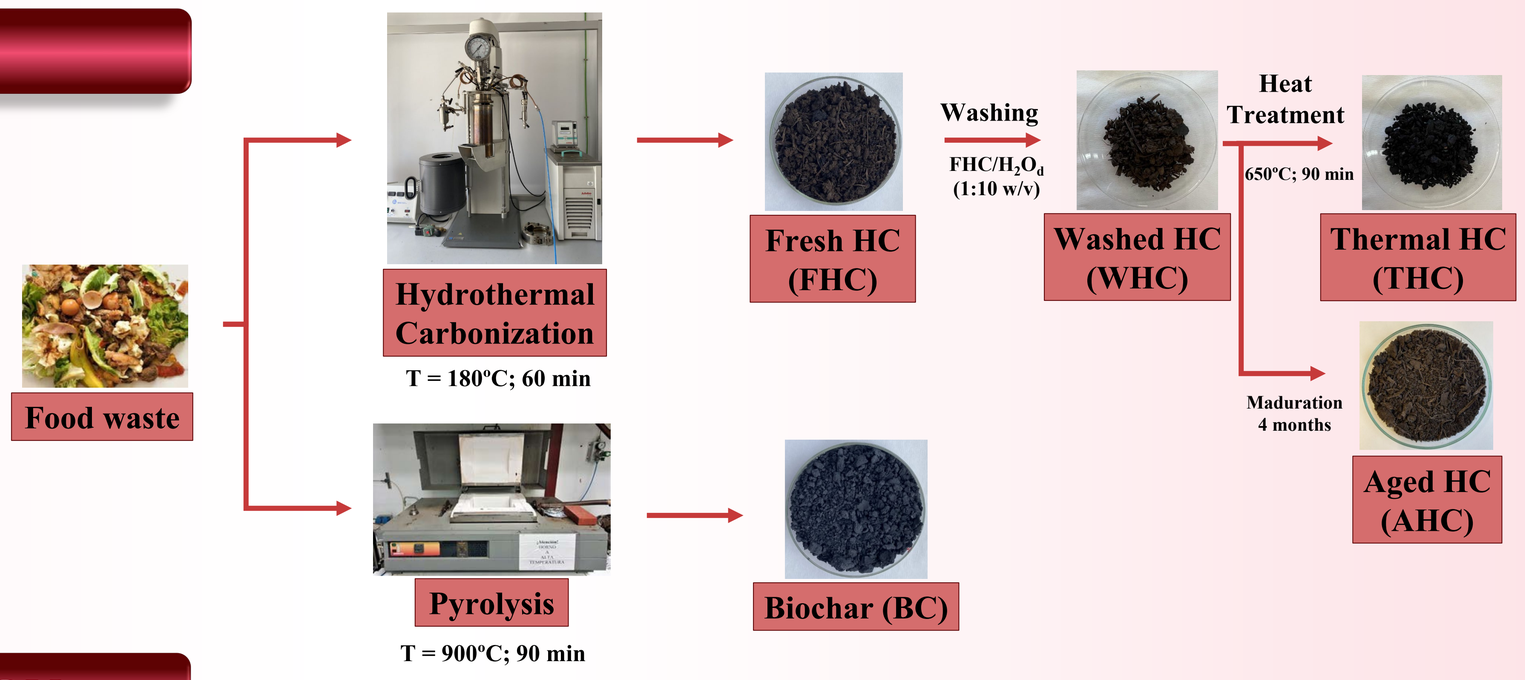
Food waste (FW) is the main urban biowaste which can be valorized by using thermochemical technologies such as pyrolysis and hydrothermal carbonization resulting in a solid product (biochar and hydrochar, respectively). Chars are promising products with diverse applications in agriculture due to their high content of carbon and nutrients.

The aim of this work is to evaluate the potential application of biochar, fresh hydrochar, and post-treated hydrochar obtained from FW as a soil amending agent. The germination index (GI) of tomato (Marmande RAF) seed was used to analyze the potential phytotoxic effect of adding char to a marginal agricultural soil.

EXPERIMENTAL

GERMINATION TESTS

- ✓Mixture of marginal agricultural sandy loam soil and 1, 3 and 5 % of each type of hydrochar or biochar.
- ✓Watered dishes were left 7 days for stabilization.
- ✓10 seeds per dish were sowed.
- ✓The germination index was determined 7 days after sowing.



RESULTS AND DISCUSSION

Table 1. Chemical characterization of soil, feedstock and chars.

