

From industrial chestnut shell waste to high-performance magnetic carbonaceous adsorbents for use in biogas improvement

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Industrial Chestnut Shell Waste (CH)

Introduction

Chemical Activation



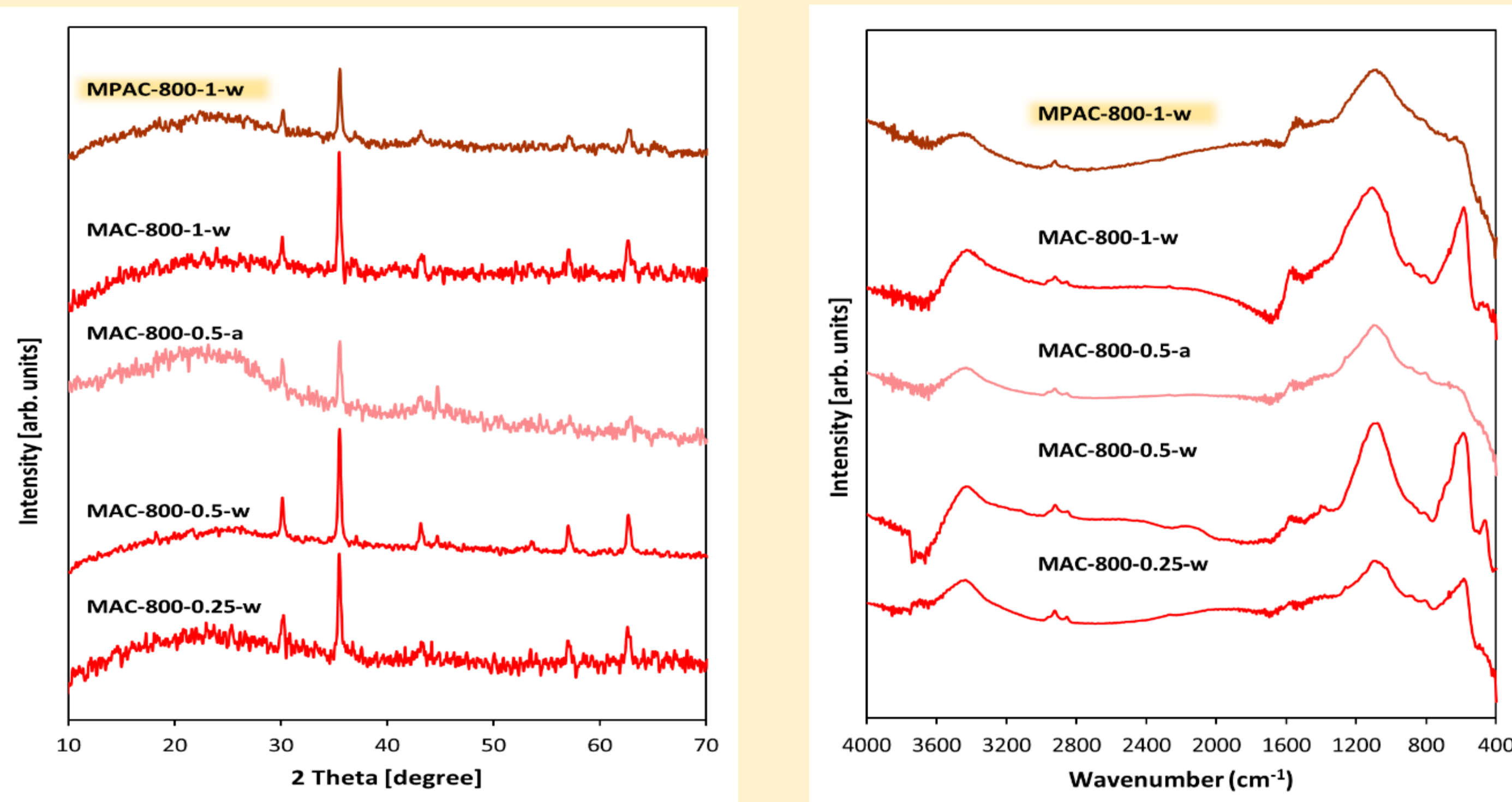
Pyrolysis step	Precursor	Material obtained	T(°C)	Mass ratio FeCl ₃ : CHP FeCl ₃ : CH	Washing step
✓	CHP	MPAC	600-800	1:1	Water (w)
✗	CH	MAC	600-800	0.25:1 0.5:1 1:1	Water (w) Acid (a)

