The Effect of Plants on CO2 Concentration in Homes

The quality of the air we breathe in indoor spaces is incredibly important for our health and well-being and it is often overlooked. You may not realize it, but the air inside our homes, offices, and other indoor spaces can often be more polluted than the air outside. This is because indoor air can become contaminated with a range of pollutants, such as dust, mould, and chemicals from cleaning products and building materials[1].

In this K-pill, we aim to estimate the potential impact of plants on the concentration of CO2 in a house. We've all heard (though it was a while ago…) that it was not adequate to have plants in a bedroom because they consumed oxygen at night. Well, let's find out about it with the support of the Indoor Air Quality monitoring tools.

For this experiment, we took two of the plants[2] we have at our offices in CARTIF and placed them in our airtight chamber (see Image 1). In a first experiment, we placed the plants in the laboratory without additional lighting. Lighting inside the chamber is insufficient for proper plants development. Then, we place additionally lighting inside the chamber as it can be seen in the image 1.

Image 1. 1 m³ experimental chamber with the plants inside. Test performed without (left) and with (right) additional illumination.

[1] 10.3390/ijerph17082927

[2] One *Epipremnum aureum* and one *Tradescantia pallida*.

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Figure 1 below shows the CO2 evolution during the test. Initially, in the period without plants, the CO2 concentration was increase and kept (door was closed) at around 800 parts per million (ppm). During this period CO2 concentration keeps approximately constant.

Then, in the first experiment where plants live under normal light conditions (maximum below 400 lumens), the CO2 concentration increases continuously due to the continuous respiration effect of the plants. Finally, in the period with plants and additional illumination (1200 lumens) these conditions favoured respiration over photosynthesis. In other words, these last conditions are conditions where the plant may have a less favourable balance towards net CO2 production.

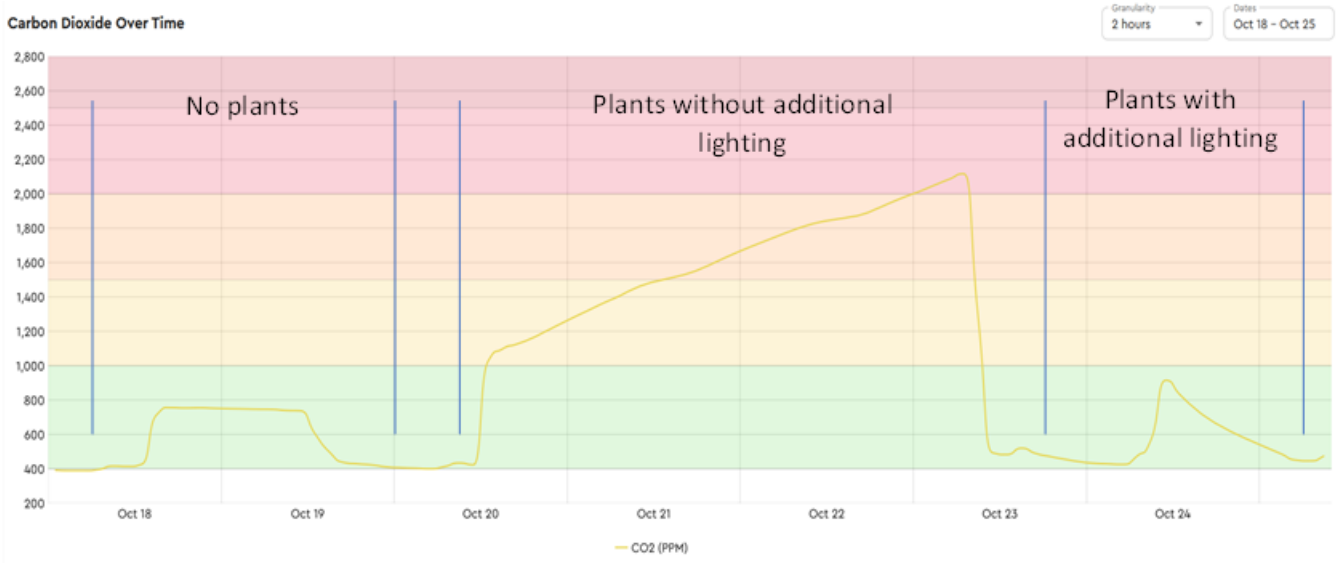

Figure 1. CO_2 evolution inside the chamber.

In order to estimate the potential impact of the plants on the CO_2 concentration in our houses, we have made some calculations. In a 1 m^3 chamber of air, the CO_2 concentration has increased by 1000 ppm over about 65 hours. In a typical room with a surface area of 12 m^2 and a height of 2.5 m, the increase in 10 hours (a good night's sleep) would be less than 10 ppm. A person breathing in that same room (assuming it's airtight) CO_2 concentration would increase by over 5000 ppm.

Additionally, let's briefly consider what happens with oxygen. We don't have an oxygen meter, but considering the generic equation that cellular respiration in plants follow, we can say that for each molecule of CO_2 produced, one molecule of oxygen is consumed. The air contains a concentration of approximately 21% oxygen, which is roughly 210,000 ppm. In our experiment, the CO_2 concentration increased by 1000 ppm, so we can assume that 1000 ppm of oxygen were consumed, which is negligible compared to the initial amount. Therefore, we can conclude that the impact on the oxygen concentration is negligible.

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Then, during the final period, we introduced additional lighting to ensure that the plants were under optimal light conditions to carry out their functions normally. As it can be seen in Figure 3 above, in the section with plants and additional lighting, the plants predominantly perform in photosynthesis, which is why the concentration of CO_2 decreases.

Hence, the plants we have at home will not appreciably affect the concentrations of CO_2 and O_2 indoors, even if the conditions in which they are growing are not optimal and we do not ventilate properly. In a subsequent K-pill, we will evaluate the impact of plants on the concentration of other pollutants like Volatile Organic Compounds and Particulate Matters.

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