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Biochar and activated carbons from GOAST leather solid waste: characterization and engineering

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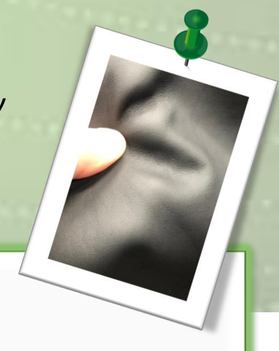
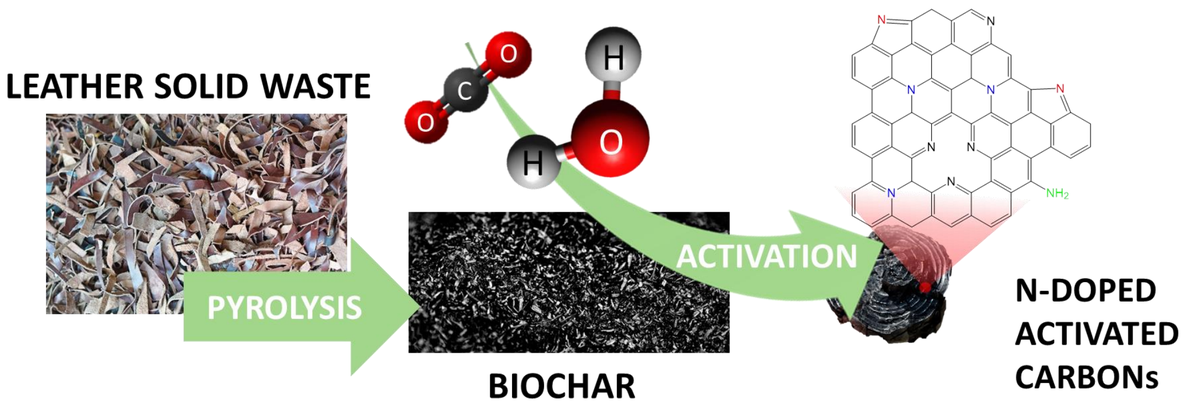


WHAT

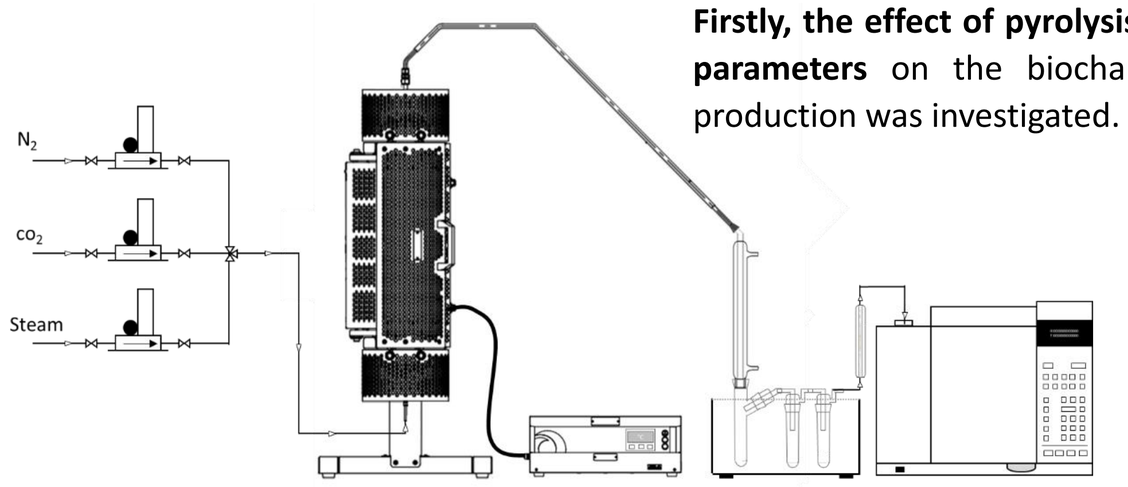
LIFE GOAST project is an European project funded by LIFE Programme, which focuses on the implementation of a novel metals-free leather tanning technology. Therefore, LIFE GOAST combines the expertise on leather chemical auxiliaries with high level tanning competences and waste-water treatment management to give an innovative and complete approach to leather tannage.

