From waste to resources: Transforming olive leaves to hard carbon as sustainable and versatile electrode material for Li/Na-ion batteries and supercapacitors.

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Supplementary Information

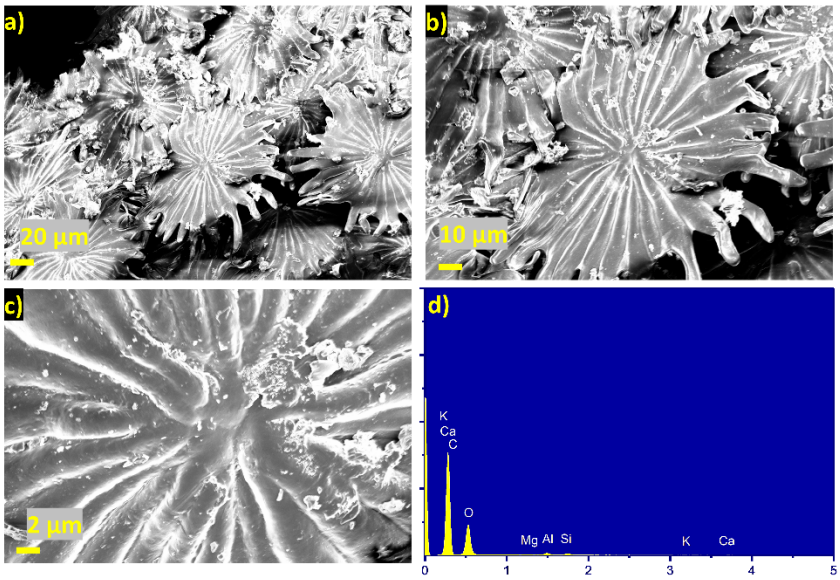

Fig. S1. SEM and EDX of pristine olive leaves.

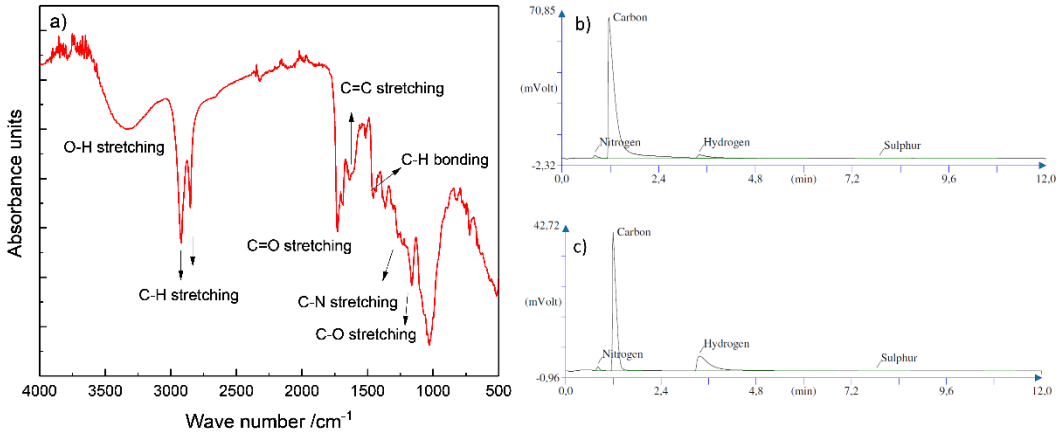

Fig. S2. FTIR spectra of pristine olive leaves (a), elemental analysis of pristine olive leaves (b) and OLDHC (c).

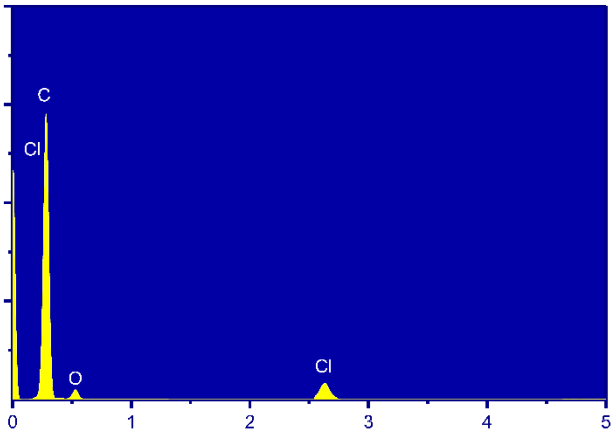

Fig. S3. EDX of ball milled OLDHC sample.

