



# Starbons®

Separation made Simple

## Novel Biobased Materials for Separations

**Starbon®** materials ("Starbons") are highly versatile materials having tuneable surface chemistry and porosity. Over 55 peer reviewed publications relate to **Starbon®** materials in a range of end use applications. For some applications there are no existing alternative technologies. For other applications **Starbon®** materials offer a sustainable, reusable and environmentally benign alternative to existing systems, whilst also delivering a step change in performance. A **Starbon®** is like a solid sponge. The hole sizes and "stickiness" of the "sponge" allow different sized species to pass through or stick to the **Starbon®**. By varying the "stickiness" substances can be captured in many ways, thus enabling technical solutions tailored to specific needs and end use applications.



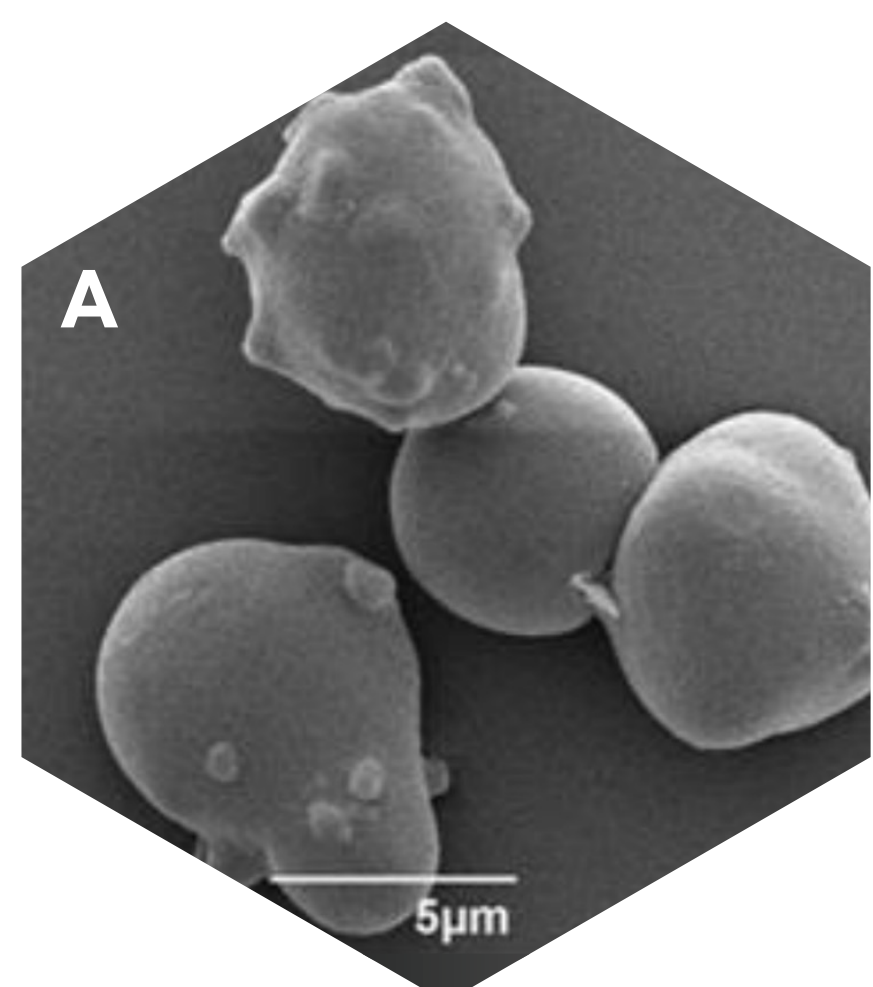
A series Starbon® alginic acid (seaweed)



P series Starbon® from pectin (citrus waste)

