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Supplementary material

Catalytic methane decomposition for the simultaneous production of hydrogen and low reactivity biocarbon for the metallurgic industry

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Supplementary data

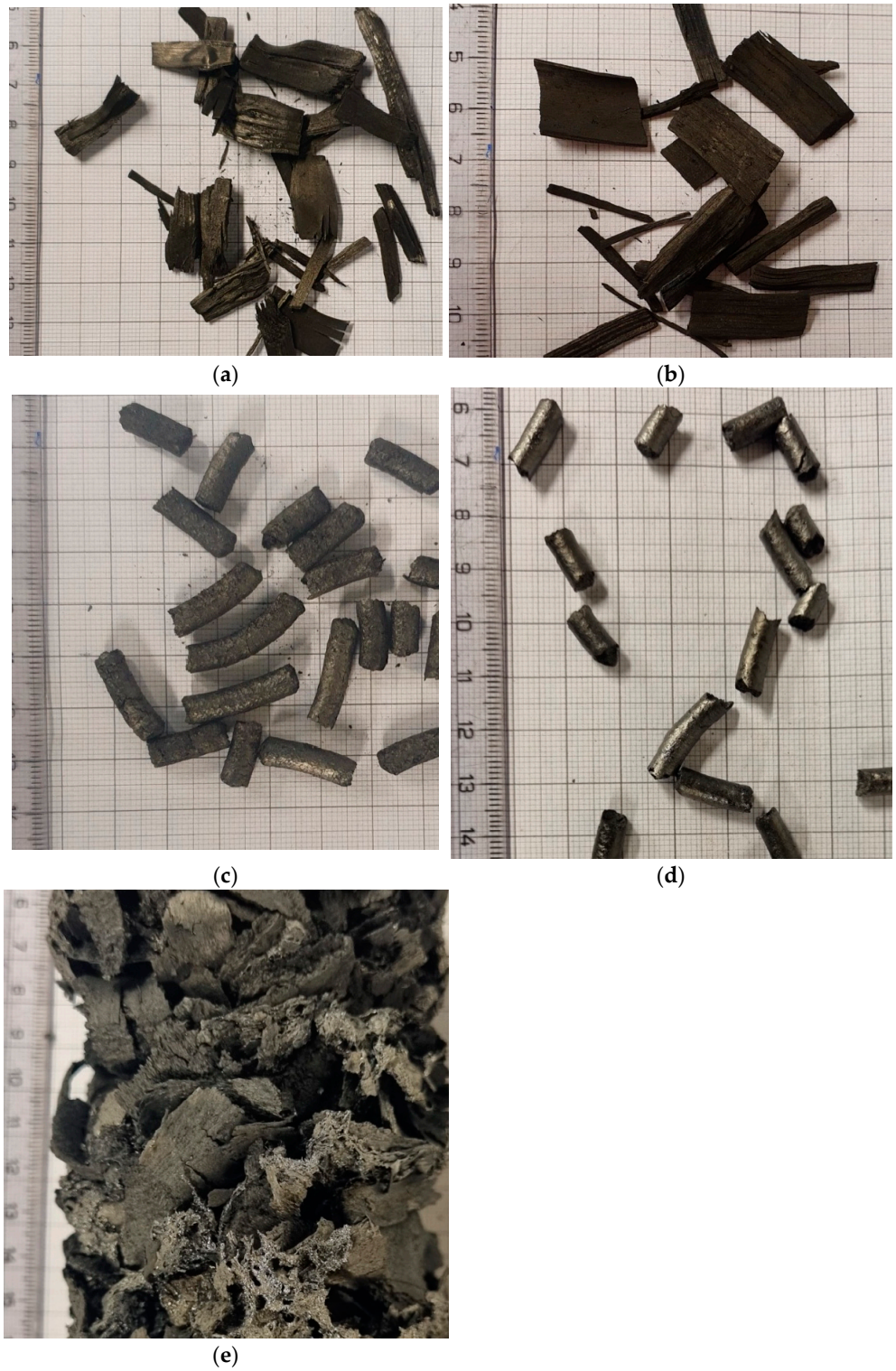


Figure S1. Pictures of the biocarbons produced at 1000 °C with 100 % nitrogen: (**a**) spruce wood, (**b**) birch wood, (**c**) wood pellets, (**d**) steam explosion pellets, (**e**) birch bark.