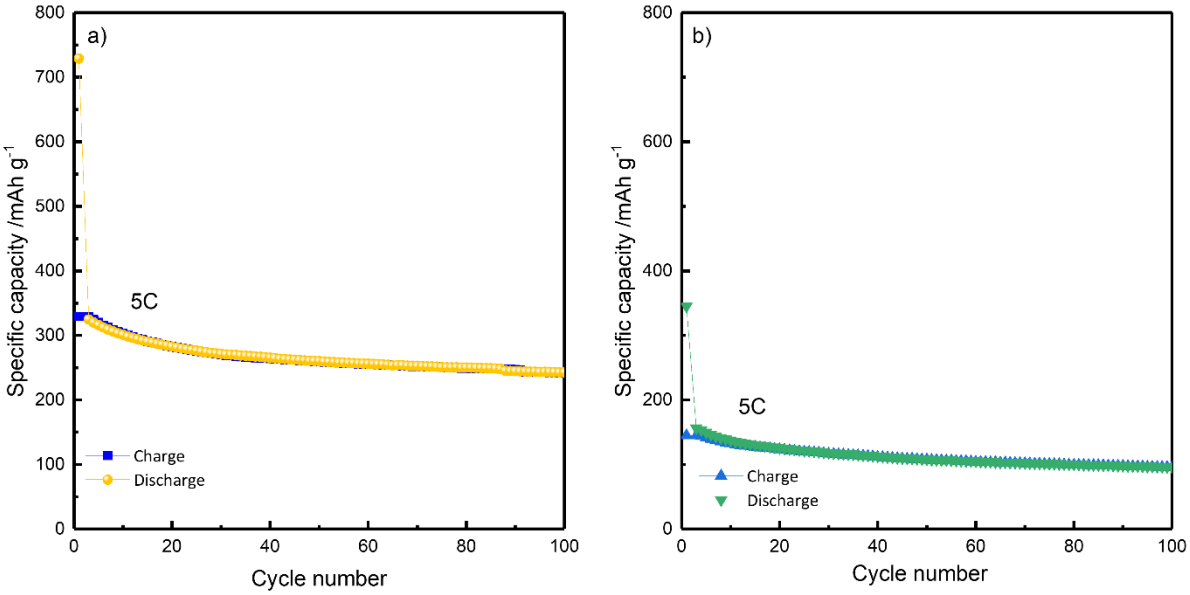

Fig. S4. Cycling performances of OLDHC-based LIB (a) and NIB (b) electrodes up to 100 cycles at 5C in the potential range of 0.01–3 V.

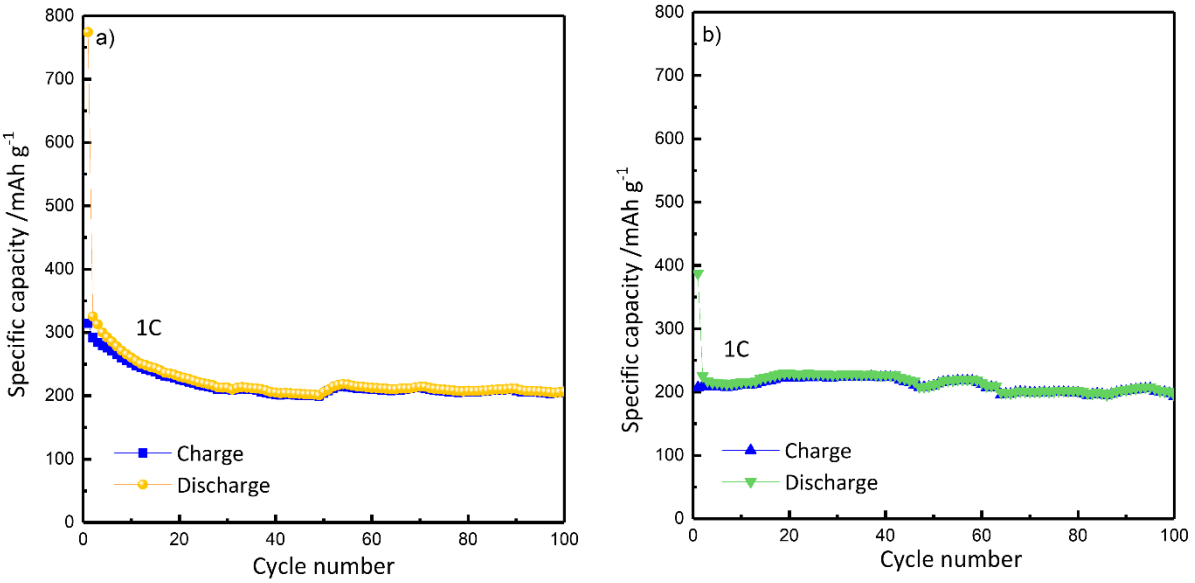

Fig. S5. Cycling performances of LIB (a) and NIB (b) electrodes based on OLDHC without ball-milling, up to 100 cycles at 1C in the potential range of 0.01−3 V.

Table S1. different natural biomass precursors used to prepare hard carbon for only NIB applications.

Precursor	Binder	Specific Capacity 2nd cycle ($mAhg^{-1}$)	Current density (mAg^{-1})	Refs.
Asparagus peel and potato peel -Derived HC	PVDF	230	30	[1]
Lotus leaves -Derived HC	PVDF	250	60	[2]
phenolic resins-Derived HC	PVDF	270	30	[3]
Leaf-Derived HC	-	270	40	[4]
Plastics-Derived HC	PVDF	190	3	[5]
Natural clay mineral halloysite-Derived HC	PVDF	266	100	[6]
Cotton-Derived HC	Na-alginate	315	30	[7]
Sorghum stalk-Derived HC	polyacrylic acid	245	20	[8]
Coconut shells, walnut shells, and corn silk-Derived HC	PVDF	290-315	50	[9]
Tire-Derived HC	PVDF	250	20	[10]
Pitch-Derived HC	Na-alginate	254	30	[11]
Apple-Derived HC	Na-CMC	230	30	[12]
Rice husk-Derived HC	Na-alginate	276	30	[13]
Pitch-Derived HC	Na-CMC	270	37.2	[14]
Pomelo peels-Derived HC	PVDF	200	200	[15]
Citrus-Peel-Derived HC	PVDF	140	100	[16]
Olive leaves-Derived HC	Na-CMC	265 and 150 (with minor irreversibility)	**300 and 1500**	**This work**

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