HEPA Filter's efficiency drop down along with the time of use

HEPA High Efficiency Particulate Air Filter is commonly used to filter out particles size > 0.3 um, which has been widely used in most HVAC system e.g. hospital and also air purifier machine. The filter must satisfy certain standards of efficiency such as those set by the US Department of Energy (DOE). To qualify as HEPA by US government standards, an air filter must remove 99.97% of all particles greater than 0.3 micrometre (μm) from the air that passes through. All HEPA must be replaced regularly.

Then, why HEPA need to be replaced?

Being of the existing material used for manufacturing of HEPA can not be washed (damaged by water) and existing technical skill and limited equipment for cleaning of HEPA, user must need to replace the HEPA. Otherwise the filter will be jam / blocked by particles and drop down the air flow passing through capacity. Then we can notice that the filtration efficiency of the HEPA will become worst especially before the day we go to replace the filter. Actually, the filter efficiency will continuously drop down since the 1st day we use.

How long time we should replace the HEPA and how the efficiency drop down?

Particles pollutant level will direct affect the lifetime of the HEPA, most centralize A/C system of a building may installed a pressure differential sensor to detect the pressure drop of the filter then go to replace. As a normal HEPA air purifier user may never calculate the time for replacement, user may just can determine or forecast by experience or waiting the machine remind signal (Timer). Despite the signal notice us to replace, we can not know how the filter efficiency has been dropped. For ref:

Depends on the HEPA air purifier total time of use and pollutants level in the environment, most cases tell us that the machine efficiency may drop down over 50% before we go to replace the HEPA. A user area with pets may need to replace the HEPA of their air purifier within half year or if a construction site close to the area will also shorter the HEPA lifetime. Different environment with different pollutant may get different result, a simple assumption may be say HEPA efficiency drop 20% – 30% within the 1st few months and 30% – 40% after few months again etc…. That's not a calculation or testing, we just want to let user more easy to understand the highest filtration efficiency at the 1st day of use, then the efficiency continuous drop down day by day and become worst lastly, we should not picture the machine efficiency will never drop down along with our daily use.