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Effect of red, blue and uv light on constituents of C*entella asiatica* L. urban grown under controlled environment

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Abstract
Our world population is expected to reach 09 billion by 2050, which will result into increasing Agricultural production demand. About 3.4 billion people in world depend on plant-based traditional medicines. Something must be done in the face of decreasing yields, increased climate unpredictability, drought and severe weather events. The efforts till date resulted into various techniques for increasing the plant yields which include developments regarding the production of agriculture as well as medicinal plants. The extract of all such methods can be termed as vertical farming, plant growth based on artificial lights etc. The objective is to design easy to install, arduino-based circuitry to monitor, control and record the values of grow chamber parameters. Using this system estimation of phytoconstituents viz. carbohydrates and protein contents under illumination of red, blue and ultraviolet lights is studied. *Centella asiatica* (L.) Urban is an important medicinal plant is used as a test plant.

Keywords: Arduino, Grow Chamber, *Centella asiatica* (L.) Urban

1. Introduction:

Centella asiatica (L.) Urban, commonly known as centella, is a small, herbaceous, annual plant of family Apiaceae, and are native to India, Sri Lanka, northern Australia, Indonesia, Iran, Malaysia, Philippines, Papua New Guinea, and other parts of Asia. It is used as a medicinal herb in Ayurvedic medicine, traditional African medicine and traditional Chinese medicine. It is also known as the Asiatic pennywort or Indian pennywort in English, among various other names in other languages. Carbohydrates are of fundamental importance as they are the main source of energy in the cell and are the most abundant biomolecules on earth. They are required for various metabolic reactions in a living cell. They are also the structural components of living organisms. Proteins are the most abundant intracellular macromolecules and constitute over half of the dry weight of most of the living things. These are the complex organic nitrogenous substances which play an important role in the functioning of a cell. The proteins with catalytic activity are largely responsible for determining the properties of a cell in a particular environment. Proteins are involved in a variety of functions such as building of the cell wall and membrane structure assisting in the transport of small molecules across the membranes, acting as stored form of nitrogen in the seeds, and catalyzing biochemical reactions. In some plants large amount of stored proteins serves as reserves of energy and nitrogen to be utilized during periods of rapid growth. *Centella asiatica* (L.) Urban is a nerve tonic that enhances learning, academic performance and improves mental ability. It acts as an anti-anxiety agent and is used to treat several mental disorders. It also calms restlessness in children. It is used as a nootropic, a drug that enhances cognitive ability used in Ayurveda for centuries; Centella supports the normal function of the mind, intellect, consciousness and good spirit. Researchers from Uttar Pradesh, India, working with Frankston Hospital in Victoria, Australia, also found that Centella showed a supportive effect on memory control and occasional age-associated memory challenges ("Psychosocial Dysfunction and Family Burden in Schizophrenia and Obsessive Compulsive Disorder", Josy K Thomas, PN Suresh Kumar, *et al Indian Journal of Psychiatry, 238-242. 2004).*

2. Materials and methods:

The effects of red, blue and ultraviolet light have been observed on plant *Centella asiatica* (L.) Urban for the period of 10 days under the light period of 16 hours and dark period of 08

hours. The samples of the plant have been taken and passed through various tests for finding changes in the concentration of phytoconstituents due to artificial lights if any. This paper discusses about these tests and the estimated results.

2.1 Estimation of Total Sugar Content

Reducing sugars: The extract was prepared by crushing 1gm of plant 10 ml of DW, allowed it to settle and the supernatant was used to estimate the concentration of reducing sugars. The reaction mixture was prepared by taking 0.1ml extract + 1.9ml DW + 2ml DNSA solution and by keeping it in boiling water bath for 8 mins. The OD was taken at 420 nm.

Non-Reducing sugars: The extract was prepared by crushing 1gm of plant material with 2 ml of DW. 2ml of conc. HCl was added to it and it was autoclaved for 45mins. The solution was neutralized using sodium carbonate (until the effervescence stops to obtain a clear solution). It was filtered and the volume was made up to 10ml with DW. The reaction mixture contained 0.1ml the above extract + 1.9ml DW + 2ml DNSA solution. It was kept in boiling water bath for 8 mins. Optical Density was read at 420 nm. The unknown concentrations of the sugars were then calculated by using a standard graph.

