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N-doped porous carbon from leather solid waste for application in sustainable lithium batteries

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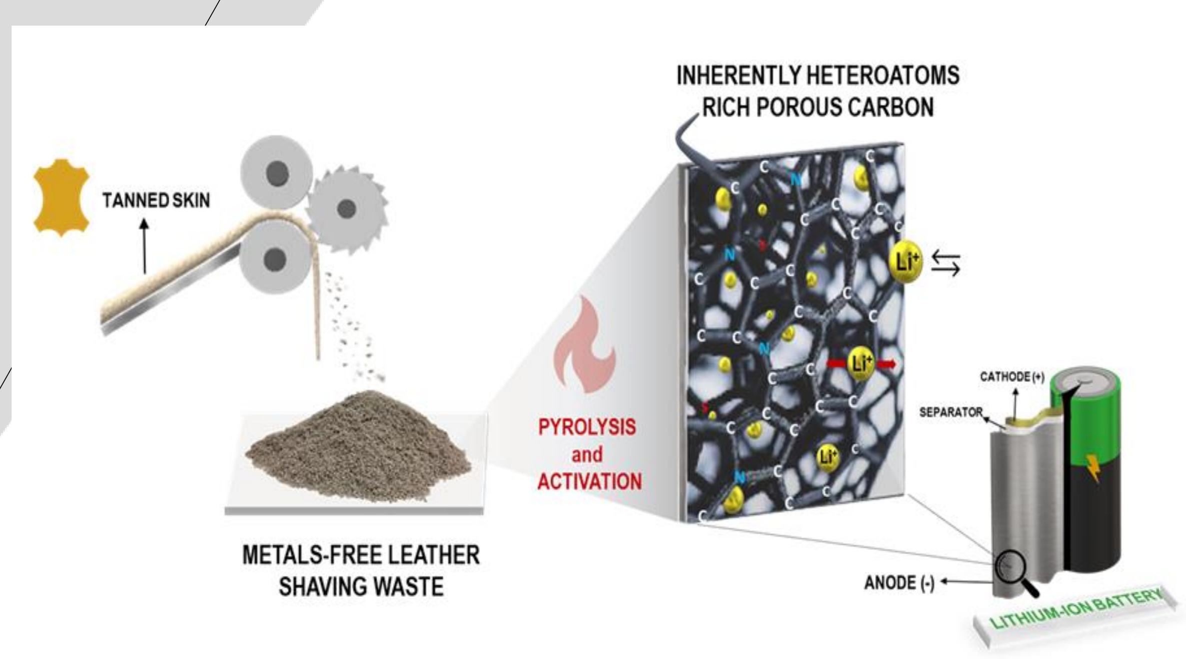
WHAT

