High Shear Wet Granulation Of Geopolymer

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Outline

PURPOUSE OF THIS STUDY

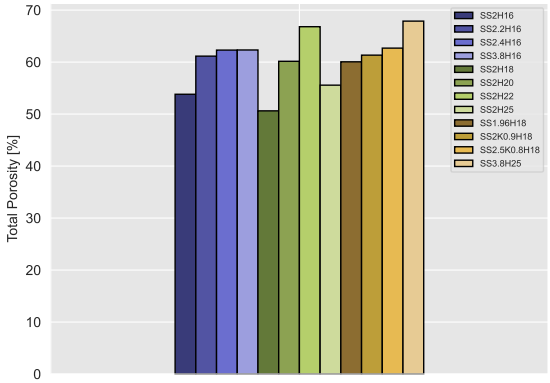
Production and charcaterization of the geopolymer granules for CO_2 adsorption test inside fluidized-bed column system

Outline

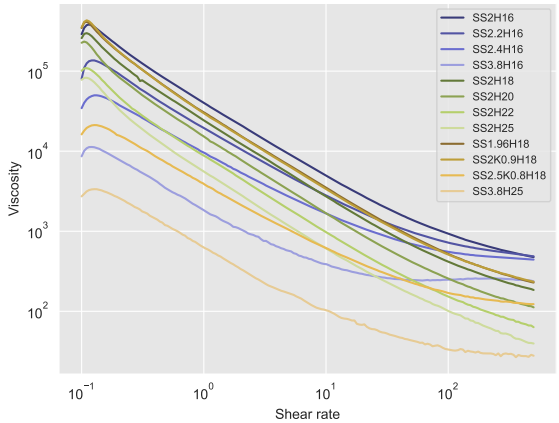
SAMPLE	AL2O3	SIO2	K20	H20
SS2H16	1	2	1	16
SS2.2H16	1	2.2	1	16
SS2.4H16	1	2.4	1	16
SS3.8H16	1	3.8	1	16
SS2H18	1	2	1	18
SS2H20	1	2	1	20
SS2H22	1	2	1	22
SS2H25	1	2	1	25
SS1.96H18	1	1.96	1	18
SS2K0.9H18	1	2	0.9	18
SS2.5K0.8H18	1	2.5	0.8	18
SS3.8H25	1	3.8	1	25

Table 1: Geopolymer compositions tested

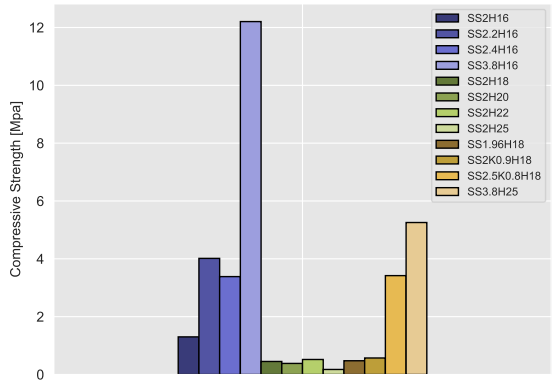
Figure 2: Different views of the geopolymer monoliths prepared to conduct the screening phase



