

***YOU CAN IMPROVE THE
PERFORMANCE OF YOUR
CO₂ INCUBATOR***



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The design of a CO₂ incubator is critical to culture growth. Culture growth is optimal when the incubator properly blends these elements: CO₂ gas, temperature, air quality, and relative humidity. The precision with which these elements are combined will determine how effective the growth environment shall be. Other factors, such as the incubator's location in the laboratory, the continuity of an electrical source, contamination, vibration, and routine maintenance are equally important to successful cell growth.

Location in the Laboratory

Improper placement within the laboratory will degrade an incubator's performance. Keep windows in the laboratory closed if they are present. Incubators should be located away from air inlets, so they are not affected by changing airflows. Adequate clearance around the incubator should be available for service and electrical safety testing. A chamber should never need to be moved for these tasks.

Continuity of an Electrical Source

The most effective incubators are often those that have the most consistent power source. The electrical supply circuit must conform to all national and local electrical codes. Surge protectors are strongly recommended to prevent voltage spikes from permanently damaging the electronics. The power source must be grounded, and voltage should vary no more than 5% to provide consistent electricity to the incubator.

Potential for Room Contamination

Chamber temperature is controlled by one of three designs: water-jacket, air-jacket, or direct-heat. Whether or not a fan is used to exchange air will not significantly improve or degrade performance when the door is opened. A rapid exchange of air and humidity between the chamber and the surrounding room occurs when the incubator door is opened. At this time, the air from the surrounding room may contaminate the incubation chamber. Air will circulate amid the chamber and the room until air pressure, temperature, humidity, and CO₂ are equalized.

HEPA Filters Improve Air Quality

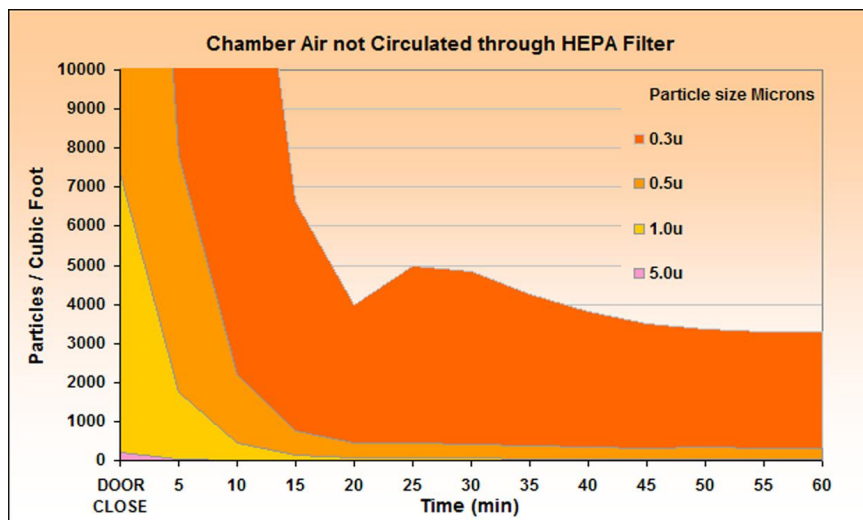
Air is constantly moving because the chamber walls are being actively heated. Humidity systems, such as water pan (passive), or injection (active) create additional movement and currents within the chamber. Exposure to fungi and bacteria will stay limited so long as the chamber door remains closed. Contaminants are readily introduced into the chamber whenever the door is opened. In this situation, contaminants that enter the chamber will be circulated throughout the incubator.

An incubator fitted with a High Efficiency Particulate Air (HEPA) filtered fan system will continuously remove airborne particulates and contaminants. NuAire incubators draw air through a .3 micron 99.99% efficient HEPA filter with a low velocity fan. The HEPA filter media is composed of boron silicate glass fibers, which will not support the growth of any particulates that become trapped within it. Contaminants will remain trapped on the inside of the filter, instead of the outside, due to the direction of airflow through the filter. Filters become less efficient over time, and therefore, should be replaced every 24 months.

The effectiveness of a HEPA filtered system can be verified using a particle counter. To demonstrate this, take readings in an incubator chamber that does not have a HEPA filter. Readings should be taken at intervals of 5, 10, 60 and 120 minutes subsequent to the door opening. The information obtained will reflect that particulates are consistently present within the chamber. Next, obtain readings at the same intervals in a HEPA filtered chamber. Within 5 minutes, the air quality of a HEPA filtered chamber will be equivalent to ISO Class 5. This quality is comparable to that of a laminar flow clean bench or Class 100 Clean room.