www.lifegoast.eu

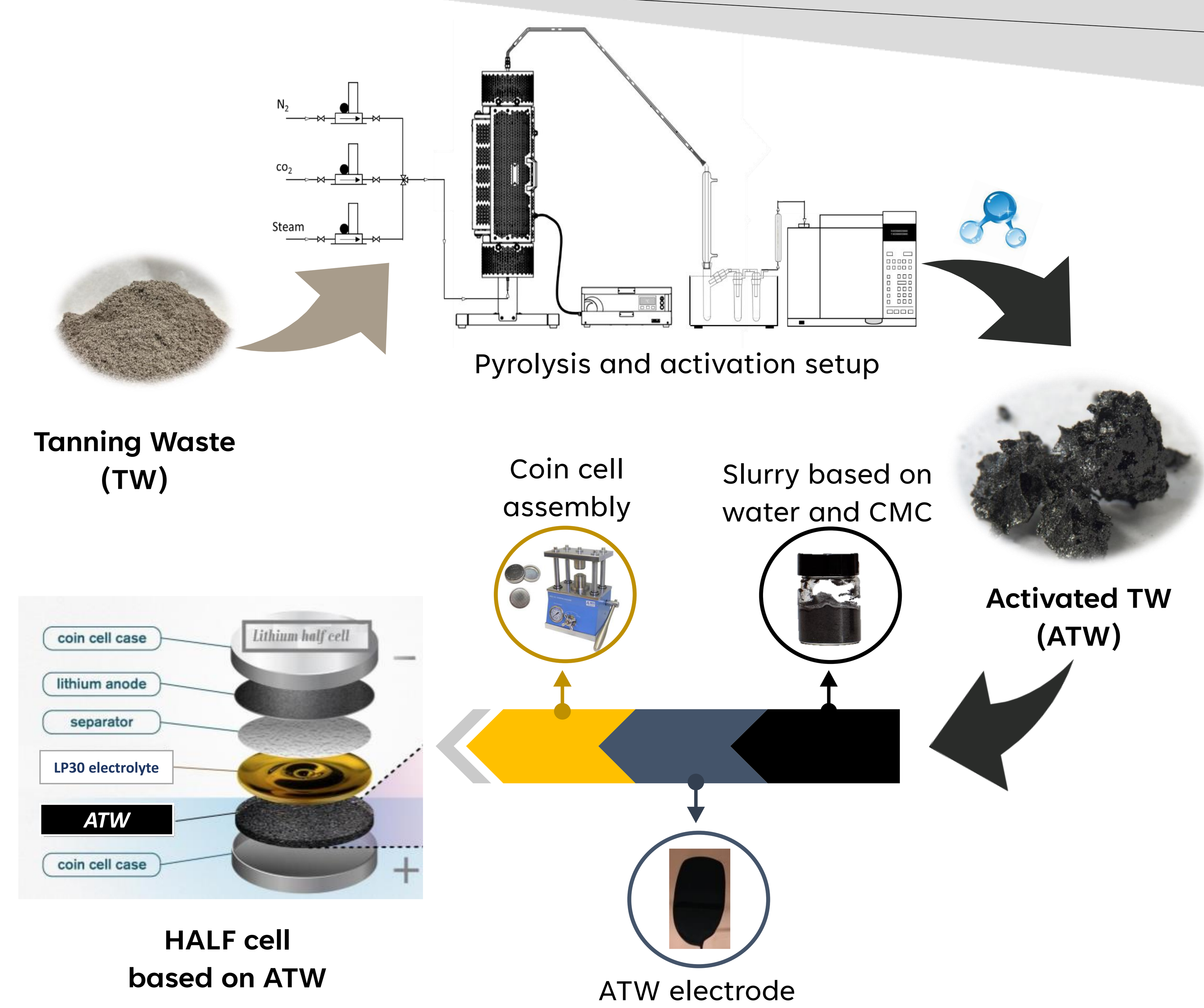
LIFE GOAST project is an European project funded by LIFE Programme, which focuses on the implementation of a novel metals-free leather tanning technology. Therefore, LIFE GOAST combines the expertise on leather chemical auxiliaries with high level tanning competences and waste-water treatment management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

THE AIM

This work presents **activated biochar** derived from **metals-free leather shaving waste** (by GOAST technology) as a sustainable material alternative to graphite in **half-cell** lithium batteries



MATERIAL AND ELECTRODE PREPARATION



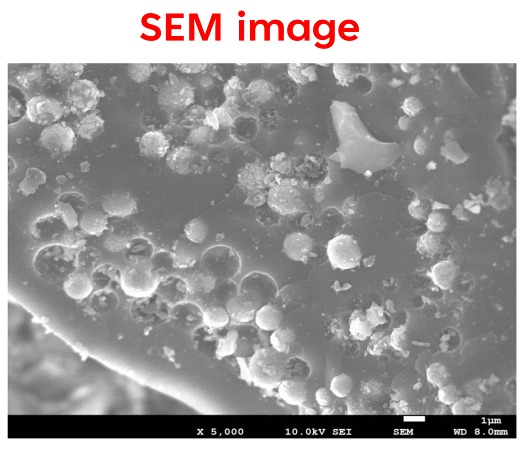
CHARACTERIZATION OF THE ATW CARBON

The doped heteroatoms and high surface area have a crucial role in Li-battery performance providing plenty of sites for charge-transfer reaction and enhancing the active sites for Li+ storage[1]