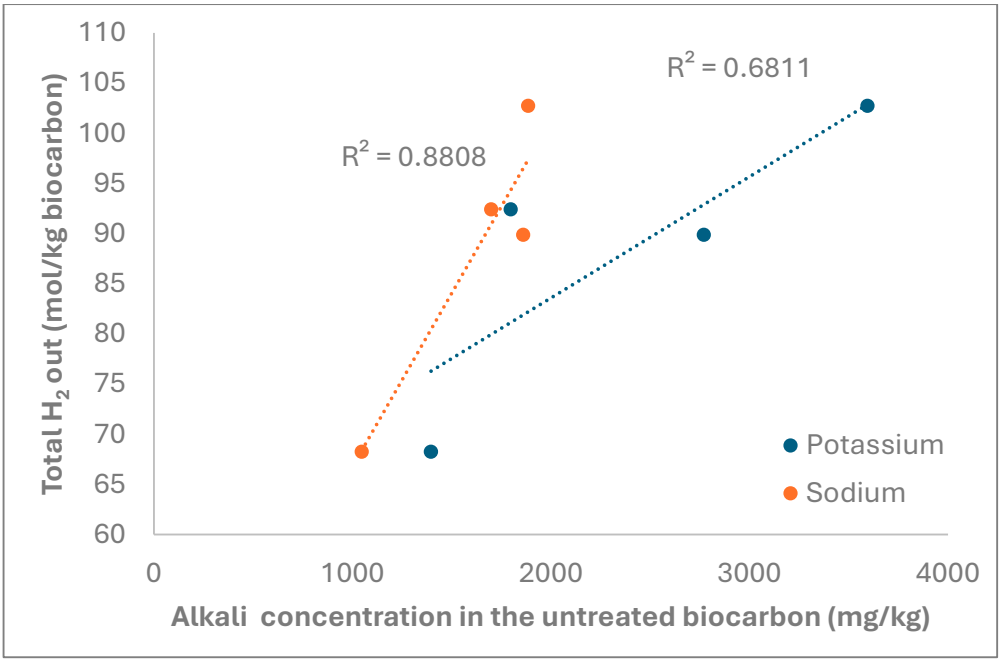


Figure S2. The influence of alkali concentration (Potassium and Sodium) on the total hydrogen produced during CDM experiments.

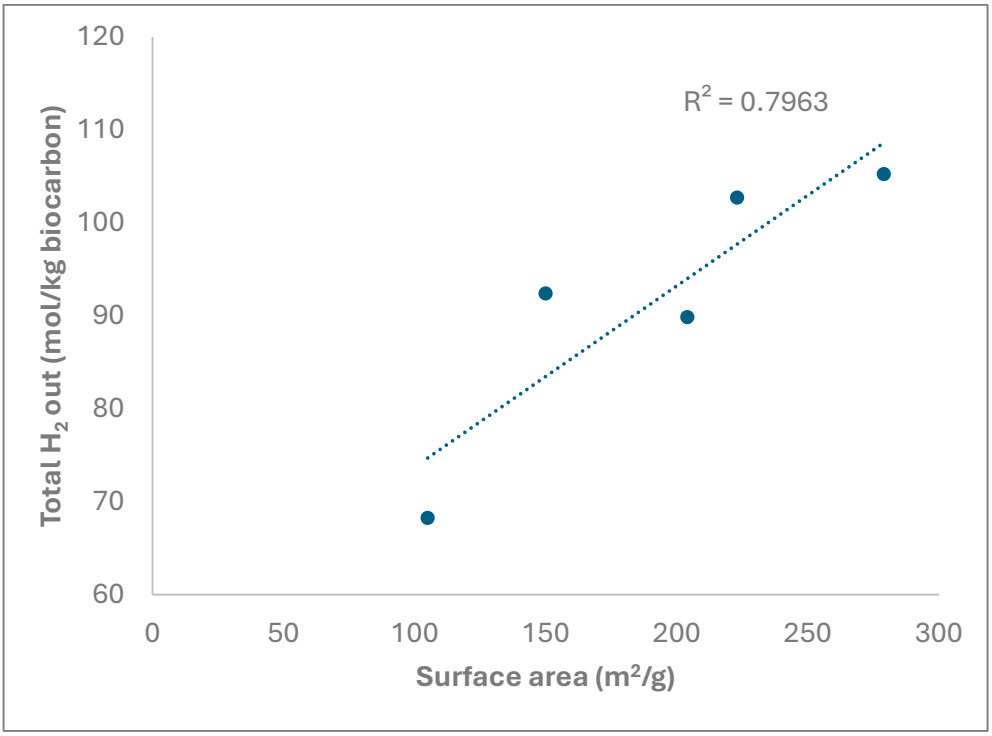


Figure S3. The influence of the initial biocarbon surface area on the total hydrogen produced during CDM experiments.

