

**ON-SITE NITROGEN GENERATION
THANKS TO
CARBON MOLECULAR SIEVES**

The Solution for the N₂-PSA business sector



CarboTech
The activated carbon people

SHIRASAGI CMS - SUSTAINABLE SUPER-MATERIAL FOR OPTIMUM PSA PERFORMANCE

CarboTech distributes Shirasagi CMS products manufactured by OSAKA Gas Chemicals under exclusivity arrangements in Europe, India, and the Middle East.

Shirasagi CMS is produced from high-quality coconut shells, being a renewable biomass source. Therefore, it is a sustainable and eco-friendly material, exhibiting a significantly reduced CO₂ footprint compared to other CMS available on the market. In contrast, those CMS are manufactured from synthetic phenol-formaldehyde resin in the process often involving hazardous chemical substances causing serious harm to the environment and human health.



PSA NITROGEN GENERATORS

The N_2 -PSA technology is widely introduced and commercially established at product flow rates up to several thousand m^3/h (STP) and purity levels up to 99.999 % N_2 . The kinetic separation of air is possible due to the significantly faster adsorption of oxygen over nitrogen in PSA plants equipped with carbon molecular sieves. High selectivity is attainable due to the sieving effect in intentionally narrowed micropore mouths of the adsorbent. Because of relatively low capital costs, the simplicity of functioning, and the possibility of operation in remote locations, the PSA technology gains a big advantage in the nitrogen market. Moreover, multiple process variables and cycle organisation strategies allow customising the system to specific requirements.

REDUCED PSA OPERATING COSTS

Competitor providers generally offer CMS materials at very small nominal pellet diameters. Operation of PSA units packed with pellets of small diameter and wide particle size distribution is associated with an inhibited speed of pressurization/depressurization within the adsorber, especially as the magnitude of the PSA unit approaches the industrial scale. Moreover, pressure gradients along the packed bed are more pronounced, resulting in inefficient utilization of the entire packed bed. To overcome this problem, inlet gas pressure must be enlarged – leading to higher operating costs. Otherwise, the separation performance drops dramatically. Additionally, a higher pressure drop leads to insufficient adsorber regeneration during the counter-current blowdown step, causing the overall process performance to drop further.





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The nominal pellet size of Shirasagi CMS is significantly larger compared to other CMS available on the market, leading to an acceptable pressure drop along columns, delivering the most advantageous separation performance regardless of the PSA unit magnitude. Therefore, the air separation process can be economically realized on those materials even in adsorbers having a height of a few meters.

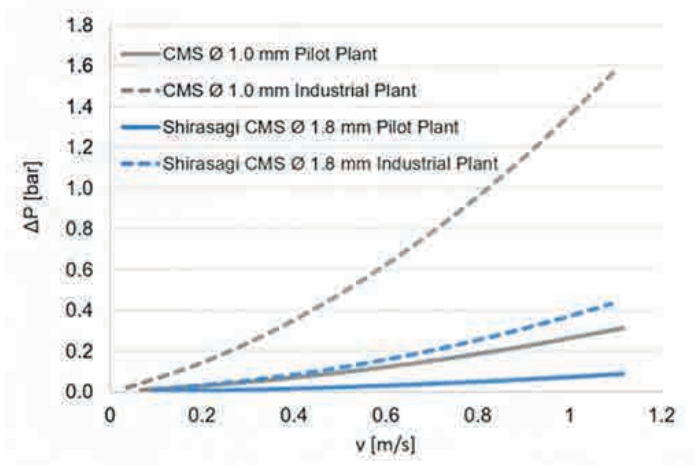


Fig. 1 Pressure drop along adsorbers filled with CMS of different pellet sizes

PROLONGED PSA LIFETIME

For the proper PSA operation, the abrasion of the adsorbent becomes a parameter of high relevance. The mechanical resistance of pellets reduces drastically as their diameter becomes smaller. Shirasagi CMS exhibits a larger mean pellet size, resulting in its excellent mechanical stability, especially at the time of pressure swing which generates a substantial impact force on the material. For this reason, PSA systems filled with Shirasagi CMS are usually operated for more than 10 years without material change, providing that other unit/equipment malfunctions do not occur. Moreover, Shirasagi CMS does not fracture during transportation or filling, thus it exhibits narrow particle size distribution with precisely defined mean particle diameter.

