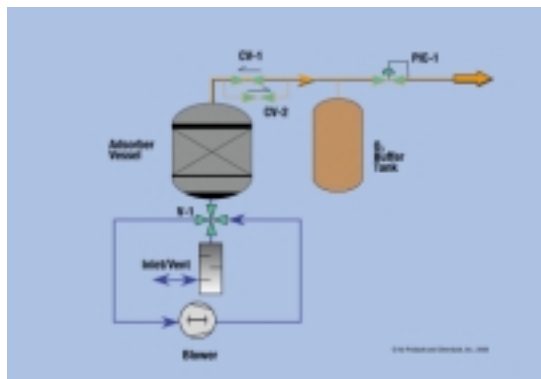


Oxygen Generation by the Vacuum Swing Adsorption Process (VSA)

In any oxy-generation process, air is passed through a bed of zeolite sieve beads, an adsorbent material derived from naturally occurring crystalline inorganic materials, similar to ordinary clays. Each bead is approximately 2 mm in diameter. This sieve is specifically designed to separate oxygen from nitrogen and other gases in air, by adsorbing the nitrogen molecules, while allowing the oxygen molecules to pass through to a collection vessel. When the bed of zeolite sieve is full of nitrogen molecules, it must be regenerated to allow the process to continue. The collected oxygen at 90% purity is the product, while the impure nitrogen combined with any water and carbon dioxide is vented.

A VSA process produces oxygen at lower pressure (1.5 barg) and totally regenerates the sieve in a mild vacuum (0.5 barg). A VSA generator does not require an air compressor.

The following schematic illustrates how the process works:-



Air enters the generator via an inlet vent, passes through the four way valve V-1, through a single stage, dry rotary lobe blower, an air cooler and then into the adsorber bed, again via valve V-1. On entering the adsorber vessel water vapour, carbon dioxide and hydrocarbons are removed in a desiccant layer. Thus only oxygen and nitrogen molecules flow over the sieve bed, where the nitrogen is adsorbed and the oxygen passes out of the vessel and through the open valve CV-2 to fill the O2 buffer tank

The bed quickly becomes saturated with nitrogen molecules. These now have to be removed in a *vacuum step* to regenerate the bed. Valves CV-1 and CV-2 are closed, and the four way valve V-1 rotates such that the blower now acts in reverse and “sucks” nitrogen molecules off the sieve bed, in addition to removing water vapour, carbon dioxide and hydrocarbons off the desiccant layer. All these are exhaust gases that are vented out of the system through the same blower (now acting as a vacuum blower) that the air originally entered.

In the *purge step* valve CV-2 opens to allow oxygen molecules to flow back into the adsorber vessel to help remove any last traces of nitrogen in the system.

Finally, in the *re-pressurisation step*, the whole system is brought back up to atmospheric pressure by valve V-1 rotating into a position such that air can rush back into the inlet. At the same time oxygen is allowed into the top of the bed, thus ensuring that there is no movement of the sieve bed (sometimes a problem in PSA systems). The product valve PIC-1 remains open throughout the whole of the above cycle so that a continuous flow of oxygen product is maintained.

Air Products VSA Oxygen Generators

Air Products range of VSA oxygen generators have been designed specifically to meet the needs of the aquaculture industry and deliver affordable, reliable oxygen. In most locations where the VSA systems have replaced the equivalent flow rate PSA considerable power savings have been demonstrated. Air Products VSA generators are supplied in a single module (feed/vacuum blower, automatic valves, and a PLC control system). In the larger generators, a single adsorber vessel is free standing, as is the oxygen buffer tank, whereas in smaller units all of this is integrated within the module. Various options are available to suit all power requirements. The generator can be skid or trailer mounted. For those applications where product compression is required, an oxygen booster compressor is supplied as a stand-alone skid, for a modest additional cost. Each generator is packaged to simplify the generators installation such that it is “plug and play”.

North America

Air Products and Chemicals, Inc.
7201 Hamilton Boulevard
Allentown
PA 18195-1501
USA
Tel +1-800-435-0299
Fax +1-610-481-2556
e-mail aqua@apci.com

Outside North America

Air Products PLC
2 Millennium Gate
Westmere Drive
Crewe CW1 6AP
United Kingdom
Tel +44(0)1270 614007
Fax +44(0)1270 259434
e-mail aqua@apci.com

tell me more
www.airproducts.com/aquaculture