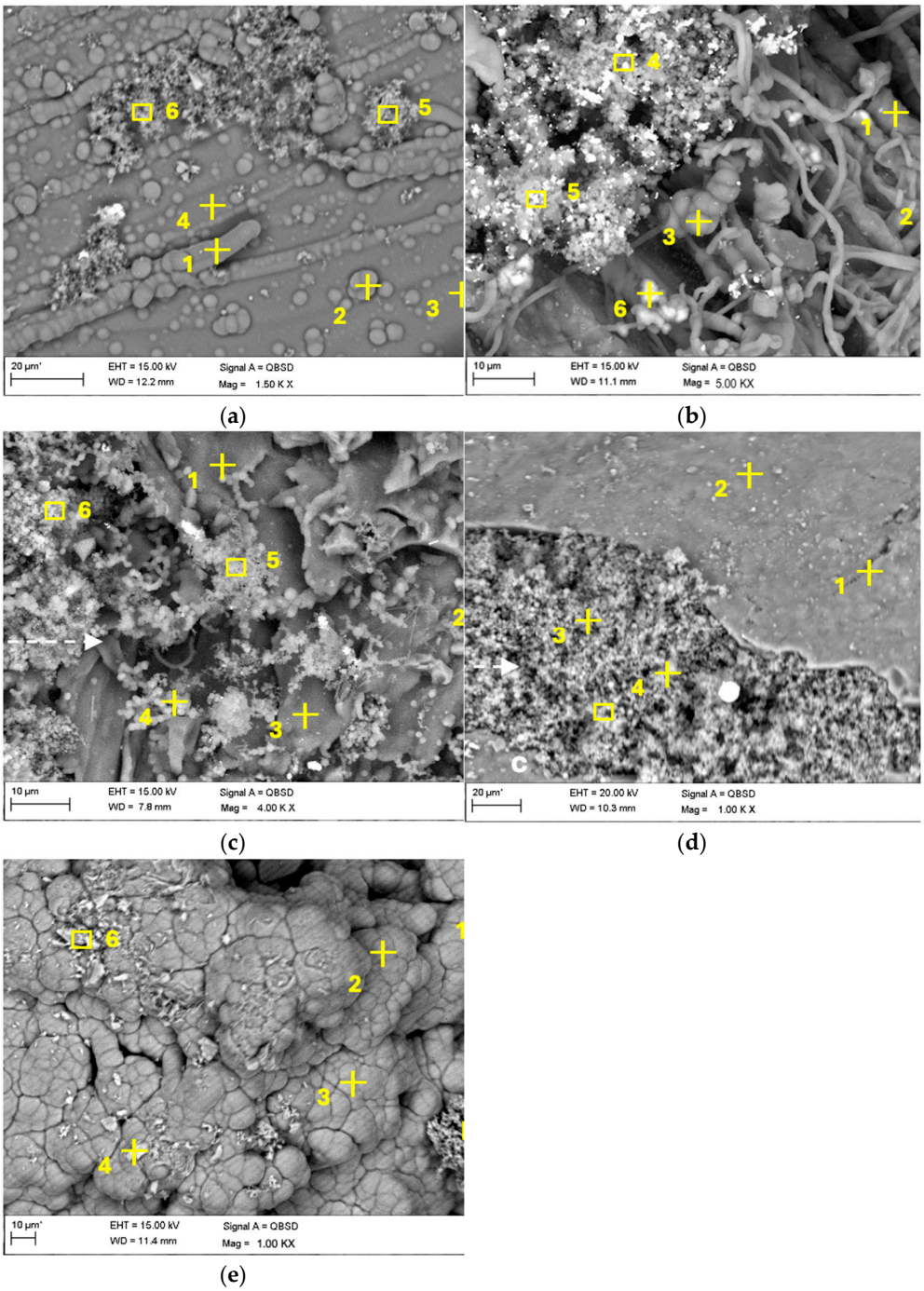


Figure S4. SEM images from the biocarbons used for methane cracking at 1100 °C with 90 % methane and 10 % Nitrogen. The biocarbons originate from: (**a**) spruce wood, (**b**) birch wood, (**c**) wood pellets, (**d**) steam explosion pellets, (**e**) birch bark.

