PLANTS VOLUME AS A FACTOR AFFECTING OUTDOOR AMBIENT AIR AND THERMAL CONDITION

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ABSTRACT

This study evaluates the effectiveness of plants for outdoor ambient air and outdoor thermal improvement based on volume size. The growing conceptualization of green space is partly as a function that contributing towards a better environmental quality and maintenance of ecological system in urban area in giving evidence to sustainable urban living. However, the general requirement for plantings in designated urban green spaces is 4% from the whole development without reckoning the height or volume of the plants which should be considered in providing outdoor thermal comfort and clean air. Focusing on ambient air quality, this study quantify amount of carbon dioxide, oxygen, temperature and relative humidity influence by plants volume based on field data. Result shows that there is influence of plants volume in green space to the pattern of air chemical composition in an outdoor space. The study also concluded that the design and planning of green space should give more consideration on both the plants volume and area size especially in a tropical country like Malaysia, in order to enhance air quality and thermal comfort.

ABSTRAK

Kajian ini dilakukan bertujuan mengkaji keberkesanan tumbuhan berdasarkan kepadatan pokok terhadap keadaan udara dan suhu di persekitaraan luar. Konsep ruang hijau yang semakin menjadi perhatian ramai adalah salah satu faktor yang menyumbang kepada keadaan persekitaran yang lebih baik dan juga terhadap kelestarian ekologi di kawasan bandar yang kini semakin pesat membangun. Walau bagaimanapun, telah dinyatakan bahawa keperluan asas untuk tumbuhan dan tanaman dalam ruang hijau yang disediakan di kawasan bandar adalah 4% dari keseluruhan pembangunan itu. Ini tidak mengambil kira ketinggian atau kepadatan tanaman dimana ia didapati perlu diambil kira untuk memberi kesan terhadap kualiti udara dan keselesaan suhu di persekitaraan luar. Oleh yang demikian, kajian ini mengenal pasti jumlah perubahan kandungan karbon dioksida, oksigen, suhu dan kelembapan udara yang dipengaruhi oleh tumbuhan berdasarkan kepadatan pokok dari kajian lapangan. Daripada kajian yang dibuat, dapat di rumuskan bahawa jumlah kepadatan pokok mempengaruhi komposisi udara di kawasan persekitaran luar. Ini menunjukkan bahawa perancangan dan rekabentuk ruang hijau di kawasan bandar seharusnya mengambil kira kedua-dua faktor iaitu kepadatan tumbuhan dan juga keluasan kawasan hijau yg di cadangkan terutama sekali di kawasan beriklim tropika seperti Malaysia. Ini penting bagi membantu meningkatkan kualiti udara dan suhu yang menyumbang kepada keadaan persekitaran yang lebih baik dan juga terhadap kelestarian kawasan bandar.

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LIST OF ABBREVIATIONS

°C	-	Degree Celsius
CO_2	-	Carbon Dioxide
H_2O	-	Water
O_2	-	Oxygen
ppm	-	Parts per million
RH	-	Relative Humidity
VOCs	-	Volatile organic compounds

CHAPTER 1

INTRODUCTION

1.1 Introduction

The world has experienced unprecedented urban growth in the last and current centuries. Wong and Chen (2009) mentioned that in 1800, only 3 per cent of the world's population lived in urban areas and this began to increase significantly after 1900. This rapid urbanization has resulted in environmental changes. According to Kiran *et al.* (2004), natural vegetations are usually the first victim of urbanization. From the ecological point of view, vegetation is important in terms of maintaining an ecological balance and without them, not only many of the earth's inhabitants die, but also the earth itself would suffer.

Changes in urban conditions are also mentioned to have often caused deterioration in environmental quality and may result in damage to the health of city-dwellers (Wilhelm, 2008). One of the alarming concerns is the degradation of ambient air quality. The urban building and economic activity result in pollution and warming of the air. Thus, in term of preventive or protective environmental actions, Wilhelm (2008) mentioned that one of the methods is to increase size of urban parks and green space as well as using plants on both vertical and horizontal surfaces since plants have proved their resistance to urban environmental stress.

Consequently, this shows that urban area and cities needs green spaces such as park and garden. Herbert (2002) mentioned that if cities were compared to organisms,

parks and garden situated within it acts as the 'green lungs'. This is because creation of green spaces, especially with trees and vegetation could promote in human and urban ecology well being. Therefore, proposed green spaces were considered as essential 'breathing spaces' within the built environment (Peter, 2006), because of the plants activities which enhanced the balanced conditions of the atmosphere.

Currently, green spaces in Malaysian urban area are usually proposed and reserved 10% from the whole development area (Jabatan Landskap Negara, 2008). This artificial formation of green spaces is usually planned and landscaped in the process of urbanization. Wong and Chen (2009) stressed that, the artificial formation of green space is the windows and links from which the urban dwellers can access Mother Nature in the harsh built environment. Passive interaction with nature and plants in urban green space has also been associated with many beneficial responses, including reductions in stress, improvements in health, and restoration from mental fatigue. Thus shows plants play a major role in providing better urban environment as well as human and urban ecology well being.

1.2 Problem Statement

The benefits of greening the urban area have been taken for granted when it is emphasized on the basis of design and planning alone. Wong and Chen (2009) stated that there are two omitted yet significant concerns which may need scientific input; how many plants should be introduced and how much the environment will respond.

The proposed plants in urban green space are also usually small and have less volume compared to the existing mature plants which usually being torn down during the site clearance for new development. Even though new plantings will be planted again, the significant size different did affect the urban outdoor surroundings and urban ecology well being. Furthermore, the formations of green area which are proposed and designed did not truly consider the amount of plantings and its dense value in improving the outdoor environment. Thus shows that, the outdoor

plantings and urban green space need to be consider quantitatively and supported the environmental balanced and physical needs in regards with ambient air and thermal condition.

1.3 Aim and Objectives

The aim of the study is to determine the effect of plants in volume size on outdoor ambient air and thermal conditions. The objectives of this study are as the followings:

(i) To determine the changes of carbon dioxide, oxygen, temperature and relative humidity according to various plants volume allocation.

(ii) To identify capability of plants in volume size upon improving outdoor ambient air and thermal improvement.

1.4 Scope and Limitation

Vegetation always accompanies the growth of cities in different formations. It is rare to have natural formation of aboriginal plants in an urban environment due to the constraint of space. This study will select the artificial formation of green area which also known as green space. Parks, garden, courtyard, green roofs, green walls or terraces are all artificial formations which are planned and landscaped in the process of urbanization. Thus, this study will focus only on courtyard which is one of the artificial formations of green space in urban area. The plants selection for this study will be ornamental plants or low shrubs. This is because large plants or trees gives shade and this could not justify the plants volume capability in improving outdoor ambient air and thermal improvement.

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