2.2 Estimation of Protein content:

The extract was prepared by crushing 1gm of plant with 10 ml of DW and allowed it to settle and supernatant was used to estimate the protein concentration. The reaction mixture contained 0.1ml extract + 0.9ml DW + 2ml Lowry's solution. It was kept in dark for 10 mins. Then 0.2ml of folin'sreagent was added. It was kept in dark for 20 mins and OD was taken at 660 nm.

3. Results and discussion

Table 1: Changes in Protein Content

Tube	Protein		
	OD	Delta OD	mg/gm
blank	0.14	0	-
0 Day	0.29	0.15	6.0
5 Day Red	0.25	0.11	4.4
5 Day Blue	0.28	0.14	5.6
5 Day UV	0.31	0.17	6.8
10 Day Red	0.27	0.13	5.2
10 Day Blue	0.29	0.15	6.0
10 Day UV	0.32	0.18	7.2

* 0.1 ΔOD ≈ 0.040 mg of BSA

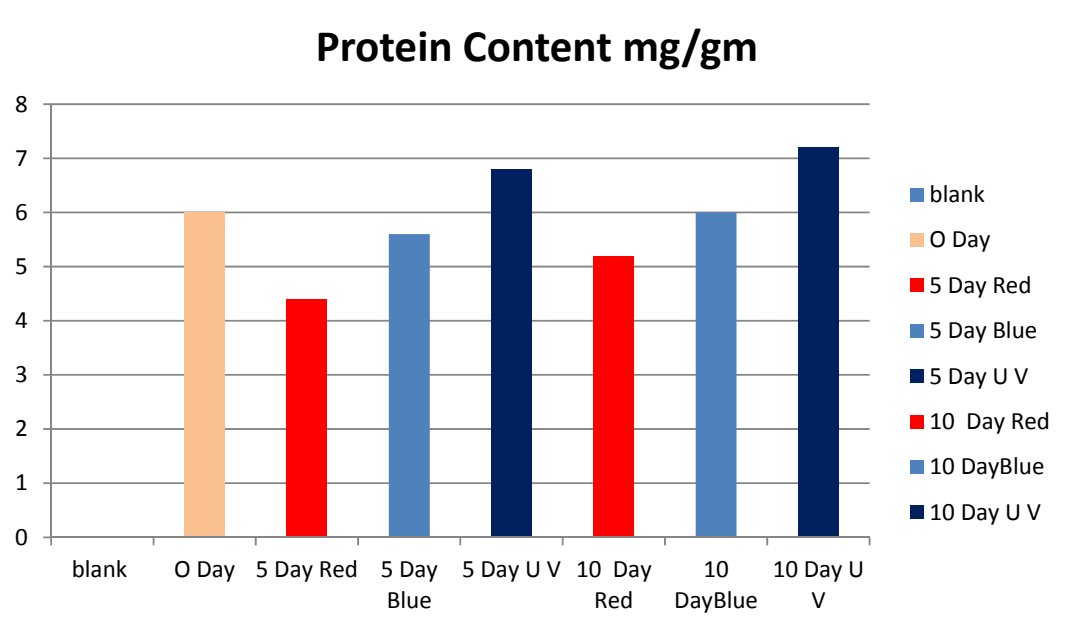

Fig 1: Protein Content mg/gm

This shows that the protein synthesis is at highest in UV light followed by visible light which is a combination of wavelengths from 400 to 700 nm. In the red light fewer amounts of proteins were formed while the blue light exhibited the intermediate range between visible and red light. If compared with initial protein content, In UV light for both 5 and 10 day treatments, the amount of proteins was high. It was the same at 10 days blue light treatment whereas in all other cases, it was lesser than initial protein content.