In contrast, CMS batches of notably smaller pellet diameters contain a significant portion of undersized particles exhibiting sizes below the mean pellet diameter value, pointing out its degraded structural stability. This leads to material crushing during the PSA operation – hence, reduced process performance and a risk of solid particles elutriation into piping and valves, leading to equipment damages. For this reason, the operation lifetime of a PSA equipped with those CMS is significantly lower than Shirasagi CMS. As this material must be changed more often and more frequent machinery maintenance services are necessary, the operating costs of the PSA plant skyrocket.

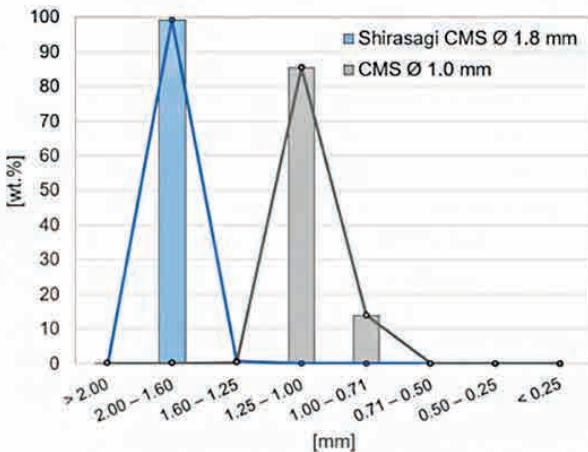


Fig. 2 Comparison of CMS particle size distributions

TRUSTFUL PSA PERFORMANCE DATA

Shirasagi CMS demonstrates narrow particle size distribution with exactly adjusted pellet diameter, resulting in very uniform packing and thus consistent development of oxygen mass transfer zone along the adsorber. On the other hand, filling PSA with CMS material of wider particle size distribution, containing a significant portion of undersized pellets, leads to non-uniformly and denser packed beds as fractured particles may fill the voids between the intact ones.

In such a system, the flow regime varies locally, depending on pellet arrangement influencing bed porosity. Therefore, stated PSA performance values of those CMS materials collected in small pilot plants cannot be translated straightforwardly to design new PSA units, especially when scaling up bed volumes.



EXCELLENT PERFORMANCE

Air separation performance delivered by Shirasagi CMS matches or exceeds the rival materials, especially at higher operating temperatures. Larger pellets of Shirasagi CMS exhibit a smaller volumetric heat-transfer coefficient in contrast to smaller CMS pellets, with generally reduced heat transfer between phases due to their reduced external surface area within the adsorber packing. Therefore, temperature swings during the PSA cycle are less intensive when using Shirasagi CMS, which is beneficial towards increased adsorption capacity and selectivity within the production step.

WHO WE ARE

CarboTech is one of Europe's leading full-service suppliers of powdered, granulated and extruded activated carbons. Based in the heart of the Ruhr area, we operate state-of-the-art production facilities for the manufacture, processing and packaging of customized activated carbons, activated cokes and carbon molecular sieves.

In addition, we offer you comprehensive technical advice, various consulting services packages and a 360° all-round carefree service.

Let us advise you!





DANGER
HIGH PRESSURE DEVICE

¡ATENCIÓN!
Este equipo pertenece a la categoría de dispositivos de alta presión.
¡MANTENER LA DISTANCIA DE SEGURIDAD EN TODOS LOS MOMENTOS!

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⚠️ Peligro de quemaduras por escape de fluidos.
⚠️ Peligro de ruido excesivo.
⚠️ Peligro de atrapamiento de miembros.
⚠️ Peligro de caída de objetos.
⚠️ Peligro de electrocución.
⚠️ Peligro de incendio.
⚠️ Peligro de contaminación ambiental.
⚠️ Peligro de contaminación acústica.
⚠️ Peligro de contaminación lumínica.
⚠️ Peligro de contaminación térmica.
⚠️ Peligro de contaminación vibratoria.
⚠️ Peligro de contaminación electromagnética.
⚠️ Peligro de contaminación química.
⚠️ Peligro de contaminación biológica.
⚠️ Peligro de contaminación radiactiva.
⚠️ Peligro de contaminación por radiación.
⚠️ Peligro de contaminación por partículas.
⚠️ Peligro de contaminación por gases.
⚠️ Peligro de contaminación por líquidos.
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