IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

Evaluation of Air Quality in Terms of the Amount of Carbon Dioxide in Black Sea Region

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Abstract

Today, the human population living in cities has reached its highest level in history and air quality thus has begun to change in a negative way. The rate of some gases that may be a threat to human health has begun to increase. One of them (gases) is carbon dioxide; it has an important rate of increase. Although there is % 0-0.03 (0-300 ppm) Carbon dioxide (CO2) in the air, it has a vital importance because of its amount and variance. The average concentration of CO2 was 290 ppm in the atmosphere in the early part of twentieth century and this concentration has reached to level of 381 ppm. Its constant increasing is well-known. Source of this increasing is not the natural cycle of world, but the people. Carbon dioxide is one of the gases which directly influences human health, besides it has effects such as global climate change. Therefore, it is important to know the amount of carbon dioxide for human health.

In this study, the amount of carbon dioxide of outdoors quantified at somewhere of Black Sea Region and the air quality had been tried to evaluate in terms of carbon dioxide concentration. According to the results of all quantified points, carbon dioxide rate is under the 800 ppm that accepted as the danger limit in terms of human health; however the amount of carbon dioxide was determined as higher than 400 ppm at high population zones.

Keywords: Carbon Dioxide, Air Quality, Black Sea Region.

Introduction

The urbanization rapidly increases in particular developing countries. It is predicted that %60 [1] or %90 of world's population will live in the cities in the 2030s. More than two third of the population has been living in the cities in European countries [2] . According to the data from the year 2008, nearly %71 of population has been living in cities in our country. Increasing population and industrialization has brought about air population and air pollution has increased as being a threat for human health in some cities; hence it has become one of the most important issues nowadays [3].

Atmosphere gas rate changes as a result of air pollution and the rate of gases that threatens human health increases. CO_2 among these pollutants especially comes up with global warming and attracts attention, in addition it's one of the gases which has been mostly examined in recent years.

However, Carbon dioxide (CO_2) varies between %0-0.03 (0-300 ppm) in the air, it has a vital importance for human health because of its amount and variance. Nearly amount %80-85 of carbon dioxide into the atmosphere is mixed up in atmosphere because of the fossil fuel and the other %15-20 of this because of the respiration of living creatures and microscopic creatures that resolve organic substances [4]. So, especially in places those have overpopulation, the amount of carbon dioxide increases because of the human activities, moreover, it becomes a threat to health in some cities.

When we look the four-hundred-thousand-years CO_2 circle, we see that the CO_2 into atmosphere has once increased every 80.000 years or 100.000 years but then it has decreases. However, although amount of CO_2 has been up to 320 ppm for 400.000 years, its amount is nearly 385 ppm today. This increasing is not a result of world's natural cycle, but of the people activities [5].

Because of the argument about the relationship between air quality and health, the air quality has become an important factor for people in choosing the city where they live. The cities that come into prominence with their fresh air, more forested lands and no pollution sources have become to seen more livable and preferred [3]. Regarding those, in the Black Sea region where is one of the most forested lands and hilly terrains, the population is low because of also its land structure is inappropriate to

settlement. Hence, it has settlements where the air quality is higher than some of the other cities. However, there aren't sufficient studies about this region's air quality; so, there isn't sufficient data about air quality.

In this study, the amount of carbon dioxide was qualified at some places of Black Sea region and compared with the other cities. Thus, the air quality was tried to evaluate in terms of carbon dioxide concentration.

Material and Method

During this study, measurements of CO_2 done through the Portable Indoor Air Quality Measuring Device in city center of Kastamonu Province, İnebolu and Çatalzeytin districts, Türkeli and Ayancık districts of Sinop Province, city center of Samsun Province, Çarşamba and Terme districts, city center and Ünye district of Ordu Province, city center of Giresun Province, city center of Trabzon Province, Akçaabat and Of districts, city center of Rize province, Arhavi and Hopa districts and Kemalpaşa town of Artvin Province. Study areas were shown in Figure 1. Studies repeatedly were tried to make at least thrice and measurement were repeated at different places in particular the city centers. Through this, city centers' the local variance of CO_2 concentration was tried to determine. Measurements were conducted during August, 2012.

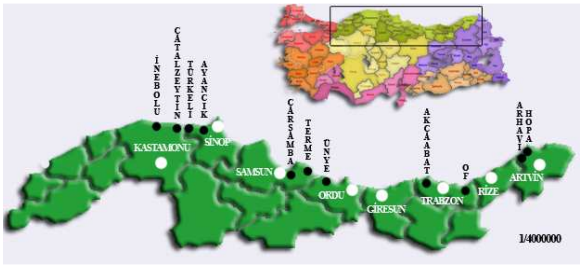

Figure 1. Study areas in Turkey

Results

According to the results of measurements, the amount of CO_2 varied between 337 ppm and 540 ppm in Kastamonu city center and this value was quite low outside the Kastamonu city center and it declined until 202 ppm at Kuzeytepe and Esentepe locations. According to the results of measurements, it was determined that the average amount of CO_2 was 379 ppm in İnebolu district of Kastamonu province, was 368 ppm in Çatalzeytin district, was 397 ppm in Türkeli district of Sinop province and was 362 ppm in Ayancık district.

In the end of study, Samsun city center was determined as one of the points where the CO_2 concentration is most variable. According to the measurements done in different points, the amount of CO_2 varied between 420 ppm and 570 ppm in Samsun city center and this value reached up to 690 ppm in density-traffic areas. According to the measurements done at seaboard and seacoast, average amount of CO2 was quantified as 492 ppm.

