

# Investigation of Air Quality in Medical Centers in Different Places in Basra Province, South of Iraq

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**Abstract**— To prevent nosocomial infection in patients, maintaining acceptable indoor air quality (IAQ) in medical centers (MCs) is crucial. The properties of IAQ in several medical centers were investigated in this study. The aim of this was to focus on some indoor air pollutants in different medical clinics. Models of air samples were measured inside several medical clinics in Basra province. The results of TVOC, CH<sub>2</sub>O, and PM<sub>2.5</sub> were distributed between exceeding the standard limits and others within the standard. The results in the urban (center of Basra city) were within the legal limits for TVOC and CH<sub>2</sub>O, but the rural areas were above the legal limits in those areas. PM<sub>2.5</sub> were above legal limits but urban sites had the highest. Healthcare workers and patients are exposed to a variety of chemicals that vary with the activities and products used. The presence and exposure of VOCs, CH<sub>2</sub>O, and PM<sub>2.5</sub> may lead to health effects on the patient people. Variation between rural and urban sites in pollutants concentration was clear.

**Keywords**— clinics indoor air, particulate matter, carbon dioxide, contamination.

## I. INTRODUCTION

The concept "indoor air quality" (IAQ) is frequently used to refer to the air quality inside a building. Human exposure to air contaminants in enclosed spaces can harm occupant health. Carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), formaldehyde (HCHO), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), total volatile organic compounds (TVOCs), and particulate matter are common air pollutants that decrease IAQ (Abdul-Wahab et al., 2015). As air pollution, whether indoor or outdoor, is considered a significant cause of environmental health problems, poor indoor air lies due to the lack of clarity of the sources, where the sources of outdoor air pollution such as traffic, industry, construction, combustion sources, etc. In addition, the human being in his natural state spends most of the time in indoor environments, so indoor air quality should be taken care of and more attention, in addition to the emergence of a new risk which is the presence of a disease, for example, Covid – 19 virus, so there are many auditors inside private medical clinics made them vulnerable to its spread to many of patients and touching, because the virus remains for hours on the surfaces, which contributed significantly to the bad and poor air through the use of disinfection, spraying clinics with chlorine and the use of alcohol to sterilize hands, as well as the excessive use of sterile materials, increased the presence of many pollutants, including formaldehyde, small suspended particles, and volatile organic compounds (Caabay, 2020).

Formaldehyde (HCHO) is a colorless, reactive, strong-smelling gas at room temperature. It is one of a large family of chemical compounds called volatile organic compounds VOCs, it is a common constituent of adhesives used in particle boards, carpeting, household cleaners, paints, personal care products, and furniture, it is considered a carcinogenic that causes cancer of the nasal cavity in workers exposed in their jobs at a remarkably high level of exposure (thousands of ppb or higher). Formaldehyde is just one of several gasses present indoors that may cause adverse health effects and illnesses. Exposure to moderate levels of HCHO (hundreds of ppb or greater) can cause several irritant symptoms, including temporary burning of the eyes or nose and a sore throat (Salthammer et al., 2010; U.S CPSC, 2013).

It is frequently used as a guide to assess whether chemical levels are elevated in air samples to calculate the total of all individual VOCs, or TVOCs. These levels usually represent the potential of occupant irritation and discomfort. TVOCs can cause symptoms that range from minor irritability to levels of toxicity that ultimately result in death (Manisalidis et al., 2020).

VOCs, as categorized by WHO, are compounds with a boiling point less than 250° C. Volatile compounds with boiling points between 0 – 100 C°, are gases, whereas the compounds with boiling points