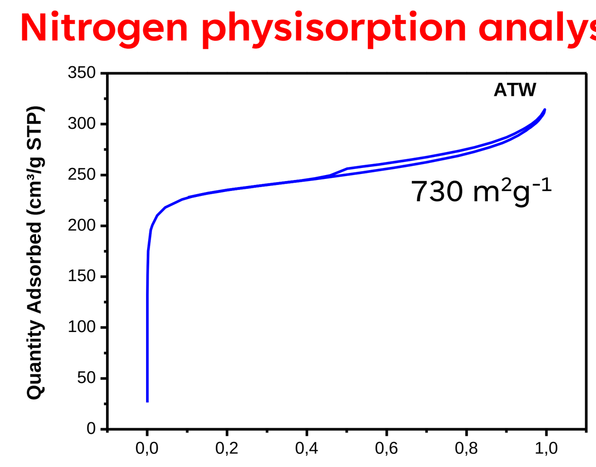
Elemental analysis

Sample	C [%]	N [%]	H [%]	S [%]	O + Ash [%]
ATW	77.8	4.0	1.3	0.6	16.3

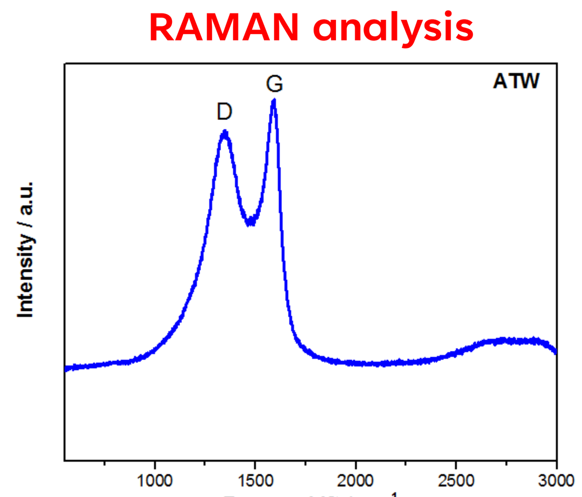
SEM image



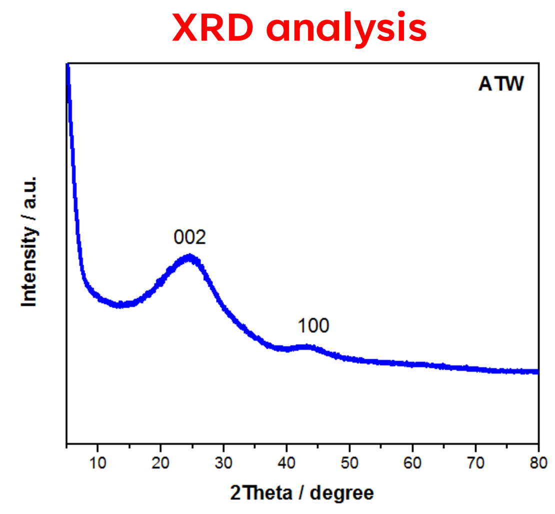
Nitrogen physisorption analysis



RAMAN analysis



XRD analysis

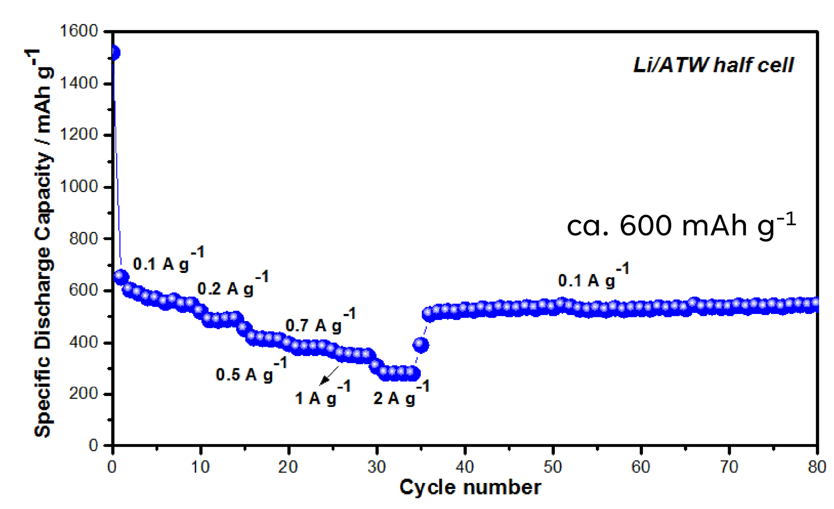


The number of defects and degree of ordered graphitic carbon contributes to **the improvement of the electrochemical behavior of the cell,** such as Li storage sites and enhanced electron transfer respectively [2].