Table S1. EDS analysis of the SEM images in Figure S4.

	C	O	Ca	Si	K	Na	P	Mg	Al	Fe	Fe
	Spruce wood (atomic ratio %)										
1	91.1	8.5	n.d.	n.d.	0.1	0.2	n.d.	n.d.	0	n.d.	0
2	91.2	8.3	0.4	0.06	0	n.d.	n.d.	n.d.	n.d.	n.d.	0.1
3	92.8	6.0	0.7	0.09	0.3	n.d.	0	0	0	n.d.	0.1

4	94.5	4.5	0.5	0.23	0.1	n.d.	n.d.	n.d.	0.2	n.d.	n.d.
5	89.2	9.1	1.4	0.09	0	n.d.	n.d.	0.1	0.1	n.d.	n.d.
6	88.9	9.3	1.0	0.24	0.3	0.1	0	0	0.1	n.d.	0
Birch wood (atomic ratio %)											
1	98.6	1.4	n.d.	0.02	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
2	98.7	1.3	n.d.	n.d.	n.d.	0	n.d.	0	0	n.d.	n.d.
3	98.9	1.0	n.d.	0.02	n.d.	n.d.	n.d.	0	n.d.	n.d.	n.d.
4	n.d.	11.3	79	0.92	n.d.	1.2	0.3	3.7	1.3	1.2	1.3
5	n.d.	10.9	80	1.27	n.d.	n.d.	n.d.	2.4	n.d.	4.2	1.5
6	33.2	6.3	45	11.8	n.d.	n.d.	n.d.	0.3	n.d.	2.5	1.1
Wood pellets (atomic ratio %)											
1	93.2	1.5	3.7	n.d.	1.2	n.d.	0.2	n.d.	0.1	n.d.	0.1
2	95.7	4.2	n.d.	n.d.	n.d.	n.d.	n.d.	0	n.d.	0	n.d.
3	96.4	3.5	n.d.	0.05	n.d.	n.d.	n.d.	n.d.	0	0	n.d.
4	75.3	19.3	1.5	0.02	2.1	1.6	n.d.	0.2	0.1	n.d.	n.d.
5	76.8	15.8	2.4	0.17	2.1	1.8	n.d.	0.6	0.3	n.d.	n.d.
6	79.7	14.5	1.6	n.d.	0.2	3.8	n.d.	n.d.	0.1	n.d.	n.d.
Steam explosion pellets (atomic ratio %)											
1	97.6	2.4	n.d.	0.03	0	n.d.	n.d.	0	n.d.	n.d.	n.d.
2	94.7	4.5	0.5	0.01	0.2	0	0.1	0	0	n.d.	0.1
3	88.8	11.0	n.d.	0.1	n.d.	n.d.	n.d.	0	0	n.d.	0.1
4	90.6	9.0	n.d.	0.1	0.1	n.d.	0	0	0.1	n.d.	0.1
Birch bark (atomic ratio %)											
1	94.6	3.5	1.6	0.07	0.2	0	n.d.	0	0.1	n.d.	n.d.
2	90.6	4.3	4.4	0.23	0.4	0.1	n.d.	n.d.	0.1	n.d.	n.d.
3	90.9	5.4	3.2	0.13	0.3	0	n.d.	n.d.	0.1	n.d.	0
4	88.7	9.9	0.2	0.24	0.2	0.3	n.d.	0.3	0.2	n.d.	0
5	83.1	14.2	0.5	0.18	0.1	0.9	n.d.	0.6	0.4	n.d.	0.1
6	88.0	9.8	0.5	0.29	0	0.5	n.d.	0.5	0.3	n.d.	0.1

