Investigations on Silica Aerogels as CO_2 Adsorbents

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Introduction

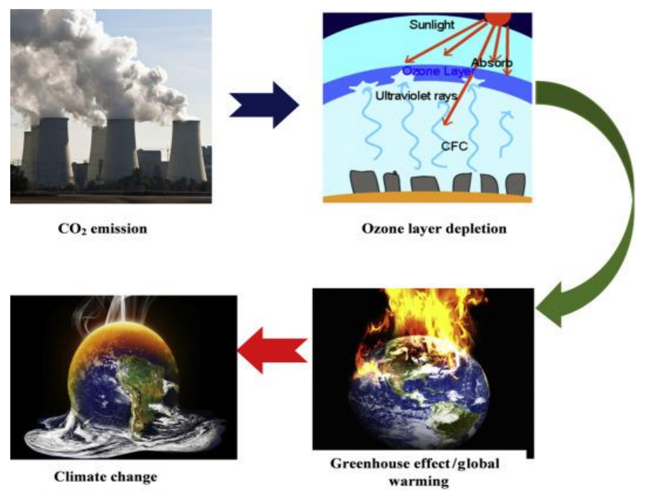


Fig 1: Effect of CO_2 Emissions

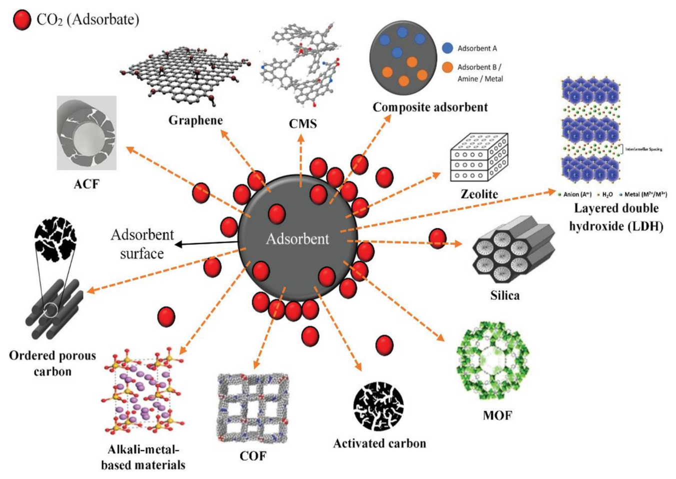


Fig 2: CO_2 Adsorbents

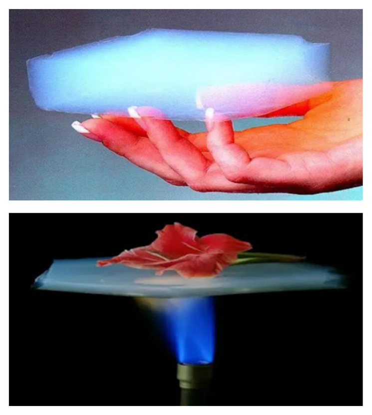


Fig 3: Aerogels

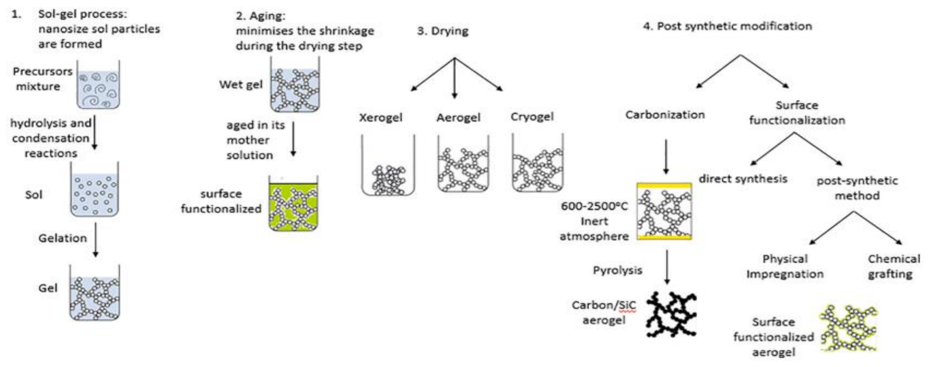
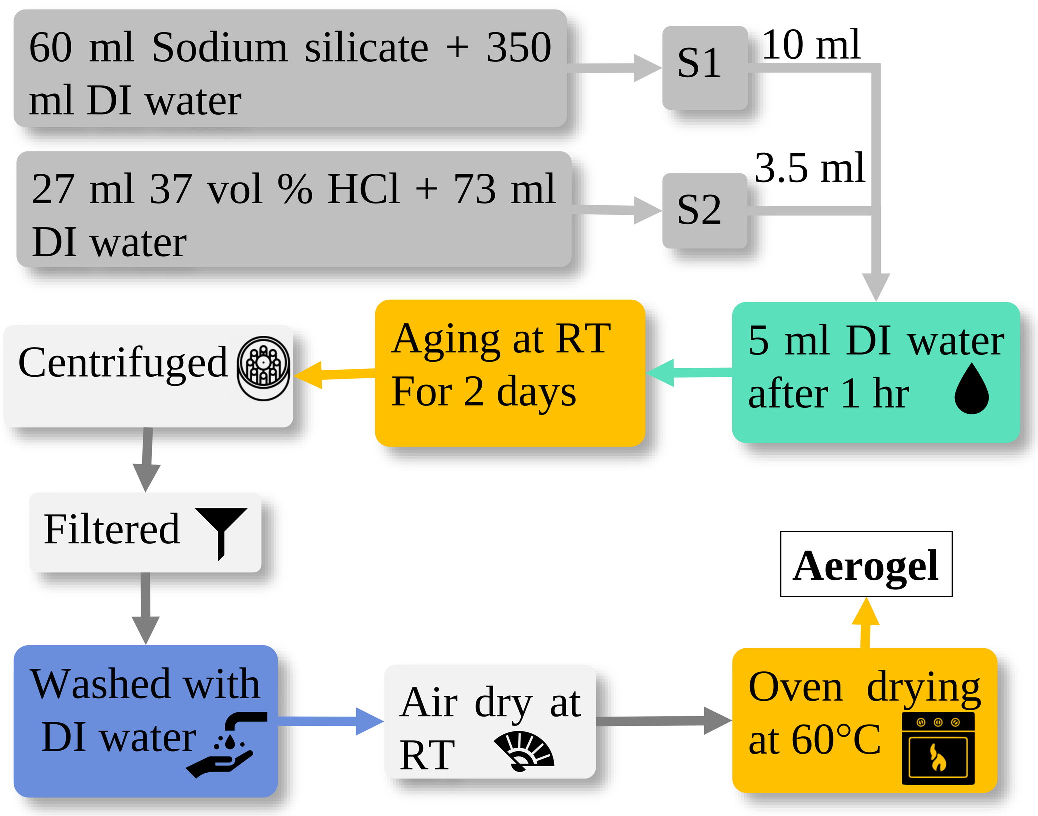