Table 2: Sugar Contents

Tube	Reducing sugar			Non reducing sugar			Total sugars (mg/gm)
	OD	Delta OD	mg/gm	OD	Delta OD	mg/gm	
blank	0.5	0	0	0.53	0	0.0	0.0
0 Day	0.7	0.2	2.0	0.77	0.22	2.2	4.2
5 Day Red	0.73	0.23	2.3	0.68	0.18	1.8	4.1
5 Day Blue	0.67	0.17	1.7	0.77	0.27	2.7	4.4
5 Day UV	0.73	0.23	2.3	0.53	0	0.0	2.3
10 Day Red	0.68	0.18	1.8	0.6	0.1	1.0	2.8
10 Day Blue	0.72	0.22	2.2	0.74	0.24	2.4	4.6
10 Day UV	0.63	0.13	1.3	0.53	0	0.0	1.3

*0.1 ΔOD ≈ 0.1 mg of glucose.

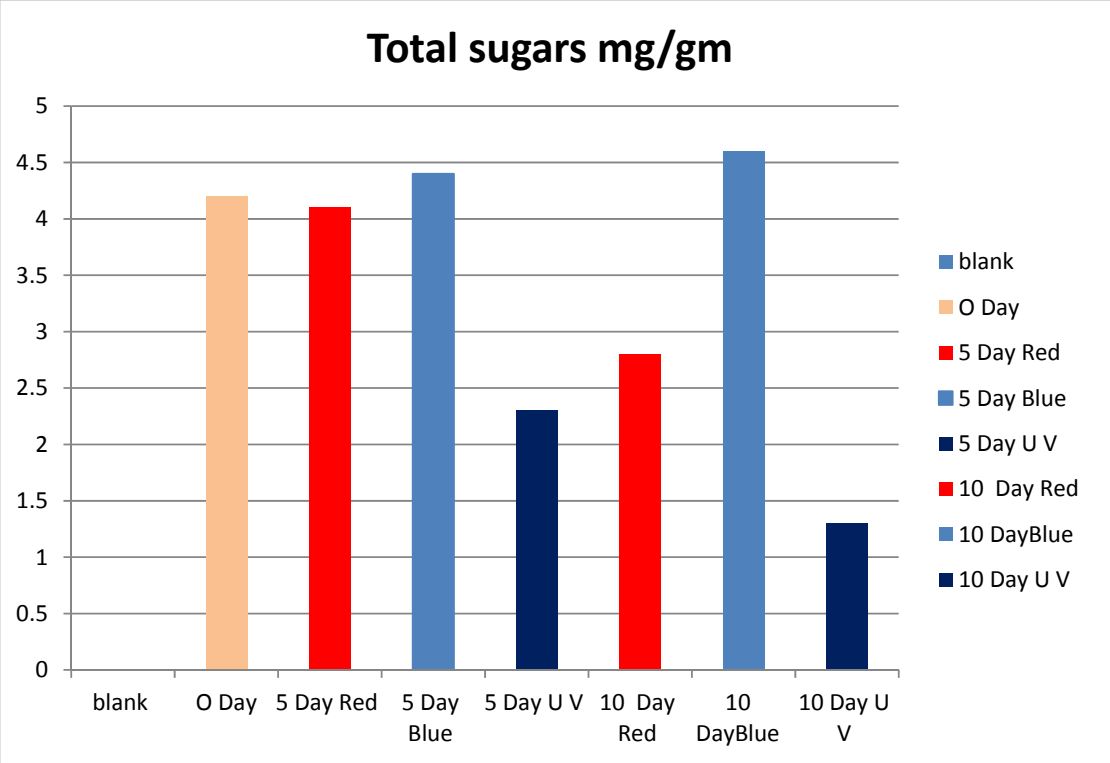

Fig 2: Sugar Contents mg/gm

4. Conclusions

These observed results are of 10 day test under growth cycle of 16 hours of light and 08 hours of dark. As per the theories so far available, the development or changes in phytoconstituents i.e. reducing and non-reducing sugars and also proteins are observed as per the test results.

- From above Tests for sugars we can conclude that red light and UV light produce negative impact on sugar content as there is in decrease in total sugar content of plant when exposed to red light and UV light, whereas there is increase in the total sugar content in plant when exposed to blue light.
- In contrast to sugars UV light show increase in the protein content more than other lights like blue light which also shows increase in protein content after 10 day exposure whereas exposure to red light leads to decrease in protein content.
- Plant thrives in red light and blue light but die after exposing to UV light, after 5 days of exposure the plant condition in UV light is deteriorated considerably.

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