(a) Total Porosity values in percentage



(b) Viscosity



(c) Mean Compression Values

Figure 3: Properties tested during the screening phase

Outline

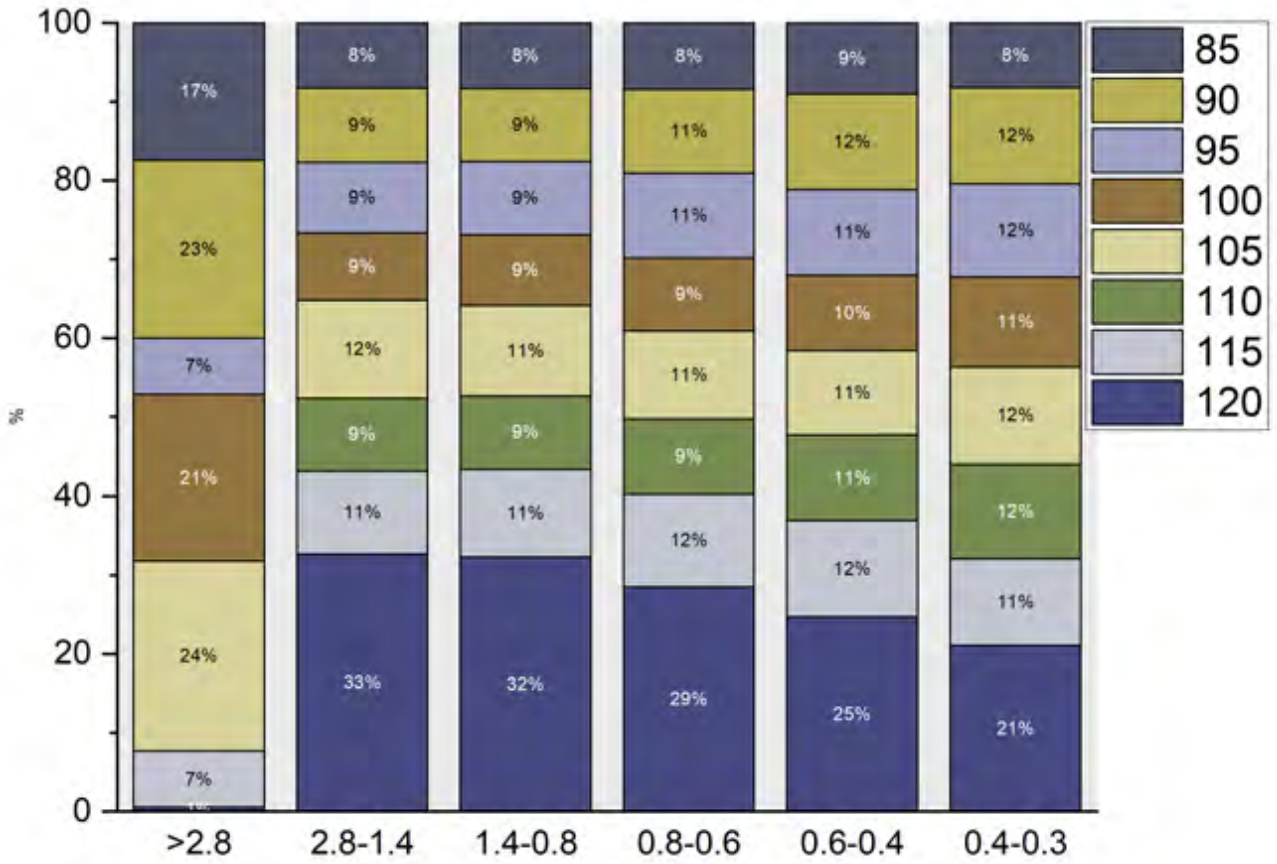
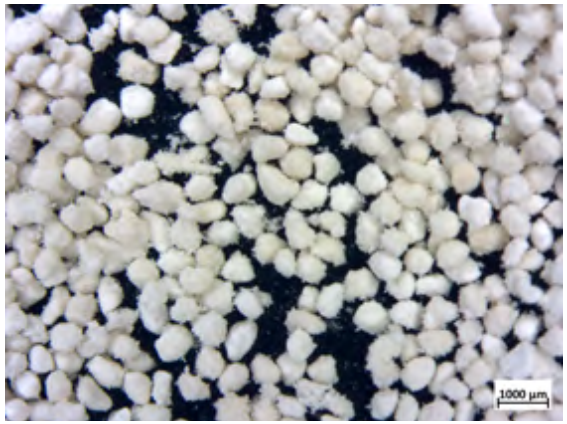
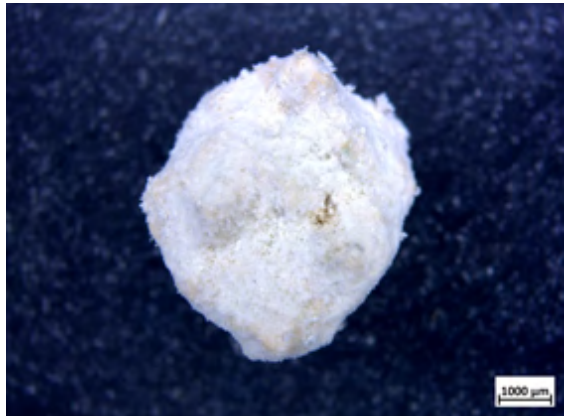


Figure 4: Size distribution of the granules for different Liquid-Solid Ratio



(a)



(b)

(c)