Fig 4: Aerogel Synthesis

Experimental Methods



Dried gel

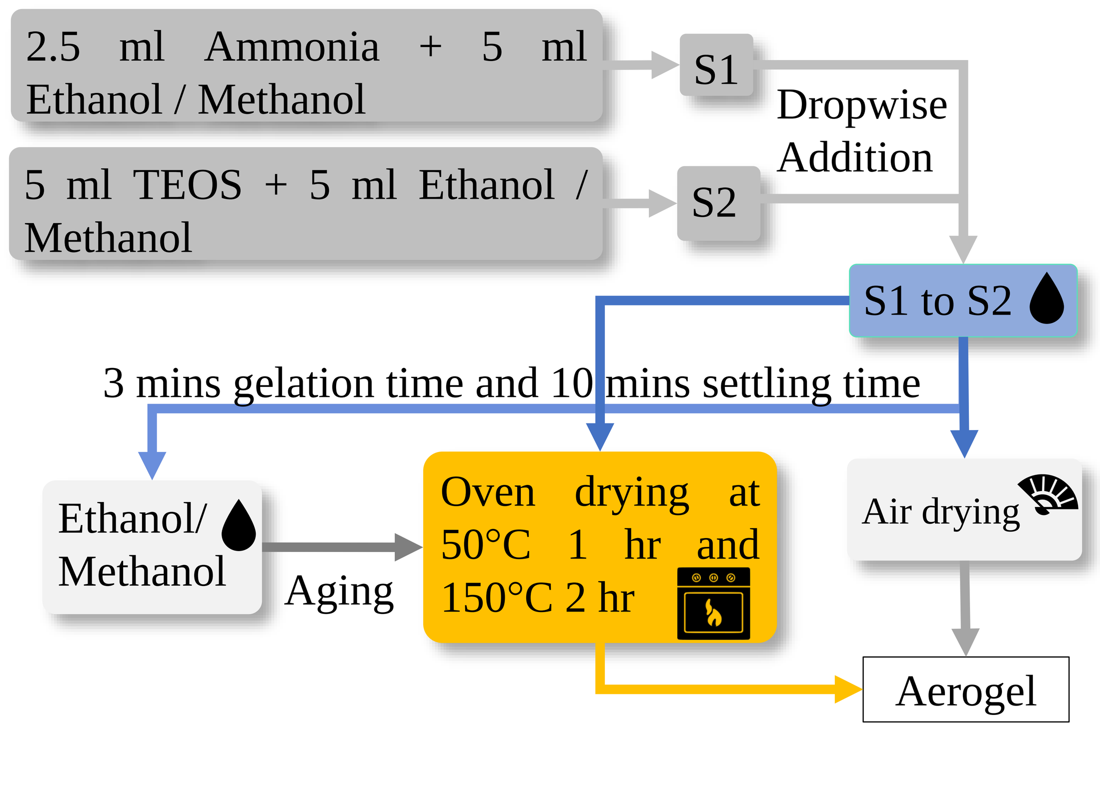
Dried gel - TEPA

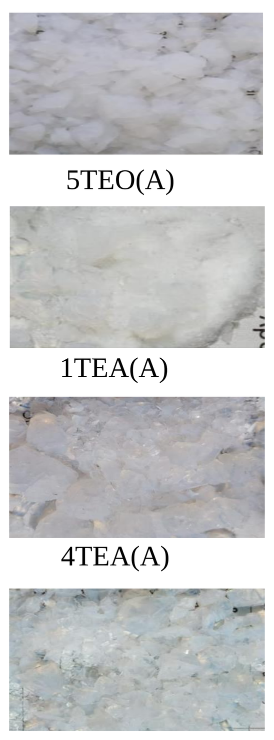
Wet gel - TEPA

Dried gel - TECS

Fig 5: Synthesis of Water Glass based Aerogels

- Dried gel: The gel obtained by the above process
- Dried gel – TEPA: Surface modified gel with TEPA after drying
- Wet gel – TEPA: Surface modified gel with TEPA before drying
- Dried gel –TECS: Surface modified gel with TECS after drying



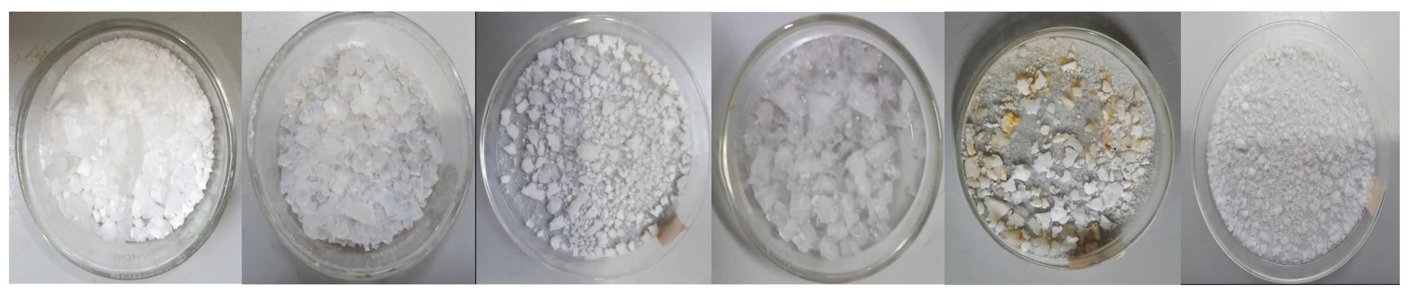


5TEO(A)

1TEA(A)

4TEA(A)

5TEA(A)



5TMA(A) 5TMO(A) 5TMO(A)1 5TMO1(A) 5TMO2(A) 5TMO3(A)