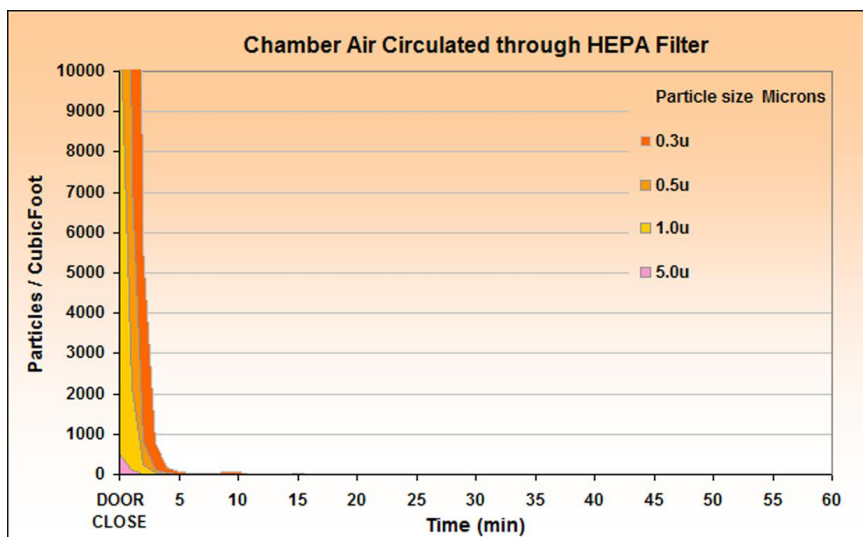
Unfiltered Air, No Fan

TIME (min)	PARTICULATE SIZE			
	0.3u	0.5u	1.0u	5.0u
DOOR CLOSE	218070	30261	7343	214
5	61844	7805	1745	40
10	18273	2191	432	7
15	6631	754	133	1
20	3999	444	68	0
25	4994	461	63	0
30	4859	420	55	0
35	4265	364	46	0
40	3807	329	43	0
45	3495	316	38	0
50	3372	328	41	0
55	3312	319	45	0
60	3312	319	45	0



HEPA Filtered, Circulated Air

TIME (min)	PARTICULATE SIZE			
	0.3u	0.5u	1.0u	5.0u
DOOR CLOSE	252486	40898	12018	507
1	49556	7250	2167	86
2	5701	813	232	10
3	776	114	44	10
4	161	19	0	0
5	62	12	0	0
6	50	5	0	0
7	49	2	0	0
8	42	4	1	0
9	54	4	0	0
10	54	4	0	0
60	1	0	0	0



Note: Intervals from 10 minutes until 60 minutes had negligible results, and are therefore not displayed here.

Minimizing Vibration Ensures Cell Growth

Incubators with fans must utilize balanced motors and fins which meet a vibration specification. This specification is designed to ensure any cultures in the growth chamber will not be affected by such vibrations.

Cleaning Helps Prevent Contamination

Routine cleaning is vital to preventing contamination within the growth chamber. Interior components should be designed to minimize the time, effort, and risk of contamination during cleaning. Fan housings, plenums, shelves, shelf supports, and the water-pan should be removable without the use of additional tools, and placed in an autoclave for sterilization. Isopropyl Alcohol can be easily used to disinfect chamber walls and rounded, crevice-free corners. The HEPA filter, housing, plenums, shelves, and brackets should be able to remain in place during a heat-decontamination cycle, if the incubator has such an option.

Conclusion

It is imperative that personnel are aware of all factors that can enhance the performance of today's high energy, dynamic laboratories. Choosing a proper location for equipment, making sure facilities have an adequate electrical power supply, maintaining equipment, and stressing the importance of weekly cleaning and decontamination to personnel will not only deliver dividends, but also improve the quality of cell culture growth.

Air quality within a CO₂ incubator is also critical to both cell growth and research. Take advantage of creating an environment where clean, HEPA filtered air is continuously provided to the growth chamber, and CO₂ gas, temperature and relative humidity are optimized. Improve cell culture growth with CO₂ Incubators from NuAire.



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