The Aim



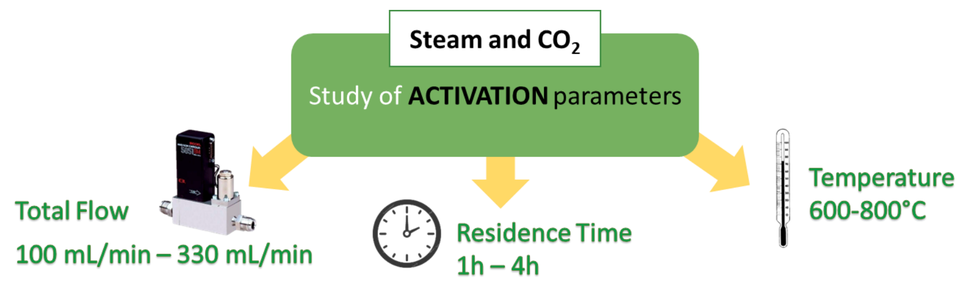
This work proposes the use of **pyrolysis approach to convert metals-free leather shaving waste (by GOAST technology) into biochar and its subsequent physical activation process to design N-doped activated carbons**

Pyrolysis and activation



Firstly, the effect of pyrolysis parameters on the biochar production was investigated.

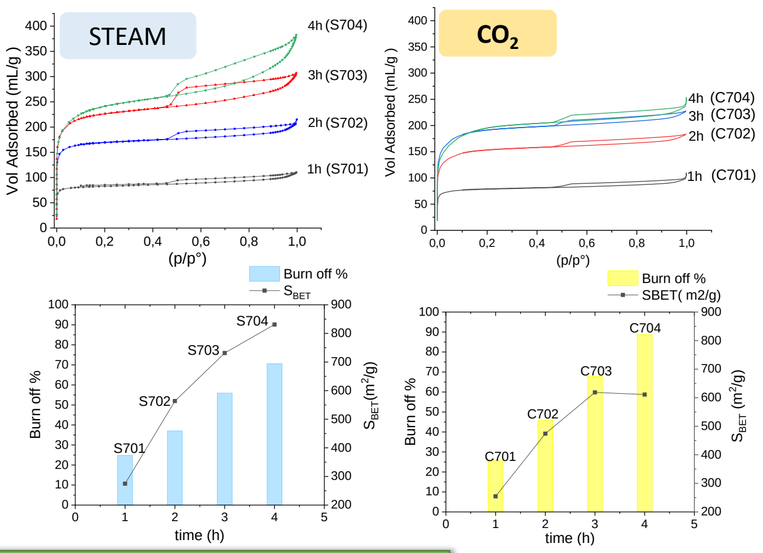
Starting from the obtained biochar, the attention was focused on **the effectiveness of physical activation (steam and CO_2) process** to design activated carbons with specific features and different N-doping.



Characterisation of Activated Carbons

For instance, the effect of time on the morphology and chemical composition of carbons is reported below