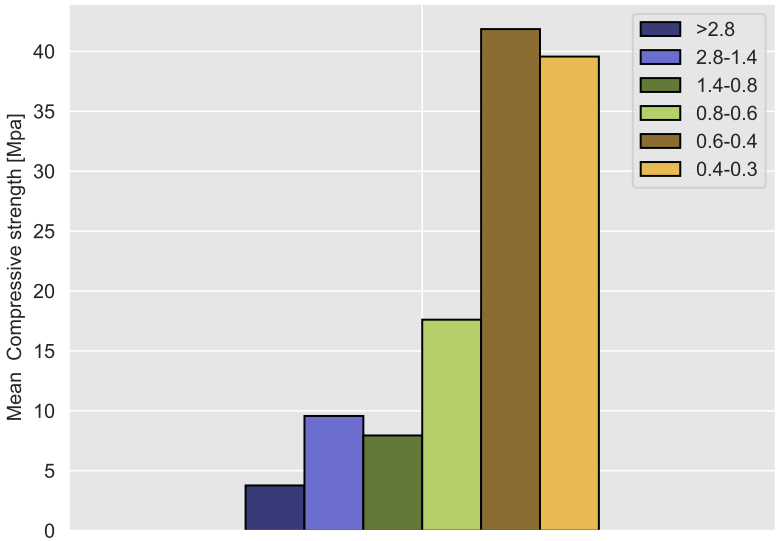
(d)

Figure 5: Images of the granules obtained

Outline

SAMPLE	SAUTER DIAMETER [mm]
>2.8	3.2958
2.8 - 1.4	1.9413
1.4 - 0.8	1.2232
0.8 - 0.6	0.7660
0.6 - 0.4	0.4237
0.4 - 0.3	0.3602

Table 2: Sauter Mean Diameter from a mastersizer 2000



$$\sigma = k \cdot \frac{F}{\pi \cdot R_{eq}^2}$$

Figure 6: Mean Compressive strength values for different granules dimensions

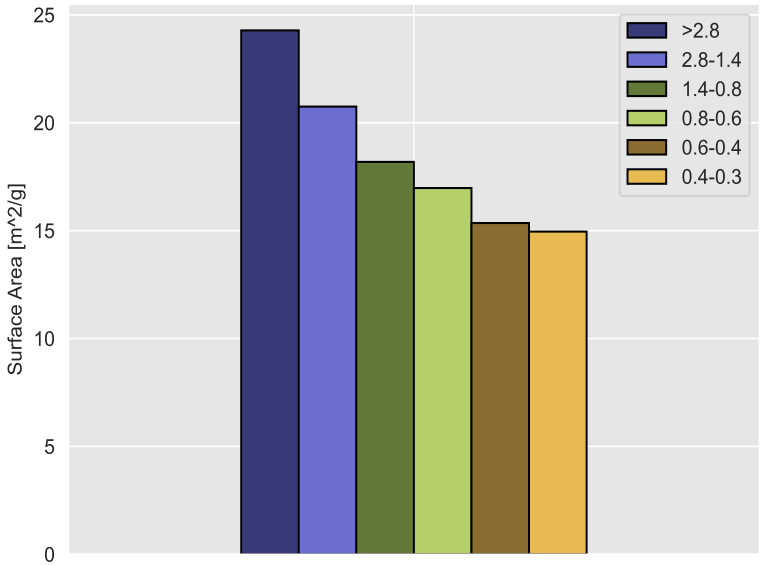
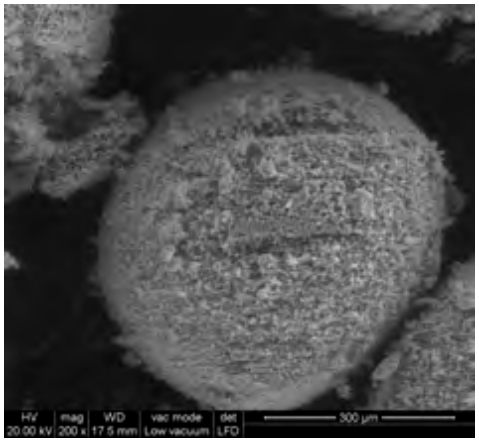


