Microbial Concrete: a Step towards Mitigating the Climate Change and Global Warming at Micro Level

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Abstract

The post-industrial revolution anthropogenic activities are mainly responsible for Pollution worldwide. This pollution is recognized globally in terms of Global warming and Climate change as their resultant impacts are felt worldwide. The world-wide effort for mitigation of climate change and global warming are in place but are ineffective and not enough to overcome the pollution in Urban landscapes. This necessitates the requirement of a system and methodology that can be applicable in a sustainable manner without disturbing the Urban Landscapes. The present study analysis the potential of microbial concrete in terms of Carbon dioxide sequestration for King Khalid University Campus. The study found that the microbial concrete panel effectively reduced carbon dioxide in range of 2-3% from ambient air quality. Since the microbial concrete is an inbuilt part of the building it can be installed without hindering the Urban Landscape and change in user pattern. The microbial concrete is a green, sustainable and environment friendly solution to changing urban dynamics air quality.

Keywords: Industrial revolution, Urban Landscapes, Global Warming, Climate Change, Microbial Concrete

1. Introduction

The research on chemical properties are ongoing to enhance the physical properties of concrete in terms of workability, compressive strength, tensile strength etc. The biological property is not exactly the property of concrete but it is introduction of micro-organism in concrete at time of production. The most recent advancement in concrete utilizing biological components is now reported where researchers have developed a concrete panel to support the microbial growth at the surface of the concrete itself. [1] The research has developed a concrete panel which can support the biological growth at macrobial level. Thus, rendering concrete more green and environmental friendly. The study also determined the extent by which the concrete panels can support in mitigating the effect of climate change and global warming.

2. Method and Methodology

The concrete was developed in the form of a panel with four layers together. The first layer serve as the structural part of the panel, second layer comprises of water proofing, third layer consisted of concrete which can provide space to the roots of vegetation for growth. The last layer consisted of the substrate layer to support the vegetative growth on the surface of the concrete.

3. Result and Conclusion

There are approximately 17000 students and 3000 staff in King Khalid University main campus Abha. The carbon dioxide released from each individual in terms of breathing was determined at 1kg/day. [2] The carbon dioxide emission for the staff and student in King Khalid University was 17 and 3 Tonne of carbon dioxide per day.

Table 1 Carbon Dioxide Emission from University student and staff

Designation	No.	CO_2 Equivalent (T/day)	(T /day) at campus
Student	17000	17	8.5
Staff	3000	3	1.5
		Total	10

Taking into account the effective time spent by student and staff in King Khalid University to be 12 hrs the Carbon emission reduced to half 8.5 Tonne and 1.5 Tonne respectively leading to the total emission per day to be 10 Tonne. The perimeter of Buildings in University campus was calculated and taking into account the height of the plinth the area available for the macrobial concrete panels was determined. Carbon Sequestration by Macrobial Concrete was Determined using the available area and the carbon capture through grass (20 kg/m^2) [3]. The total carbon sequestration only from the major building structures in King Khalid University main Campus is 61.58 CO_2 Equivalent (T/m^2). Taking into account the carbon dioxide released by the student and staff i.e. 10 T/day the macrobial concrete can effectively overcome this micro level carbon emission. The circulation of the

oxygen rich air into building will be beneficial to the student and staff and keep up a fresh, and energetic environment in the University. If the human respiration air quality is taken into account than the air quality will comprise of the following components. [4]

The reduction in CO_2 concentration achieved through macrobial concrete is 3% which reduces the percent emitted through respiration by 65 %. However, the results are not close to the results obtained from the perimeter-based calculation. This is due to the fact that increased surface area for macrobial concrete provides greater carbon sequestration. While the number of human population can only increase the carbon emission. If macrobial concrete is considered to overcome carbon dioxide emission through human breathing than only 1.57 % of carbon dioxide has to be taken care of rather as ambient air contains 0.04 % CO_2 and 3 % reduction is achieved through macrobial concrete.

4. Discussion

The carbon dioxide concentration under unventilated condition reaches at high level which in long term effect may lead to impact on health on continuous exposure for long time. At 1000 ppm concentration of CO_2 have been reported to reduce human decision making efficiency by 75% - 50 % for different testing parameters. The office concentration in the inner building space for faculty easily reached 700-800 ppm. Even if it is not reaching 1000 ppm concentration the long exposure of 6-8 hours is bound to affect the performance of the faculty in King Khalid University.

The macrobial/microbial concrete will be an effective measure to mitigate the climate change and global level at micro level in future. Still both the concrete are in initial phase microbial concrete panels are under patent while macrobial concrete panels have been developed recently by the authors themselves and is under study phase. The potential of mitigating the climate change and global warming through these concrete panel depends upon how the public and industry adopts to it with time.

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