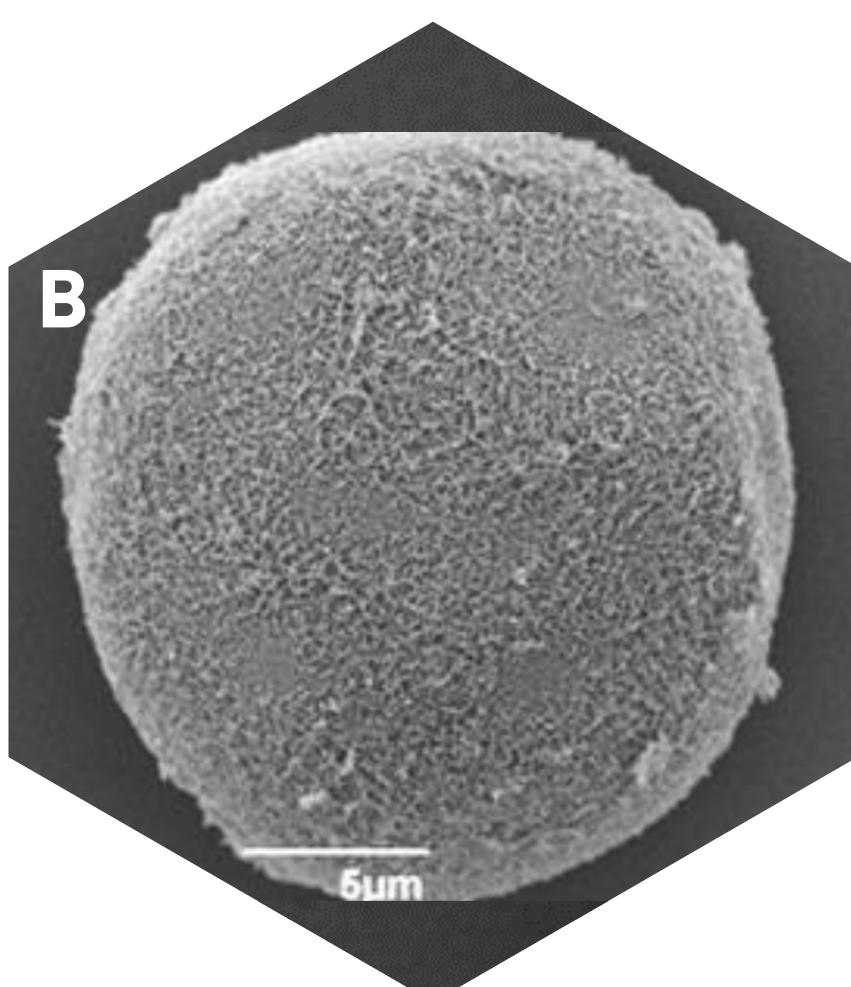


S series Starbon® from starch (potato waste or corn starch)



