

A Survey and Analysis on the Dormitory Building Environment Indoor Pollution

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ABSTRACT. This experiment by measuring the concentration of volatile organic compounds in the dormitory one day and particulate matter, so we can get through the analysis of the impact of indoor air quality and pollution sources and their distribution, to propose improvement measures. We measured concentrations of pm2.5, pm10 and TVOC, relying TVOC tester and dust instrument.

1.Introduction

Using VOC and dust tester to measure indoor pollutants, I measured at different locations and height in different time periods quarters, the concentration of TVOC, pm2.5 and pm10. Firstly, the experiment analyze the influences of different locations TVOC concentrations on the human body, and then analyze the impact pm2.5 pm10 concentration on the human body. The final analysis is of the main factors causing indoor pollution. The conclusion is to achieve the degree of pollution analysis and propose preventive measures and improvement program.

2.Method

2.1 Sample

In this study, the test object is in a student dormitory of North China Baoding . Haze pollution in the city ranks first in China. Volatile organic compounds are a class of low-boiling organic compounds in general. USEPA definition of VOC is: In addition to carbon dioxide, carbonic acid, metallic carbides, carbonates, and ammonium carbonate and some other carbon-containing compounds involved in atmospheric photochemical reactions outside, including methane, ethane, acetone, methyl acetate and methacrylic acid and so on. Indoor Air Quality Researchers usually define their sampling and analysis of all indoor organic gaseous substances as VOC. Various measured total VOC are known TVOC. VOC mainly comes from indoor building materials circulated, and therefore the indoor VOC concentration is usually higher than outdoor lot. Room TVOC concentration range from usually 50 to 1000. VOC impact on human health is mainly glasses and respiratory irritation, skin allergies, gives rise to headache, sore throat and fatigue symptoms.

2.2 Procedure and Measures

I measured 11-point quarters inside including doors, windows, desktop and so on. Test time is 7:00 am and 18:00, because the hostel two time points pollutant concentration is relatively stable. Experimental data are shown in Table 1 and Table 2:

Table 1:Each measuring point concentration of TVOC at 7:00

Location	condition	1	2	3	4	5	6	7	8	9	10
door	open	450	433	407	403	402	403	407	423	446	454
	close	453	451	447	447	445	452	457	450	456	456
aisle	1 m above the ground	377	374	369	370	369	370	369	368	369	375
	2 m above the ground	385	384	383	384	387	389	387	362	365	366
balcony	1 m above the ground	411	409	414	431	438	439	435	434	430	428
	2 m above the ground	420	421	425	430	434	426	411	396	400	410
window	open	466	471	476	480	482	482	481	481	482	481

Gap between bed and wall	Test Point 1	504	498	501	495	494	491	492	493	501	499
	Test Point 2	524	526	530	532	536	537	540	539	538	537
desktop	Test Point 1	474	470	472	469	462	442	427	420	416	415
	Test Point 2	367	367	367	368	370	373	380	387	401	411

The unit of data in the table is $\mu\text{g}/\text{m}^3$.

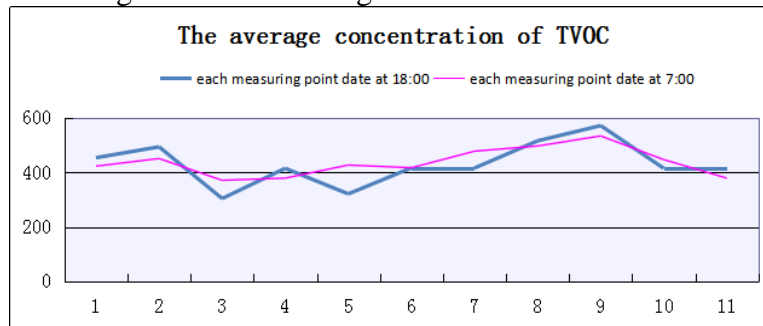
Table 2: Each measuring point concentration of TVOC at 18:00

Location	condition	1	2	3	4	5	6	7	8	9	10
door	open	462	450	446	448	451	456	457	458	459	449
	close	495	495	495	496	495	495	492	492	492	492
aisle	1 m above the ground	259	284	296	297	302	314	321	322	321	324
	2 m above the ground	417	419	418	420	420	416	418	417	413	394
balcony	1 m above the ground	332	328	324	320	317	315	314	315	321	328
	2 m above the ground	414	423	429	428	422	412	401	411	415	415
window	open	414	415	413	413	417	421	419	417	416	417
Gap between bed and wall	Test Point 1	510	513	513	517	519	521	520	517	517	517
	Test Point 2	568	568	569	570	571	572	570	572	579	581
desktop	Test Point 1	412	415	416	416	416	420	418	409	411	412
	Test Point 2	414	415	413	413	417	421	419	417	416	417

The unit of data in the table is $\mu\text{g}/\text{m}^3$.

I measured concentration of TVOC at the same place and ground level but different time. Explore the method of control variables change in different time TVOC, and calculate the average TVOC obtain curve shown in Figure 1:

Figure 1 The average concentration of TVOC



By analyzing the images I can get some conclusions. In the evening, the average concentration of TVOC measuring points 1,2,4,9,11 were higher than in the morning, however, the measuring point 3,5,7,10 the opposite. Therefore, in the morning and evening time of day segments, changes in indoor TVOC concentrations not a correlation. We can think of TVOC concentration values of these two time periods little change, which ensures that we do not receive in a day when other factors affect the decoration. Indoor air TVOC basically in a stable state, at different times, and it has no significant trends.