Fig 6: Synthesis of TEOS-based Aerogels

Results and Discussions

Table 1: Characterization

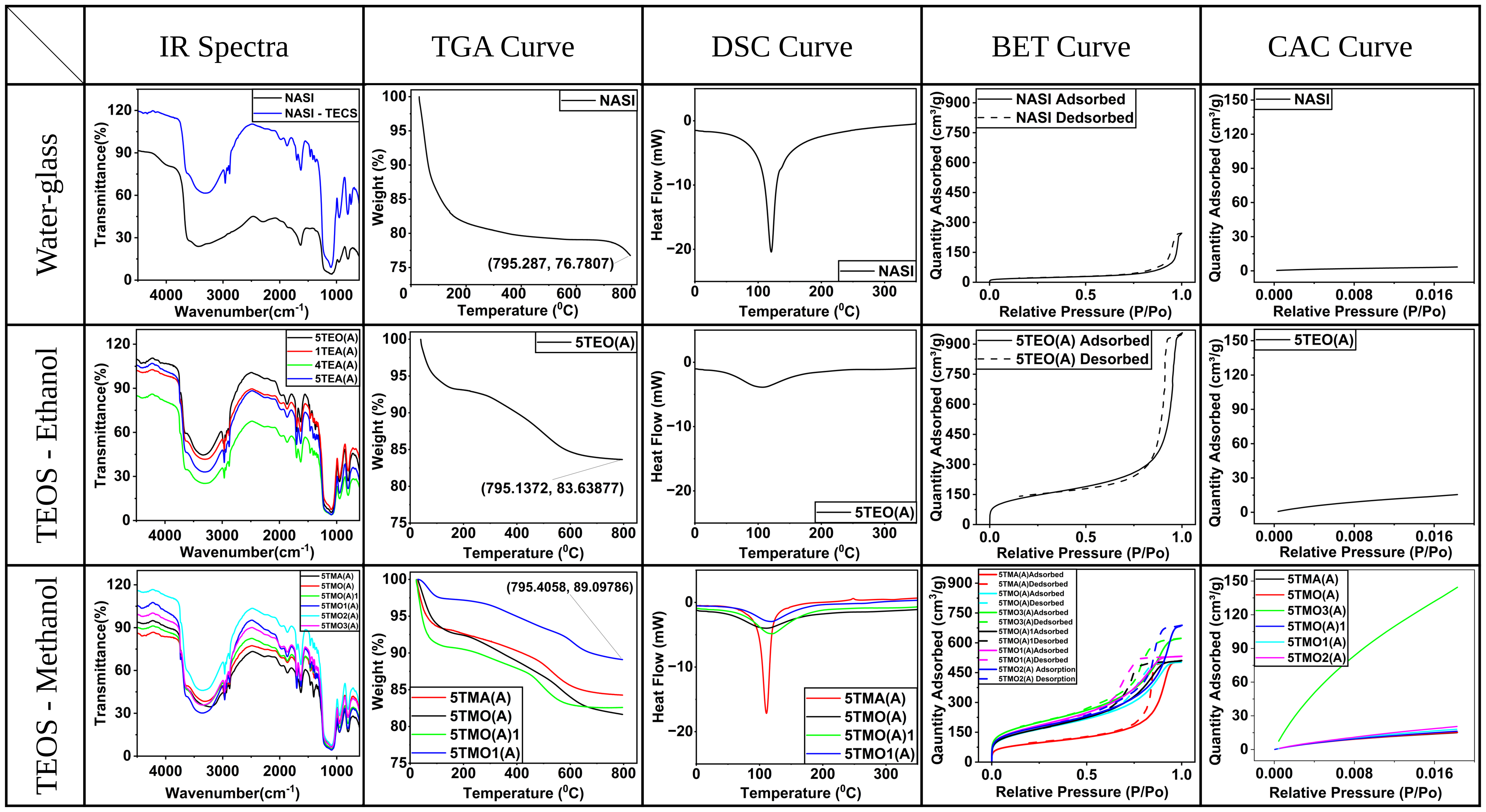


Table 2: BET analysis

Sample	BET surface area(m^2/g)	Pore size (nm)
NASI	74.3158	20.48967
5TEO(A)	496.6151	11.78119
5TMA(A)	325.4834	9.57388
5TMO(A)	560.4922	5.54378
5TMO(A)1	567.3874	5.53904
5TMO1(A)	624.6671	5.27206
5TMO2(A)	596.8098	7.13571
5TMO3(A)	672.1753	5.71998

Table 3: CAC analysis

Sample	CO_2 adsorption capacity(cm^3/g)	Relative Pressure (mmHg)
NASI	3.3466	0.018311000
5TEO(A)	15.4807	0.018328711
5TMA(A)	14.9895	0.018262026
5TMO(A)	15.3009	0.018308785
5TMO(A)1	16.2809	0.018258872
5TMO1(A)	18.0165	0.018225000
5TMO2(A)	20.5572	0.018251507
5TMO3(A)	144.4644	0.018298281

Conclusions

- Silica aerogels can be tuned for their surface properties and employed as efficient CO_2 adsorbents
- With their high surface area up to 672.1753 m^2/g, low density, and well-defined pore size distribution, silica aerogels offer promise as materials for CO_2 capture and storage
- Silica aerogels exhibited a CO_2 uptake capacity up to 144.4644 cm^3/g with significant stability
- Overall, our study highlights the importance of continued research in the development of silica aerogels as innovative CO_2 capture and storage materials

Acknowledgements

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References

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