Starbon® Case Study - *selective adsorption & recovery of CO_2*

Mesoporous Starbon® materials have been shown to possess superior CO_2 adsorption properties when compared with microporous activated carbon (AC), both in terms of the amount of CO_2 adsorbed and the selectivity for CO_2 adsorption over N_2.

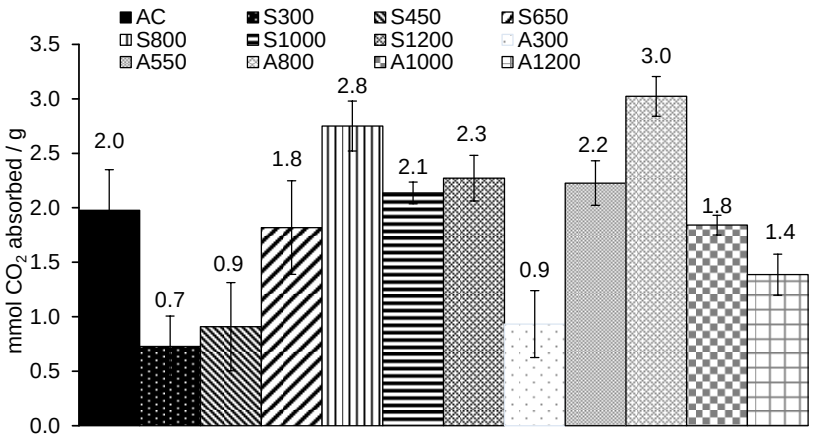

Figure 1. CO_2 absorption data for AC, and Starbon® materials. The data given is the average of five measurements and the error bars represent the highest and lowest measurements for each material.

In this study, the CO_2 adsorption properties of Starbon® materials were measured under pressure-swing conditions. The materials were first dried (16 hours at 110 °C, cooled under vacuum), then subjected to five cycles of pressurisation to 5 or 10 bar with CO_2 for 30 minutes, and finally subjected to vacuum at room temperature until the mass had dropped to the value recorded after drying. The mass difference between the end of the pressurisation and vacuum steps was used to calculate the number of mmols of CO_2 absorbed per gram of sample. Figure 1 shows the average data (over the five cycles) obtained when the samples were pressurized to 5 bar (10 bar data also available on request) see supporting information). It is apparent from Figure 1 that certain Starbon® materials outperform the CO_2 absorption capacity of AC by up to 50% (up to 65% at 10 bar).

For both starch and alginic acid derived Starbon® materials optimal results were obtained using material carbonised at 800 °C – corresponding to the material with the highest total surface area and smallest average pore radius.

Table 1. Selectivities for CO_2 adsorption versus N_2 adsorption.

Material	T (K)	CO_2 / N_2 selectivity
AC	298	5.4
AC	323	4.0
S800	298	14.0
S800	323	20.3
A800	298	14.8

The two most active mesoporous materials (S800 and A800) were selected along with AC to study the selectivity for CO_2 versus N_2 adsorption at both 298 and 323 K. Porosimetry was used to measure the mass of gas adsorbed at pressures of 0-1 bar. As shown in Table 2, both S800 and A800 showed much greater selectivity for CO_2 adsorption than N_2 adsorption (between 14:1 and 20:1) when compared to AC (between 4:1 and 5.4:1).