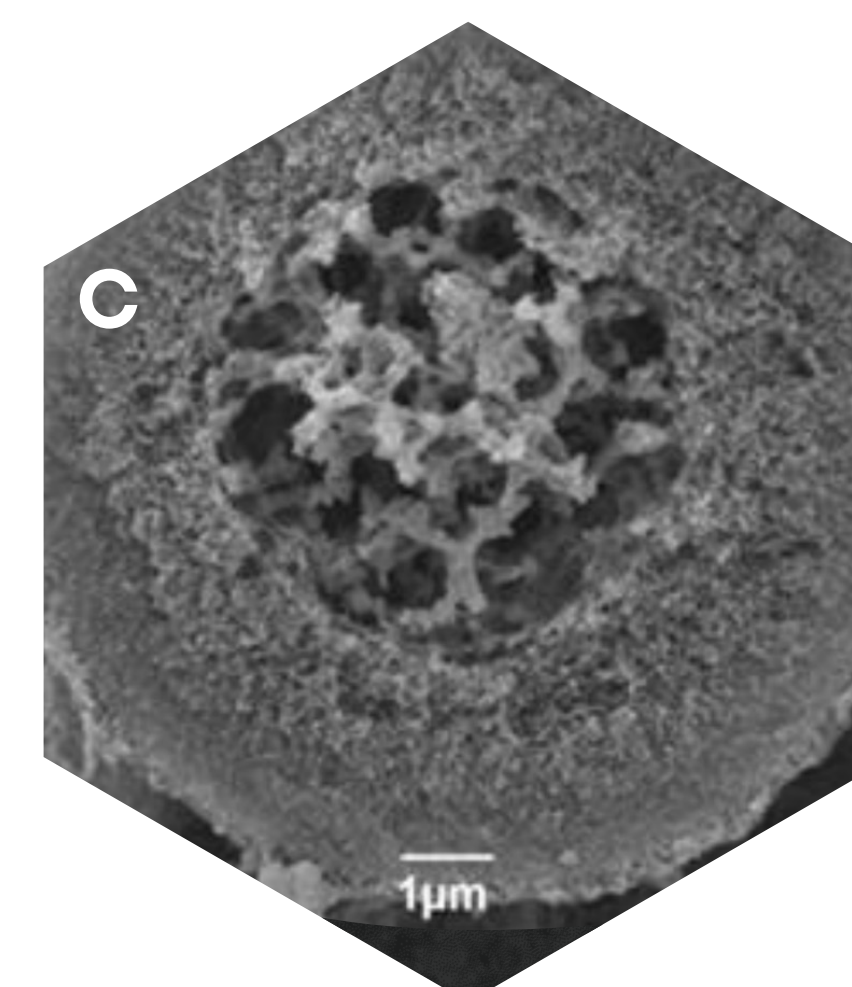
Polysaccharide granule

Gel and dry to make pore structure



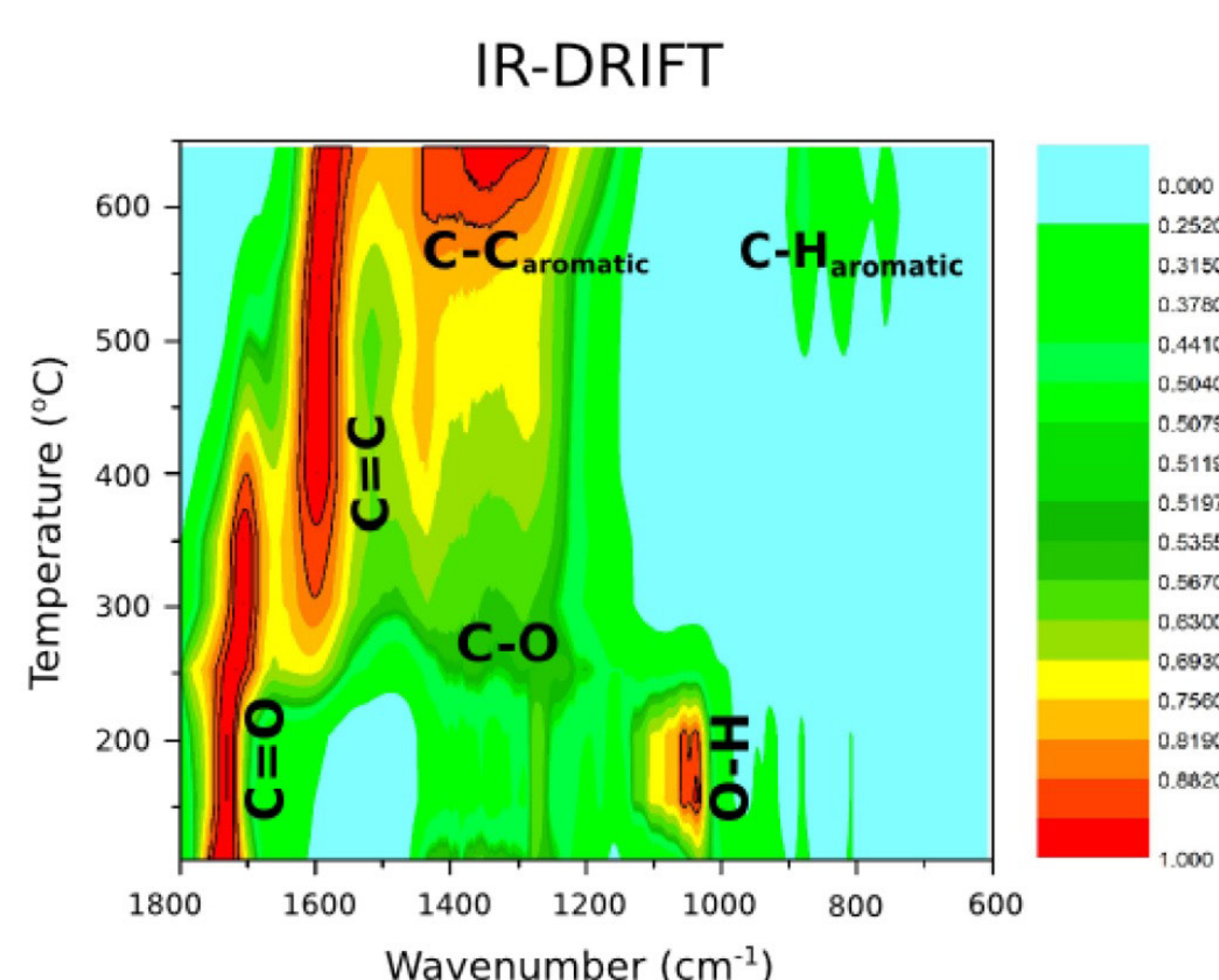