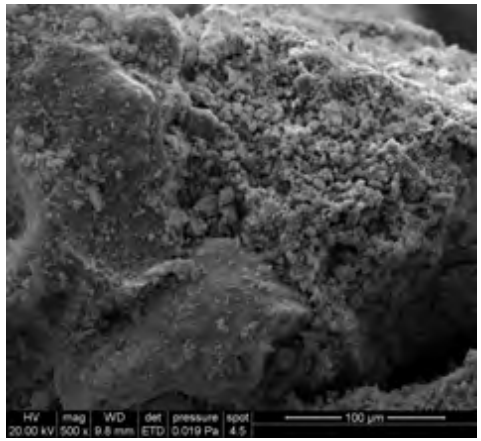
Figure 7: Surface Area Values

SAMPLE	SURFACE AREA [m^2/g]
>2.8	24.281
2.8 - 1.4	20.750
1.4 - 0.8	18.187
0.8 - 0.6	16.975
0.6 - 0.4	15.354
0.4 - 0.3	14.957
Initial powder	82.718

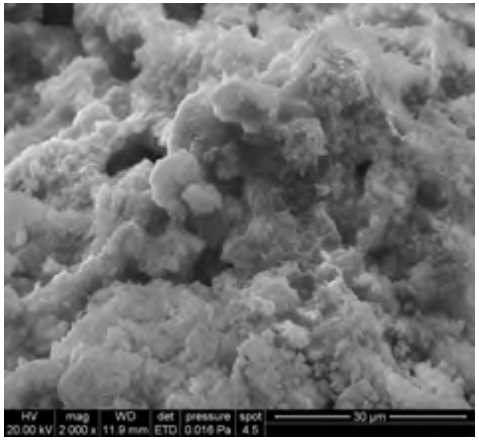
Table 3: Surface Area Values



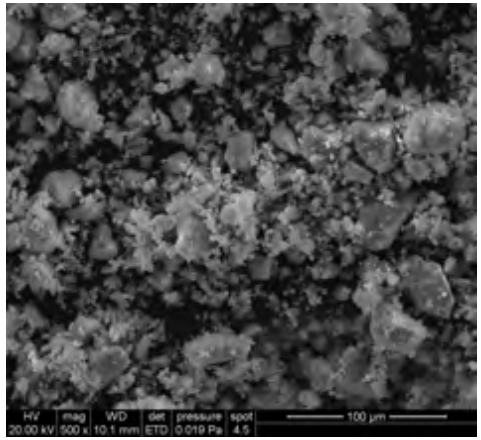
(a)



(b)

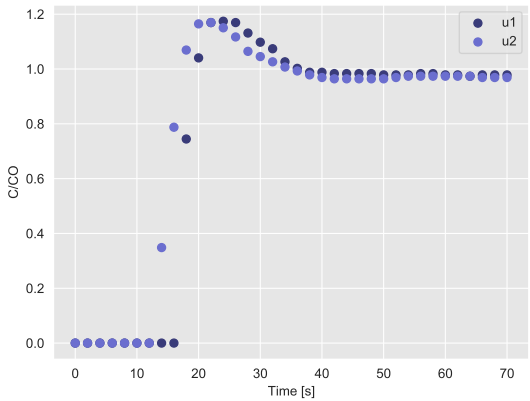


(c)

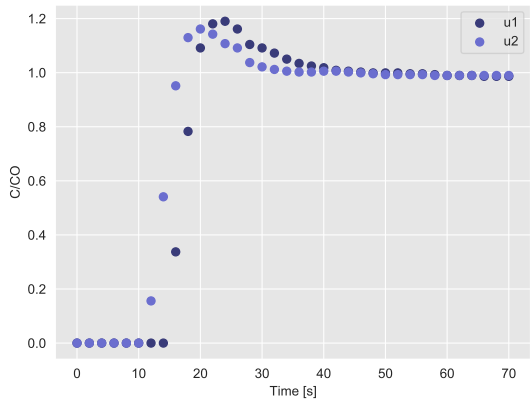


(d)

Figure 8: SEM images of the external (a,b) and internal (c) surface of the granules and (d) of the initial powder



(a)