It is seen that the more you go far Samsun city center, the more CO_2 amount declines. The CO_2 amount was quantified as 383 ppm in Çarşamba district and as 417 ppm in Terme district. These values are quite low in forested lands of Ordu-Samsun highway -at the level of 380 ppm.

The rate of CO_2 was determined between 460 and 542 ppm in Ordu city center and it was 450 ppm in Ünye district of Ordu city. The average amount of CO_2 is 416 ppm in Giresun that is one of the small cities of Black Sea region.

It was determined that the amount of CO_2 varied between 415 and 622 ppm in Trabzon city center. The average amount of CO_2 was determined as 425 ppm in Akçaabat district and 417 ppm in Of district. The results of measurements were almost the same in Arhavi and Hopa districts of Artvin province- nearly 450 ppm in district centers.

Especially according to the measurements made at the seaboards, which are near to forested lands and far from settlements, the amount of CO_2 was determined as being quite low at there. According to the measurements made at seaboards, values were like these; 292 ppm in İnebolu, 296 ppm in Arhavi and 302 ppm in Kemalpaşa.

According to the results of study, amount of CO_2 is quite high especially in cities where the population is high and concretion and traffic are more. Besides, levels of measurement are 540 ppm in Kastamonu, 690 ppm in Samsun, 542 ppm in Ordu and 622 ppm in Trabzon. When you go far from the overpopulated areas in the same zones, these values rapidly declines and declines more than 300 ppm can be seen (as measurements present).

Discussion

As the influences of the air quality on human health are demonstrated, the studies about determining the air quality have fairly increased. Especially in recent years, it has begun seriously to investigate the influences of amount of CO_2 on human health- point out by determining its role in the global warming.

As the results of studies demonstrate, increasing in rate of carbon dioxide generates the fatigue, absence of perception and sleepiness and various health problems supervene on this situation's persistence. Decreasing of air quality directly influences performances and health of human [6]. According to EPA, the rate of CO_2 should be maximum 800 ppm indoors. In the common areas such as school or lecture room, this value should be maximum 1000 ppm [7]. A study demonstrates that if the rate of CO2 reaches up to level 1000 ppm, the frequency of dry cough and hay fever increases for children [8].

Letting some fresh air into place is the simplest and the most effective method is applied for increasing the air quality indoors. Studies of American Environment Protection Association (EPA) demonstrate that the level of pollutants in the internal environment may be about 5-1000 times more than the external environment [9]. Letting some fresh air into indoors from outdoors thus could help to decline rate of CO_2 of indoors under the value that accepted as a danger to health. Yet by this method, the air of indoors could be as fresh as the outdoors. Therefore, air quality of outdoors is one of the most important criteria that influences and determines the air quality of our environment [3]. Whereas, the rate of pollutant gases constantly increases, so the air that we breathe is increasingly polluted.
Scientific observations demonstrate that CO_2 concentration was 290 ppm in the early part of twentieth century and 381 ppm in 2006, and it has continued to increase [10]. It is predicted that if the CO2 concentration had been increased as twice, global warming would increase as 2°C in average [11]. According to the predictions, the rate of CO_2 will have been reached 500 ppm in the later 21.century [10].

The measurements done in different cities promote these results. According to a study made in Kastamonu province and its districts, the average amount of CO_2 has been 358 ppm in Kastamonu city center but this value could occasionally reach to 500 ppm where the air circulation is limited. According results of the measurements done in 4 different points of Samsun city center, the amount of CO_2 has varied between 463 ppm and 535 ppm in outdoors [12]. The amount of CO_2 was quantified as between 375 and 395 ppm [13].

In Europe, according to a study in Cracow, Poland, the average amount of CO_2 has been quantified as 411 ppm [14]. In a study of Rome, it was determined that the amount of CO_2 has varied from year to year; the average amount, which was 367 ppm in 1995, reached to 477 ppm in 2004 [15]. According to the results of a study of Spain Plateau, the rate of CO_2 has varied around the clock; however, the average amount of CO_2 has been determined as 384 ppm as measurements of rural areas [16].

The similar results have been seen in the measurements made in the settlements of different countries of the world. The amount of CO_2 was found as more than 500 ppm in outdoors of Korea [17]. As another study of Korea, the amount of CO_2 was determined as 454 ppm in rural areas and as 478 ppm in urban areas [18].

The amount of CO_2 was determined as 373 ppm in the measurements made in Hawaii [19]. According to the results of a study of Dallas, the amount of CO_2 varied between 369 ppm and 415 ppm in outdoors and this rate varied between 392 ppm and 475 ppm in the areas have traffic density [20]. In Phoenix, Arizona, the amount of CO_2, which was 370 ppm in uptown, reached to 555 ppm in city center [21]; the average amount of CO2, which was 369 ppm in rural areas, could reached to 650 ppm [22] . In another study of the same region, the average amount of CO_2 was determined as 488 ppm in the urban area and as 422 ppm in the rural area [23]. In the other studies' results, the average amount of CO_2 was 384 ppm in Chicago [24], was 397 ppm in California [25] and could be up to 500 ppm in winter, in Utah [26].

According to a study made in Tel-Aviv, the amount of CO_2 varied between 386 ppm and 590 ppm [27], according to a study made in Vilathur, India, the amount of CO_2 was 425 ppm in outdoors [28]. According to a study of Brazil, the average amount of CO_2 was quantified as 384 ppm [29].

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