Unpyrolysed Starbon® aerogel

Pyrolysis



Highly stable mesoporous Starbon®

## Properties



DRIFT IR of A series Starbon as a function of temperature

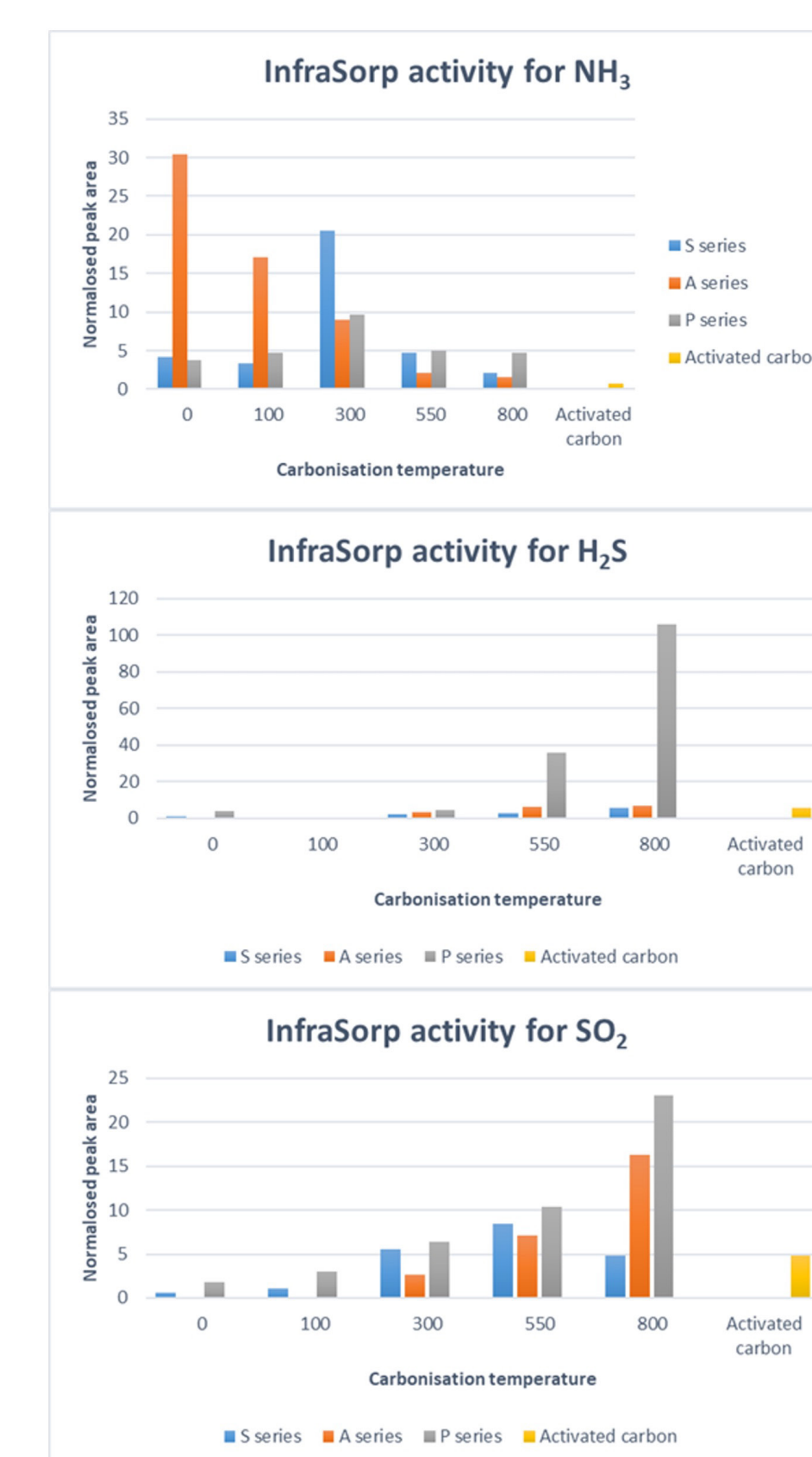
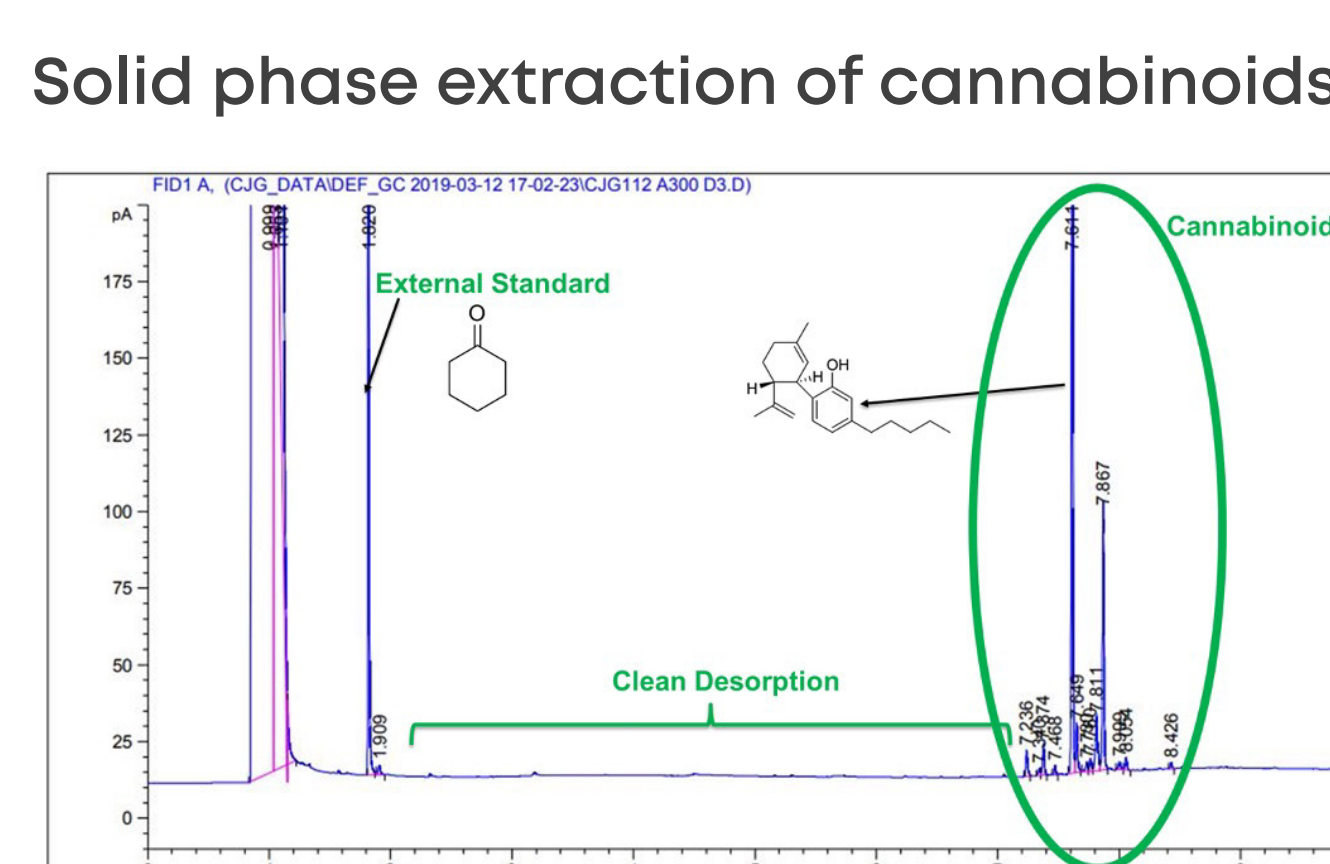
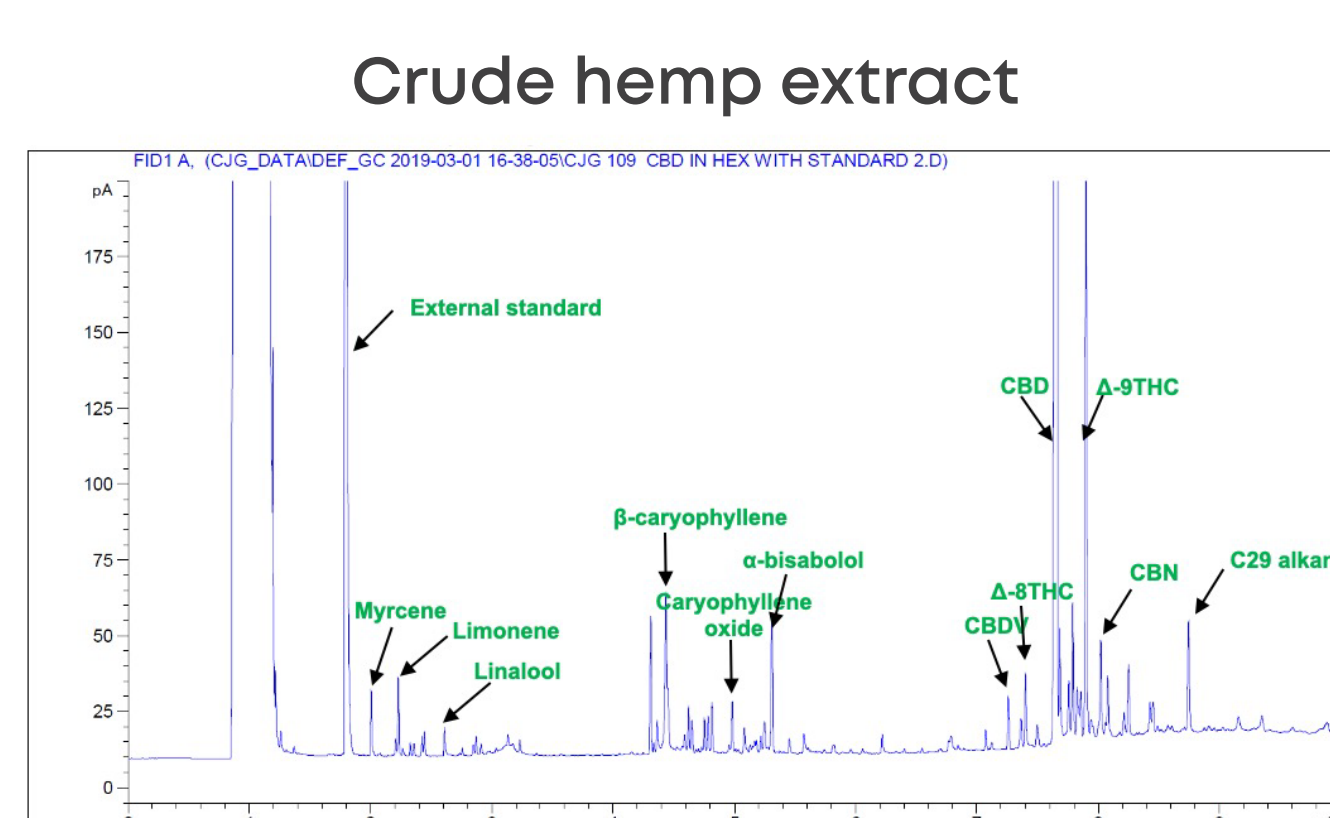
