Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Investigation Design Proposal)

(Word Limit: 1,600 words, Pages: 2 pages only)

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Project Title: Ozone medical sewage treatment device for hospital

Project Type: Investigation Design Proposal

To our best knowledge, there are / are no * ***similar works in the field*****; (if there are,) related research links are as below:**

Drainage Services Department: Type of Sewage Treatment Facilities in Hong Kong:
https://www.dsd.gov.hk/EN/Sewerage/Sewage_Treatment_Facilities/Type_of_Sewage_Treatment_Facilities/index.html
There's only centralized sewage treatment facilities in Hong Kong, no specific sewage treatment devices at each hospital/clinic.

The enhancement our project proposed / the difference with related research are:

We arrange ozone medical sewage treatment device to dispose sewage before wastewater discharge to government sewage treatment facilities, in order to reduce the concentration of virus in hospital wastewater.

Please delete if not applicable. The competition values the originality of works. Students must do enough literature research to ensure that their works are unique and list relevant reference materials before starting research or invention.

I. Background

Under the current stage of pandemic, hospitals need to deal with more covid infected patients. This cause the concentration of virus in hospital sewage much higher than usual. If not dealt with properly, sewage from hospital can become a source of infection that is difficult to prevent. We searched how Hong Kong government deal with sewage, there's no specific treatment before all the sewage is disposed to government sewage treatment facilities. These virus-carrying sewage is a potential threat to Hong Kong citizens, specially to those who works at sewage treatment facilities.

II. Objective(s)

Therefore, to solve this issue, we need to do experiment on add ozone disinfection facilities. To test the feasibility of such treatment, we will simulate ozone sewage treatment facilities in lab, to figure out whether hospital sewage can be efficiently disinfected. Also, how to effectively perform ozone disinfection to hospital sewage.

III. Hypothesis

Focus:
1. The concentration of Escherichia coli after ozone disinfection.
2. The ideal concentration of ozone for disinfecting sewage.
3. The time needed to disinfect the sewage most efficiently.

Hypothesis:
1. Concentration of Escherichia coli is suitable to represent covid virus concentration in sewage.
2. Hospital sewage contains no inhibitor to ozone's disinfecting property.
3. Same volume of suspension have same amount and concentration of Escherichia coli

IV. Methodology

Materials:
(1) Ozone; (2) suspension of Escherichia coli (concentration same as the virus in medical sewage from hospital); (3) Test meter for Escherichia coli; (4) Conical flask with tube and plug; (5) gas flow velocity sensor; (6) Residue gas collect devises; (7) Fume cupboard; (8) measuring cylinder

Experiment one:
- Experimental set-up: conical flask with suspension of Escherichia coli, then inject ozone into conical flask in a constant speed.
- Control set-up: conical flask with suspension of Escherichia coli, then inject air into conical flask in a constant speed.

If the concentration of Escherichia coli decreased dramatically, then we can prove ozone is useful for disinfection.

Experiment two:
- Experimental set-up: 5 conical flasks with suspension of Escherichia coli, then inject ozone into different conical flasks with different speed for same period to time.
- Control set-up: conical flask with suspension of Escherichia coli, laying at rest.

Find out which conical flask's concentration of Escherichia coli decreased most dramatically.

Experiment three:
- Experimental set-up: 6 conical flasks with suspension of Escherichia coli, then inject ozone into different conical flasks at same speed, by for period of time 5 mins, 10mins, 15mins, 20mins, 25mins and 30mins.
- Control set-up: conical flask with suspension of Escherichia coli, laying at rest.

Find out which conical flask's concentration of Escherichia coli decreased most dramatically.

V. Expected Results and Impact of research

Expected results:
The amount of Escherichia coli decreased obviously after ozone injection. At certain speed/with certain time, mount of Escherichia coli decreased most efficiently, we can find out the ideal speed of ozone and time for ozone disinfection.

Limitation:
Escherichia coli may not perfectly replace covid virus.
Experiment in lab may not replicate all aspect of ozone sewage treatment devices.

VI. Conclusion

Adding ozone medical sewage treatment device to hospital sewage before wastewater discharge to government sewage treatment facilities can reduce the concentration of virus in hospital wastewater.