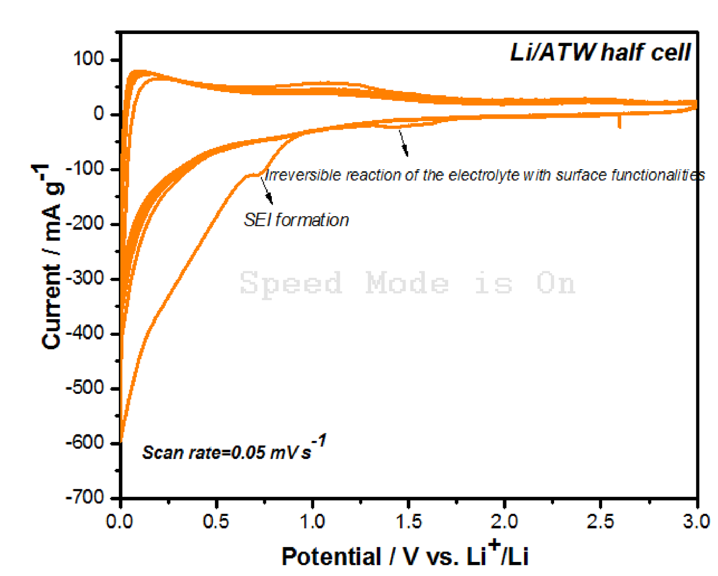
[1] Zhao, Y. Liu, X. Quan, S. Chen, H. Zhao, H. Yu, Electrochim. Acta, **204** (2016) 169–175.

[2] L. Yan, J. Yu, J. Houston, N. Flores, H. Luo, Green Energy Environ, **2** (2017) 84–99.

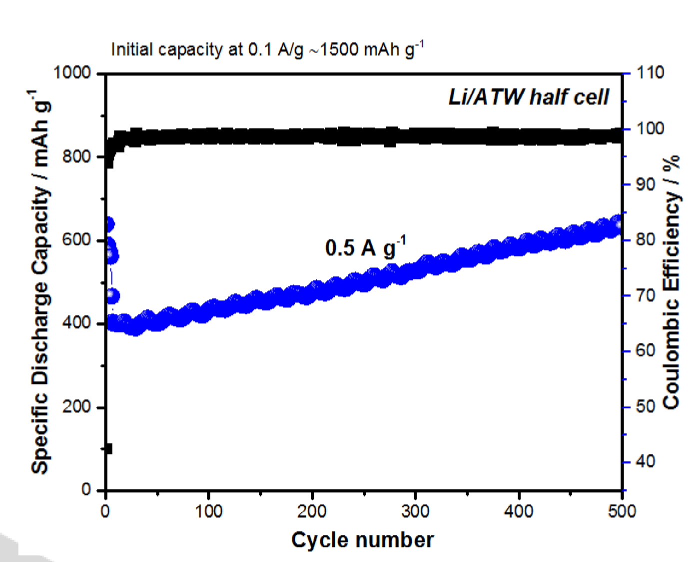
ELECTROCHEMICAL PERFORMANCE



When the current density rolls back to 0.1 A g^{-1}, the **electrodes show the excellent capacity retention of 100%.**



In CV analysis, the overlap of cycles after the first run demonstrates the **high reversibility and electrochemical stability**



The electrode exhibits **capacity and coulombic efficiency increase after the initial charge-discharge cycling** process, showing a specific discharge capacity of **635 mAh g^{-1} after 500 charge and discharge cycles**

CONCLUSION

Biochar obtained from the pyrolysis and activation ***of tannery waste has been found to be a promising source of the carbon-based*** *electrode in Li-ion batteries*

The characterization analyses showed that the ***synergistic effect of chemical and physical properties of carbon material*** *has a strong influence on the electrode electrochemical performance*

High capacity, and stability performance of the carbon *and synthesis approach used in this study could be applied to improve high-potential electrodes for next generation of electrochemical devices.*

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