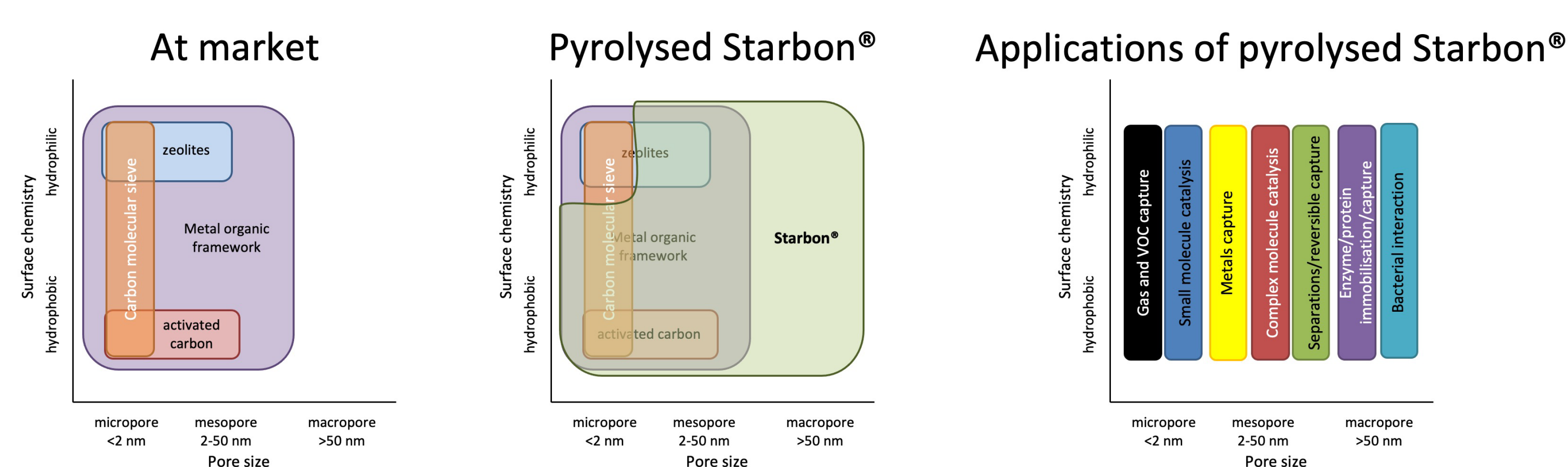
Surface area and pore volume as a function of starting material and temperature