MACs and MPACs
for biogas upgrading

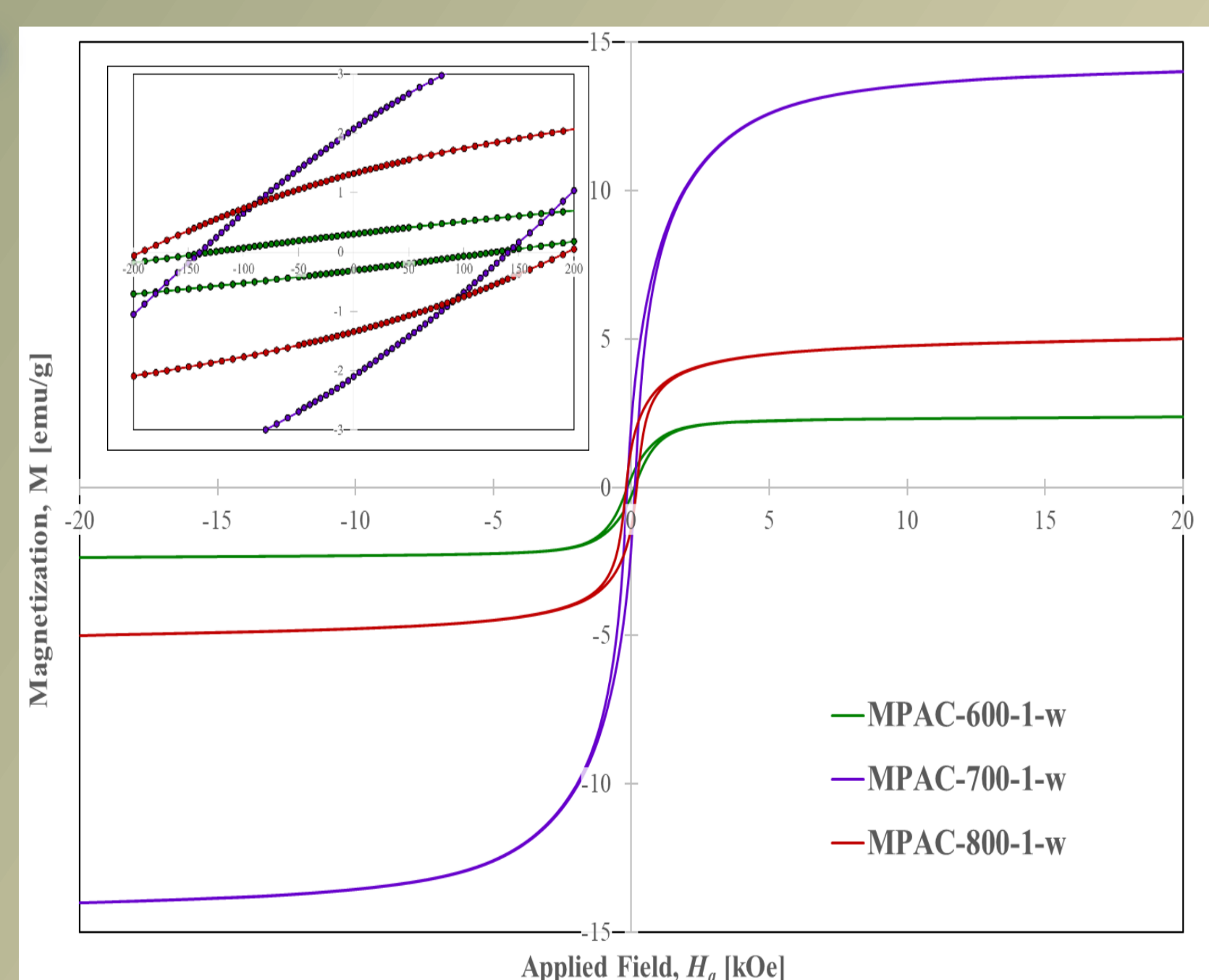
Results & Discussion

Samples	T (°C)	Ash (%)	C (%)	Fe (wt%)	S _{BET} (m ² /g)	V _{TOT} (cm ³ /g)
CH	-	0.9	50.3	0.55	1	0.007
CH-P500	500		83.9			
MPAC-600-1-w	600		73.6			
MAC-600-1-w	600	12.9	60.9	16.8	558	0.340
MAC-600-1-a	600	12.0	75.2	7.7	594	0.372
MAC-700-0.5-w	700	25.2	69.5	16.7		
MPAC-700-1-w	700		64.6			
MAC-800-0.25-w	800		72.8	15.9	653	0.351
MAC-800-0.5-w	800	29.1	68.1	23.5	568	0.294
MAC-800-1-w	800		59.6	25.7	638	0.364
MPAC-800-1-w	800		72.0	25.7		
MAC-800-0.5-a	800	8.0	88.5	5.0	822	0.356