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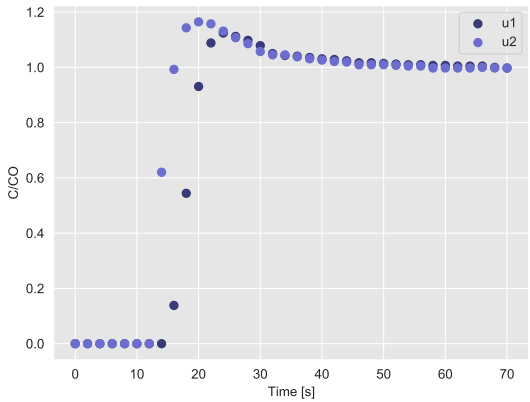
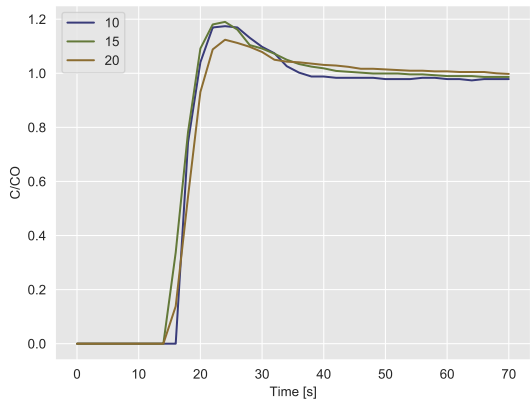
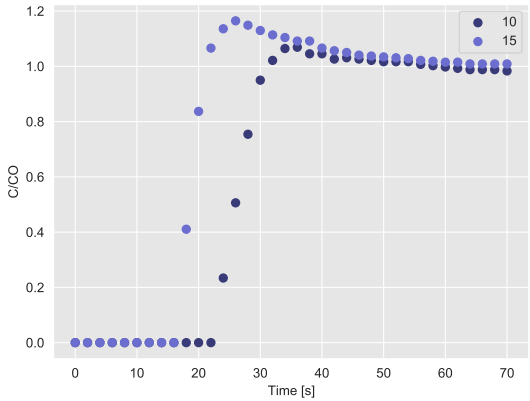


(c)

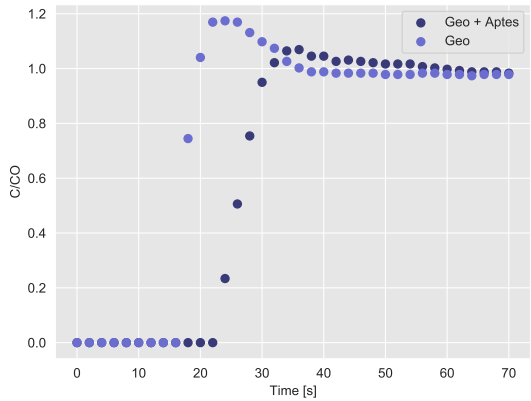


(d)

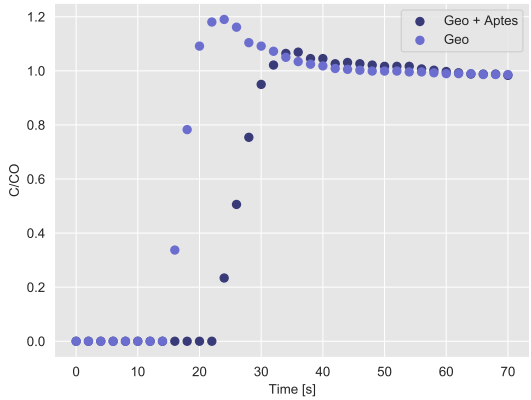
Figure 9: Breakthrough curves of different C/CO Ratio and (d) the comparison



(a)



(b)



(c)

Figure 10: Breakthrough curves of different C/CO Ratio and (d) the comparison

	10 % CO_2		15 % CO_2		20 % CO_2	
$[\frac{cm}{s}]$	u1	u2	u1	u2	u1	u2
	5	7.4	5	7.4	5	7.4
$\frac{CO_2}{Kg_{ads}}$	5.4	6.2	7.4	9.1	10.4	12
$t_b[s]$	18	16	17	14	15	14
$t_s[s]$	22	22	22	20	22	22

10% CO2	Zeolite 13x	Si + APTES	Geo	Geo + APTES
$\frac{CO_2}{kg_{ads}}$	15.2	10	5.4	8.7
$t_b[s]$	50	26	18	26
$t_s[s]$	56	30	22	32

Outline

- Good CO_2 Adsorption Capability

Other Applications:

- Polluttant adsorption
- Water Purification

THANK YOU FOR YOUR ATTENTION!