Sample	S <sup>BET</sup> surface m <sup>2</sup> /g	V <sub>p</sub> <sup>BH</sup> cm <sup>3</sup> /g	V <sub>p</sub> <sup>DFT</sup> cm <sup>3</sup> /g	Micropore vol <sup>BH</sup> cm <sup>3</sup> /g	Micropore vol <sup>DFT</sup> cm <sup>3</sup> /g	Mesopore vol <sup>BH</sup> cm <sup>3</sup> /g	D <sup>BH</sup> nm
S000	85.62	0.488	0.472	0.009	0.010	0.479	12.68
S300	291.98	0.609	0.557	0.045	0.058	0.564	11.44
S800	773.84	0.678	1.025	0.261	0.244	0.417	10.5
A000	83.09	0.448	0.392	0.000	0.000	0.448	8.51
A300	137.29	0.198	0.348	0.010	0.016	0.188	12.04
A800	689.20	0.962	1.139	0.147	0.176	0.815	11.7
P000	83.62	1.398	1.348	0.006	0.000	1.392	3.53
P300	100.33	0.525	0.438	0.000	0.007	0.525	13.86
P800	631.18	0.986	0.997	0.158	0.158	0.828	9.93

## Conclusion

Starbons offer a "green" and highly effective processing solution. Designed with structural flexibility, they enable one-step selective separation and capture of a wide range of molecules. Starbon® mesoporous materials can be employed to separate and capture at speed with fewer processing steps, using less energy. Furthermore, they are re-usable, 100% biobased and biodegradable.

## Applications



Solid phase extraction (SPE): Starbons have been proven to remove high value active pharmaceuticals from complex mixtures such as organic natural product extract (CBD from hemp), aqueous natural product extract (UV actives from seaweed) or biological systems (water soluble chemotherapy drug from fermentation broth).

Gas capture: Starbons excel in permanent (chemisorption) trapping of toxic gases (such as ammonia, hydrogen sulphide and sulphur dioxide), and in the reversible trapping of CO<sub>2</sub> or volatile organics (for carbon capture or environmental monitoring respectively).