Advances in Environmental Research, *Vol. 4, No. 3 (2015) 143-153*
DOI: http://dx.doi.org/10.12989/aer.2015.4.3.143

Indoor air quality and ventilation requirement in residential buildings: A case study of Tehran, Iran

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(*Received June 14, 2015, Revised July 04, 2015, Accepted July 05, 2015*)

Abstract. The ventilation system is a key device to ensure both healthful indoor air quality (IAQ) and thermal comfort in buildings. The ventilation system should make the IAQ meet the standards such as ASHRAE 62. This study deals with a new approach to modeling the ventilation and IAQ requirement in residential buildings. In that approach, Elite software is used to calculate the air supply volume, and CONTAM model as a multi-zone and contaminant dispersal model is employed to estimate the contaminants' concentrations. Amongst various contaminants existing in the residential buildings, two main contaminates of carbon dioxide (CO_2) and carbon monoxide (CO) were considered. CO and CO_2 are generated mainly from combustion sources such as gas cooking and heating oven. In addition to the mentioned sources, CO_2 is generated from occupants' respirations. To show how that approach works, a sample house with the area of 80 m^2 located in Tehran was considered as an illustrative case study. The results showed that CO_2 concentration in the winter was higher than the acceptable level. Therefore, the air change rate (ACH) of 4.2 was required to lower the CO_2 concentration below the air quality threshold in the living room, and in the bedrooms, the rate of ventilation volume should be 11.2 ACH.

Keywords: indoor air quality; ventilation; contaminants; modeling; ASHRAE 62

1. Introduction

There has been increasing concerns about indoor air quality (IAQ) in residential buildings mainly because of its influence on occupant's health. This has led to several conducting researches to address the problems arising from poor indoor air quality (Langer and Beko 2013, St-Jean *et al*. 2012). This would be noticeable where residential building hasn't equipped with ventilation system or with poorly designed one. IAQ relates indoor pollutant concentrations to various influencing factors, i.e., building geometry, ventilation system, sources and sinks of contaminants, air flow characteristics including wind air pressure coefficient, leakage of envelope elements, and schedules for openings of building elements (doors and windows) (Frontczak *et al*. 2011, Pepper and Carrington 2009, Trading Standards Institute 2013). Contaminants dispersal analyses require

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http://www.techno-press.org/?journal=aer&subpage=7 ISSN: 2234-1722 (Print), 2234-1730 (Online)

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