Next, I did a comprehensive analysis of TVOC concentrations dormitory staff work and study area. In this indoor TVOC concentrations measured in the experiment, we measured the two students TVOC concentrations in the air in at 18:00 on the desktop, and research personnel in the dormitory when the breathing air quality. Sorting through the data obtained in the following figure 2.

Figure 2 The concentration of TVOC

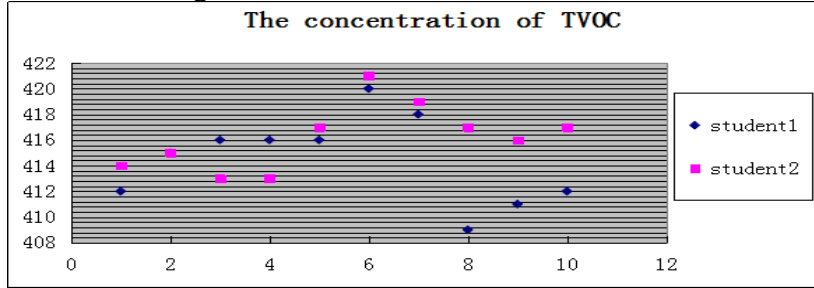


Table 3: Relationship of TVOC concentration and reaction of the human body

The concentration of TVOC	Health Effects	classification
<200	No stimulation, no discomfort	Cozy
200-3000	When combined effects with other factors, it may appear irritation and discomfort	Usually caused by synergies
3000-25000	Headache may occur when the combined effects with other factors	Unwell
>25000	The exception of headache, may have other neurotoxic effects	Poisoning

From Figure 2, we can visually see the changes in the scope of TVOC concentration is 409 ~ 421, combined with Table 3 quarters were likely due to the synergistic effect appears more irritation and discomfort, we do combine at the location. Conclusions might cause headaches, dizziness and other symptoms in the haze and other factors. Solutions are learning or life process should increase exercise, do not be in a place for long periods.

Determination of indoor pm2.5 and pm10 concentration of the raw data

Table 4: Each measuring point concentration of pm10 at 18:00

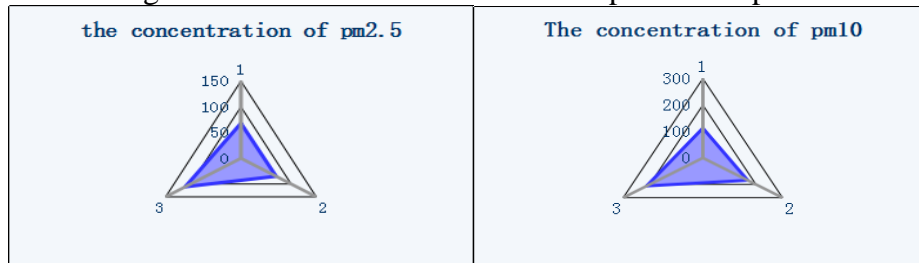
Location	condition	1	2	3	4	5	6	7	8	9	10
door	open	151	125	124	123	119	113	112	115	128	125
	close	88	89	86	101	104	106	105	103	101	100
aisle	1 m above the ground	124	125	124	123	119	113	112	115	128	129
balcony	1 m above the ground	168	165	166	172	169	170	170	169	169	169
window	open	212	208	215	209	213	212	210	211	213	212
Gap between bed and wall	Test Point 1	117	119	121	125	124	123	120	119	119	120
	Test Point 2	107	109	110	111	108	111	109	110	111	112
desktop	Test Point 1	98	99	98	101	100	102	103	105	106	104
	Test Point 2	118	115	117	120	122	123	125	123	124	120

Table 5: Each measuring point concentration of pm2.5 at 18:00

Location	condition	1	2	3	4	5	6	7	8	9	10
door	open	85	86	85	86	87	85	87	86	85	84
	close	60	61	62	63	67	67	64	62	61	59
aisle	1 m above the ground	70	69	70	69	70	69	70	70	72	73
balcony	1 m above the ground	115	110	112	111	112	111	113	110	109	108
window	open	233	234	235	236	239	241	243	249	252	254
Gap between bed and wall	Test Point 1	69	70	72	73	76	75	74	73	75	77
	Test Point 2	75	77	78	80	79	78	76	75	74	72
desktop	Test Point 1	66	64	63	60	60	57	56	58	59	62
	Test Point 2	75	74	75	74	72	75	74	73	73	74

Indoor pm2.5 and pm10 gathering analysis is the primary task. Due to environmental conditions in the room is single, so I chose the indoor and outdoor at the interface as a data point to compare and analyze the secondary distribution of indoor respirable particulate matter. I put the area into three. The first area is the dormitory hallway, hostel desktop dormitory door closed state, the gap bed and the wall. The second area is the balcony, this is the boundary between the outdoor and indoor. The third area is the balcony window that is open outdoor environment. I am pm2.5 and pm10 analysis and comparison of the three regions get Figure 3 and 4.

Figure 3 and 4 The concentration of pm2.5 and pm10



By analyzing the picture, I can get a conclusion. pm2.5 and pm10 concentration distribution in the region is higher than the third one, two regions, but also pm2.5 distribution concentration in the second region is large.

3. Conclusion

TVOC in the indoor environment from the outdoor air may enter or emanating from building materials, cleaning agents, cosmetics, wax products, interior paint, so we should not enter the dormitory renovations such as painting the walls after some time in the open window ventilation to effectively remove TVOC, regular cleaning in the gap at the bed and the wall, prevention of harmful substances gathering. After another period of study compare to breathe fresh air, to prevent headaches and other symptoms.

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