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**INTRODUCTION**

“An underground city” - A concept which will be soon realised in Singapore together with the existing subterranean projects such as Underground Ammunition Facility (UAF). With such developments, we have to acknowledge the need to remove Volatile Organic Compounds (VOCs) in such confined spaces to prevent the Sick Building Syndrome (SBS). Plants can be grown in the underground city using Light-Emitting Diodes (LEDs), which has an edge over fluorescent lights, which aid in improving Indoor Air Quality (IAQ).



*Figure 1: Underground Ammunition Facility*

# GREEN City Under The Earth

**LITERATURE REVIEW**

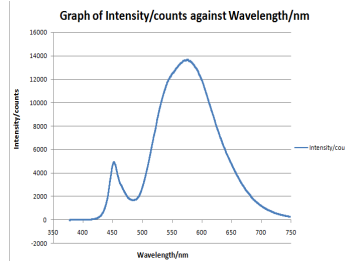
**Emission Spectrum For Plant Growth**

Chlorophyll A & B absorb mainly the blue and red region of the light spectrum while Carotenoids absorb part of the green region which ensure the healthy growth of a plant.

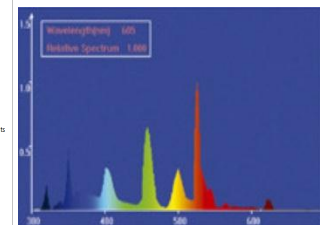
With the spectral distribution of both light sources obtained (Figure 3 & 4), we concluded that the low intensity of the red region emitted by the LEDs can be a possible explanation to the stunted growth of the plants under the LED lights.

**Comparison of LEDs & Fluorescent Light**

	LEDs	Fluorescent Light
<b>Lifetime</b>	50,000 hours (6 years) if switched on continuously	5,000 hours if switched on continuously
<b>Energy Efficiency</b>	Up to 200% efficiency	5% - 20% efficiency
<b>Toxicity</b>	Mercury-free	Contains small amount of mercury



*Figure 3: Spectrum Distribution (LED Lights)*



*Figure 4: Spectrum Distribution (Fluorescent Lights)*

**Preliminary Experiment**

Two hydroponic set-up of Lactuca Sativa L. were placed under cool white fluorescent lights and LED lights respectively, with approximately 10% deviation in the luminosity. Plants under the fluorescent light had a healthier growth compared to those under LED lights (Figure 2) after 38 Days After Planting (DAP).

**Moving Ahead**

We will explore and test the use of different types LED lights to improve indoor plant growth compared with the initial results obtained. At a later stage, architecture design of growth mechanisms will be designed.



*Figure 2: Under Fluorescent Light (Left) & Under LED Lights (Right)*

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