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Methanol Vapor Information Applicable to the BioPro 190

In order to prevent pressurization of the BioPro, the lid which covers the reaction chamber is not locked down, but is rather held down by its own weight – about 10 lbs. for a 190 lid. This lid seals the reaction chamber up to a pressure of about 0.11 PSIG. The lid seal will allow any pressure above this level to bleed off, should it develop.

Assuming that the BioPro is loaded cold (there has been no preheating of the oil), during the 8 hour reaction processes, due to thermal expansion of the gas in the vacant space above the fluid in the BioPro, as well as the partial pressure exerted by methanol as it dissolves in free air inside the vessel, there is typically some venting that occurs. Worst case, as much as 1 cubic foot of methanol gas may be vented during this eight hour period. (In reality, this is probably closer to 0.50 cubic feet. The effects of the methanol under partial pressure cause the bulk of the initial venting to be composed almost entirely of just air.) But we'll stick with 1 cubic foot for worst case.

To put this in perspective, the relatively small exhaust fan which cools the electronics in the top of the BioPro is rated at 250 cubic feet of gas moved per minute.

Does this venting pose a flammability issue?

Methanol's lower flammability limit is 6.7% concentration in air. To achieve this concentration, using the maximum amount of vapors that can escape (1 cubic foot), you need to confine all of these in sealed volume of about 16 cubic feet.

This, however, is impossible with a BioPro. If you designed a rectangular space (like a coffin) to enclose the BioPro on all sides, so that it just fit inside, the total volume of that space would be about 50 cubic feet. The volume of the BioPro itself is about 11 cubic feet. This means that the minimum free space that you could achieve in this sealed volume would be about 39 cubic feet, well over 2X the maximum allowable volume to reach the lower flammability limit for methanol.

If you stuck the BioPro in a 36" x 40" broom closet, and it was completely sealed, you'd have over 5X the maximum allowable volume to reach the lower flammability limit for methanol.



And if it was in a typical 1 car garage, completely sealed, you'd have about 100X the maximum allowable volume to reach the lower flammability limit for methanol.

How about breathing this air? Is it hazardous?

When it comes to methanol concentration in the air, OSHA designated 200ppm methanol in the air as the limit for continuous workplace exposure. (All day long, every day.) For non-continuous exposure, the related agency NIOSH (National Institute of Occupational Safety and Health) rates 6,000 ppm as a level immediately dangerous to health.

At www.cdc.gov/niosh, this rating is discussed and described as a conservative value. References are cited which place the actual value at around 30,000 ppm.

If a BioPro operated in a completely sealed shop, it would need to be 23' x 23' with 10' ceilings (5280 cubic feet) to keep the worst case concentration in the air below 200ppm. (Although if there truly was no ventilation, you might eventually die from suffocation as you consumed all of the available oxygen due to breathing.)

If a BioPro is operated in a completely sealed, small 1 car garage, the methanol content in the air may reach around 600ppm, higher than OSHA's limit for continuous workplace exposure, but about 1/10th of NIOSH's conservative level for an immediate health hazard.

So, the bottom line is: If you've got a large garage, and no ventilation whatsoever, you can live out there with your BioPro processing and have

- a) no flame hazard (~1/300th of the lower flammability limit for methanol)
- b) no health hazard (per OSHA's limits)

If you've got a 1 car garage, and no ventilation whatsoever, you still have nowhere near any flame hazard. (~1/100th of the lower flammability limit for methanol). With no ventilation, the methanol levels may exceed OSHA's limit for continuous workplace exposure. They will, however, only reach about 1/10th of NIOSH's classification of an immediate health hazard. With the minimum ventilation required by ANSI/ASHRAE for an occupied room, (17 CFM) you will be well under OSHA's limit for continuous workplace exposure as well.

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