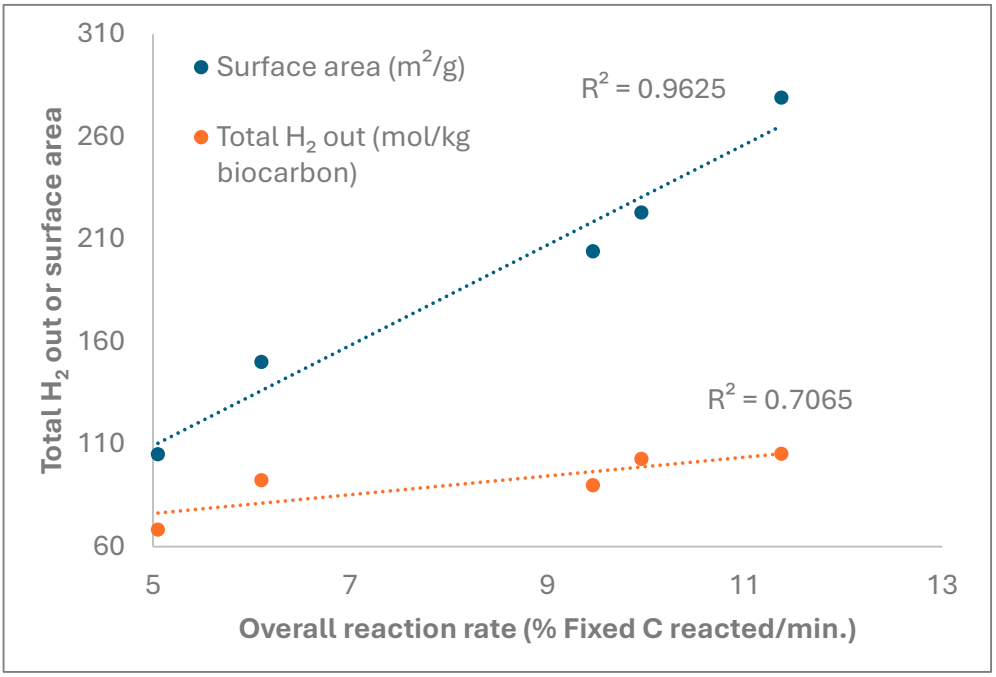


Figure S5. The influence of the overall CO_2 reaction rate of initial biocarbon on the total hydrogen produced and the surface area during CDM experiments.

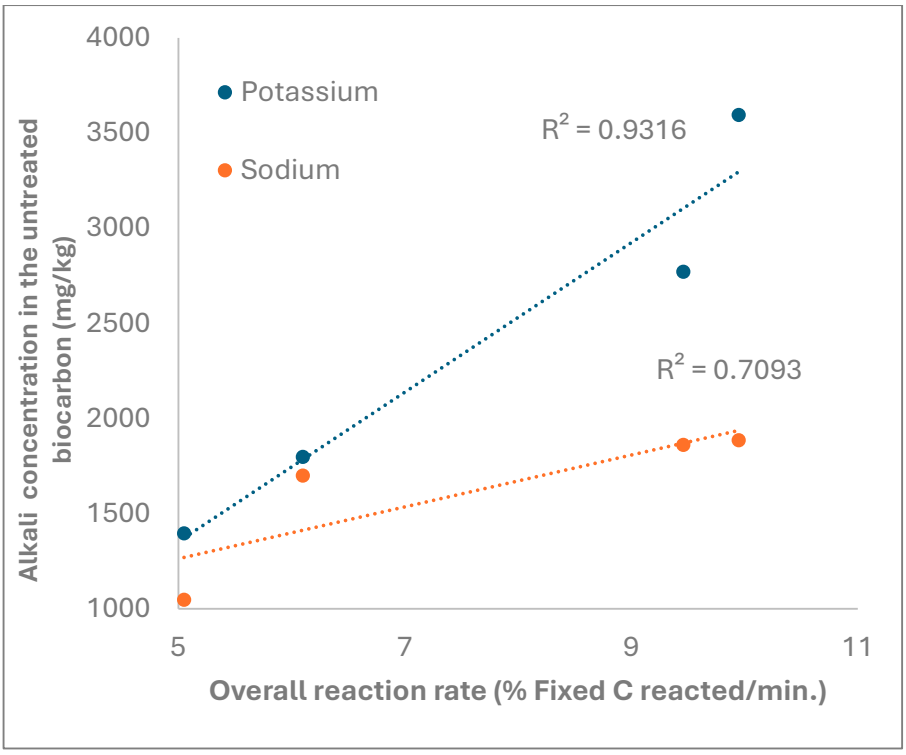


Figure S6. The influence of alkali content on the overall CO_2 reaction rate of initial biocarbon during CDM experiments.