	Soil	FW	FHC	WHC	AHC	THC	BC
pH	7.6	5.1	4.6	4.8	4.7	9.0	8.9
EC (mS/cm)	0.2	9.9	4.9	0.1	0.2	0.6	26.0
VM %	7.15	79.5	73.7	74.2	74.5	22.4	25.7
FC %	0.0	17.1	23.7	22.4	20.4	63.6	56.2
C/N	13.1	18.7	19.5	24.4	21.3	20.4	33.4
O/C	1.85	0.8	0.4	0.4	0.4	0.1	0.2
H/C	1.95	1.7	1.2	1.3	1.4	0.4	0.2

- ✓Volatile matter (VM) and fixed carbon (FC) → thermogravimetry (ASTM-D7582).
- ✓Elemental composition → CHNS analyzer.
- ✓Individual volatile fatty acids (VFA) → GC/MS.
- ✓pH and electrical conductivity (EC) → (UNE-EN 13037-13038).

- The higher temperature used for THC and biochar production promoted basic pH and increased the fixed carbon compared to the other treatments.
- Post-treatments decreased EC values and were significantly lower than biochar, indicating differences in surface functional groups.
- No changes in VM were observed in post-treatments at room temperature, suggesting a low efficiency of the washing procedure.
- C/N ratio for all post-treated hydrochar, as well as biochar was in the optimum range for microbial activity.

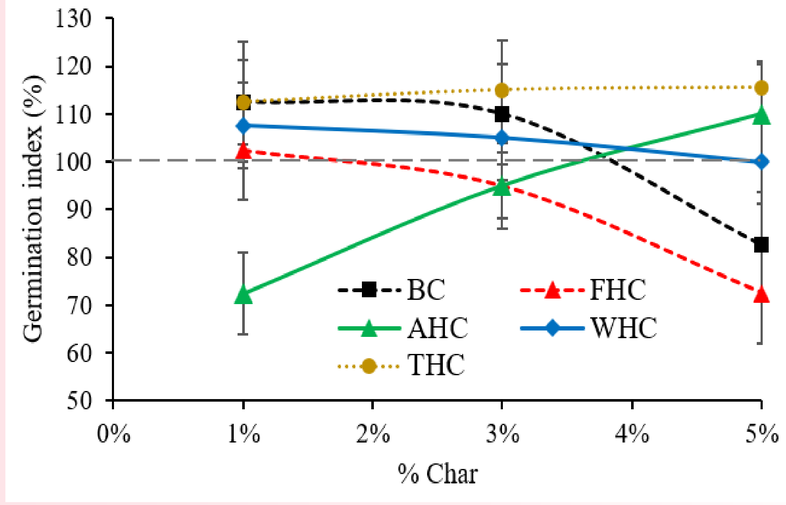


Fig. 1. Germination rates of tomato seeds compared to control (100%) 7 DAS

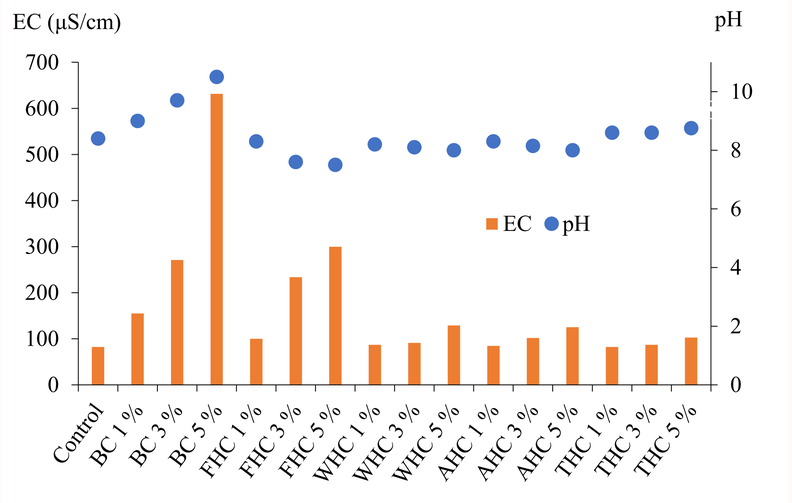


Fig. 2. pH and EC of stabilized soils

A decrease of total VFA content of up to 90% was achieved after 3 washing cycles

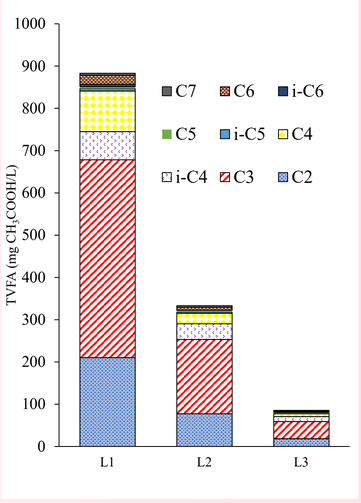


Fig. 3. Total volatile fatty acid distribution in leachates of FHC washing

CONCLUSIONS

- ❖ All hydrochar post-treatments enhance seed germination, being the thermally-treated hydrochar the best alternative for all the dosages tested.
- ❖ No hydrochar or biochar exceeds the EC limit (2700 µS/cm) for tomato germination.

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