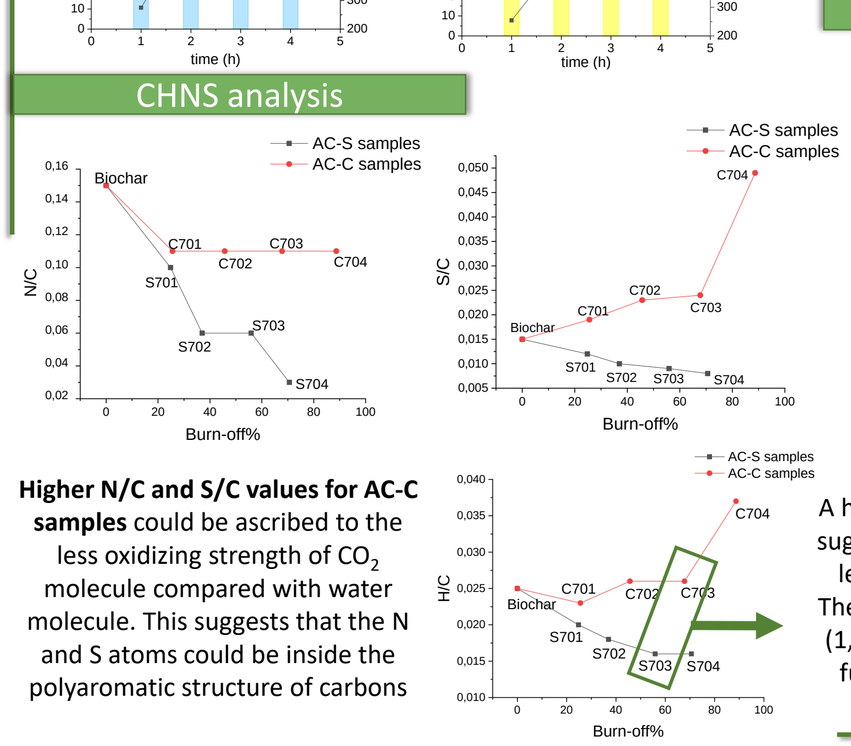
N2 physisorption



Reaction conditions:
800°C
330 mL/min
70% of Activating Agent/N_2

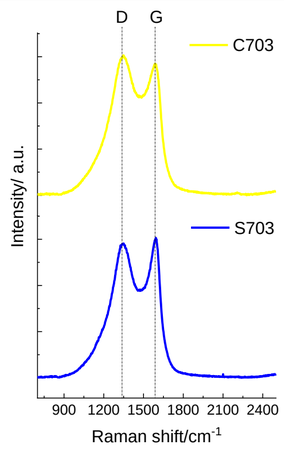
Increasing the **residence time the burn-off (relative mass losses) increases and the surface area increases accordingly**

CHNS analysis



Higher N/C and S/C values for AC-C samples could be ascribed to the less oxidizing strength of CO_2 molecule compared with water molecule. This suggests that the N and S atoms could be inside the polyaromatic structure of carbons

RAMAN analysis

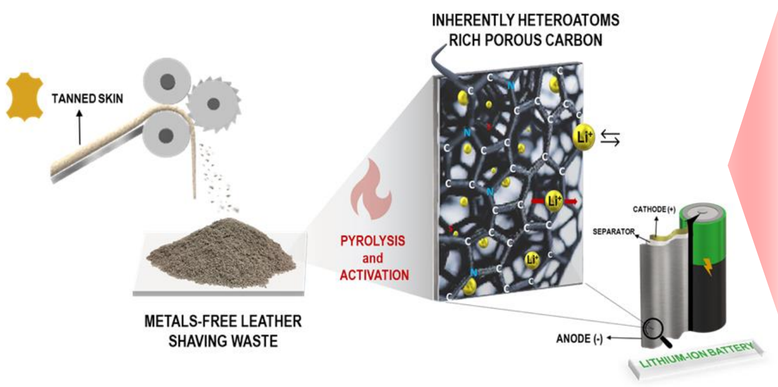


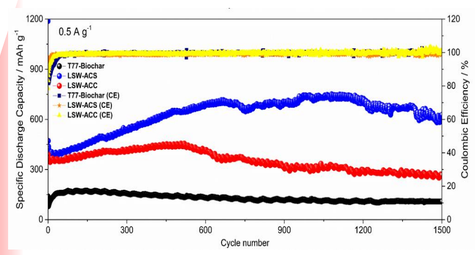
A **higher H/C ratio for AC-C samples** suggests that the carbon structure is less aromatic and carbonaceous. The higher I_D/I_G for the C703 sample (1,06) compared to the S703 (0,96) further confirms less ordering of carbon structure

Conclusion

1. by defining the treatment parameters and selecting the activation agent, it **is possible to modulate the morphological and chemical properties** of activated carbons
2. The physical activation with **CO_2 allows to keep the heteroatoms** into the carbon structure (higher N/C and S/C).
3. The physical activation with **steam promotes the formation of activated carbon with a high carbonisation degree and surface area**

Application of Activated Carbons





The electrodes showed **very high Li-ions storage capacity over cycling**

The Activated Carbons obtained from GOAST shaving waste were used to design innovative **electrode in half cell and full cell LiBs***

*P.Salimi, S.Tieuli, S.Taghavi, E.Venezia, S.Fugattini, S.Lauciello, M.Prato, S.Marras, T. Li, M.Signoretto, P.Costamagna, R.P.Zaccaria " Long-life sustainable LiBs based on Metals-free tannery waste biochar" in draft.

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