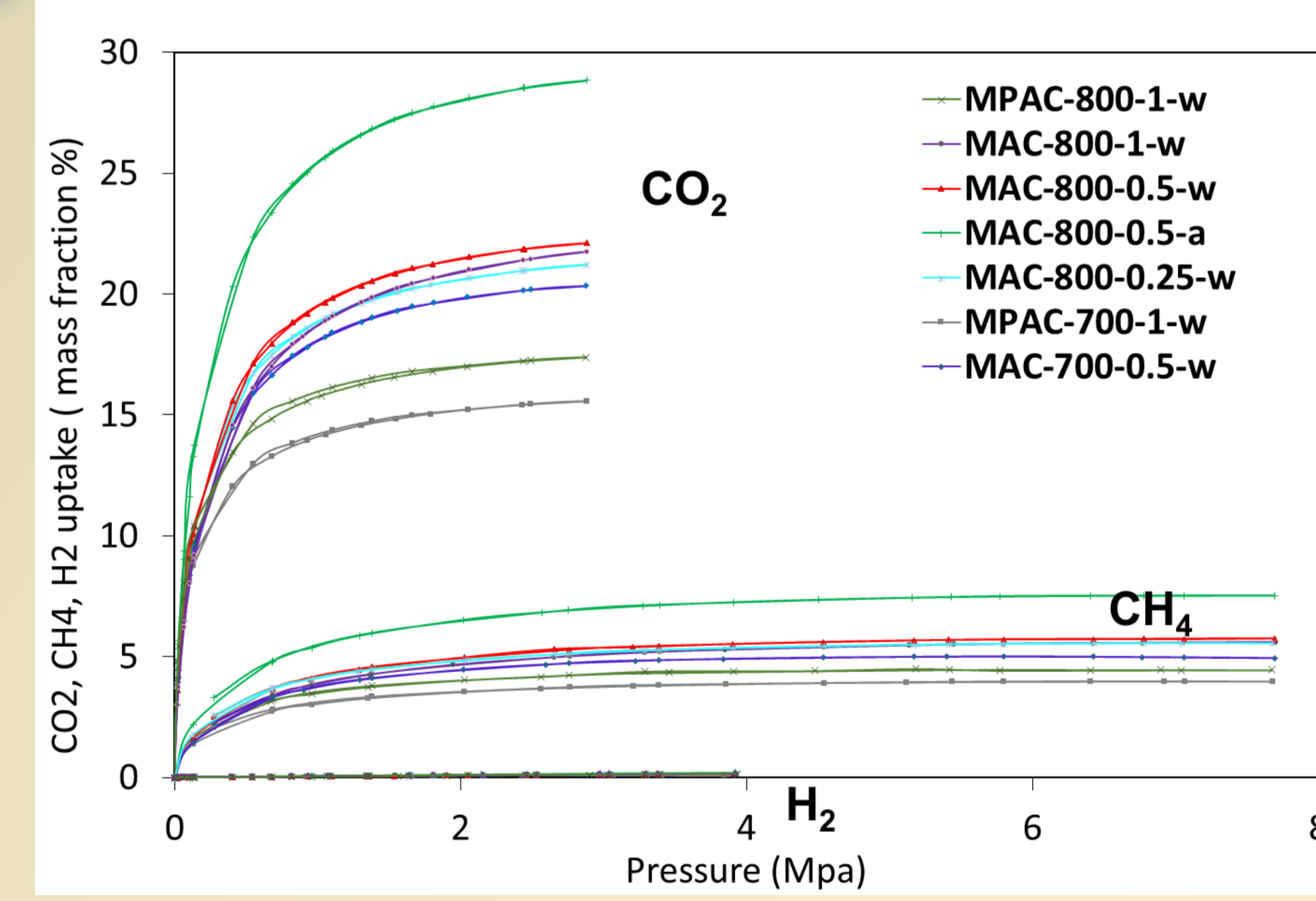
X-ray diffraction (XRD) and FTIR comparison between MACs and MPACs.



Vibrating Sample Magnetometer



High pressure balance



Conclusions

- ❖ CH or CHP was a suitable precursor for obtaining MAC or MPAC.
- ❖ Chemical activation with FeCl₃ as an activating agent is an effective method for obtaining magnetic adsorbents.
- ❖ The MACs or MPACs showed a good selectivity to CO₂ adsorption, moderate for CH₄ and insignificant for H₂.
- ❖ MACs and MPACs obtained resulted good candidates for CO₂ capture and gas storage.

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