INVESTIGATION OF AIR POLLUTION IN HOUSE DUE TO USE OF VARIOUS FUELS

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Air pollution in house caused by combustion of coal is more serious than that by combustion of natural gas and methane (primarily by SO_2 and NO_2). The gas concentration after cooking is higher than that before cooking, and it is higher in kitchen than in bedroom and outdoor.

There was mutation in the extract from TSP in 30m2 air in the bedroom, kitchen and outdoor, where coal and natural gas were used.

The supernatant saliva activity of children whose family uses coal is significantly lower than that of children whose family uses natural gas.

This study provides scientific data for replacing and changing city fuel and for setting sanitary standard of indoor air.

INTRODUCTION

House is one of the most important environments where humans live. Human health is closely related to the quality of air in a house. According to using different fuels, we chose 64 houses (using coal in 44 houses, natural gas in 10 and methane in 10) for investigating pollution in the air. The monitoring points are respectively located in the bedroom and kitchen. Basic contrast monitoring point is placed outdoor of every two houses. It is 5-10 meters away from these houses.

METHODOLOGY

The air was collected by using sampler. The concentration of SO_2 was monitored with pararosaniline colorimufic method and NO_2 with N (1 - napthyl) - ethylendiamin - ditydrodiloride. The stream of the air are 0.5 1/min and 0.3 1/min, respectively. The concentration of CO_2 was monitored with chronotographic method)SP-2305E). In order to monitor TSP, it takes us two hours to collect the air sample (the stream of the air is 60 1/min, and the sample of 5 houses is collected in the same filter) with gravimetric method.

Ames test is chosen in mutation studies. Methanol is used as an extract and TA98 as test strain. The concentration for the test is 7.5, 15 and 30 m^3/plate, respectively. Sterile dimethylsulfoxide is chosen as negative contrast, and clear fiber-glass filter membrane as basic contrast.

We collected supernatant saliva for two groups of 67 and 80 children aged seven to fifteen. Take 5 ml for each one to put into the tube which the volume is 10 ml. Then it was used to monitor saliva lysozyme activity with furbidimatry.

RESULTS

From monitoring, we obtained the average values of the concentration for SO_2 gave off from three kinds of fuel. They are 1.42, 0.04, 0.03 mg/m³ respectively. The pollution air in the houses from combustion coal is significantly more serious than that from natural gas and methane (P<0.01). Seventy one point four percent (71.4%) of the survey values are higher than allowable concentration. The maximum value is 57.1 times of the standard. The concentration of SO_2 given off from combustion coal after cooking is significantly higher than that before cooking. The average values are 1.65 and 1.07 mg/m³, respectively (p<0.01). In the same house, the concentration of SO_2 in the kitchen is higher than in the bedroom and outdoor (near the house 5 - 10 m). The concentration proportion of the kitchen to the bedroom equals 3:1 and that of the kitchen to the outdoors equals 10:1. The concentration of NO_2 from coal in the house is significantly higher than that from natural gas and methane (F = 3.0374, P<0.01). The concentrations of CO_2 and TSP in the air are not significantly affected when people use the above three kinds of fuel. The measurement results are listed in table 1, 2, 3.

There was matation for TA98-S9 and TA98+S9 in the extract from TSP in 30 m³ air in the bedroom, kitchen and outdoor (near the house 5 - 10 m) where coal and natural gas, respectively, it was 76.8% and 110.8%. There is a significant difference in the two groups. The 95% confidence interval is 73.6%-80.1% and 102.8-118.8%, respectively.

SUMMARY

The pollution air in the house from combustion coal is the more serious than that from natural gas and methane (primary from SO_2 and NO_2), it after cooking is higher than that before cooking as well as it in the kitchen is higher than in bedroom and outdoor.

There was mutation in the extract from TSP in 30m³ air in the bedroom, kitchen and outdoor, where coal and natural gas are used.

The supernatant saliva activity of children whose family use coal is significantly less than that those of families using natural gas.

This study supplied scientific data for replacing and changing city fuel and for determining sanitary standard of indoor air.

Table 1. The investigation results of polluted air in house because of using different fuels. Unit: mg/M³

Type of fuels	SO_2 range	average	standard deviation	NO_2 range	average	standard deviation	CO_2 range	average	standard deviation
coal	0.05-29.03	1.42	3.50	0.01-1.95	0.06	0.16	0.03-0.18	0.05	0.02
natural gas	0.01-0.18	0.04	0.04	0.01-0.10	0.04	0.08	0.01-0.20	0.05	0.03
methane	0.00-0.17	0.03	0.04	0.01-0.22	0.02	0.03	0.03-0.07	0.04	0.01
P	P<0.01 (F=5.03)			P<0.01 (F=3.04)			P>0.05 (F=1.56)		

Table 2. The measurement results of polluted air in house because of different fuels burning after and before cooking   Unit: mg/M³

Pollution	Type of fuels	Before cooking			After cooking			P
		range	average	standard deviation	range	average	standard deviation	
SO_2	Coal	0.09-14.00	1.07	2.01	0.04-29.03	1.65	4.42	<0.01
	Natural gas	0.01-0.18	0.07	0.05	0.01-0.08	0.03	0.02	<0.01
	Methane	0.01-0.10	0.03	0.02	0.00-0.11	0.03	0.03	>0.05
NO_2	Coal	0.01-0.19	0.06	0.003	0.01-1.95	0.07	0.22	>0.05
	Natural gas	0.01-0.10	0.05	0.02	0.01-0.05	0.03	0.01	<0.05
	Methane	0.01-0.22	0.02	0.04	0.01-0.02	0.02	0.003	>0.05
CO_2	Coal	0.03-0.12	0.05	0.02	0.03-0.18	0.05	0.02	>0.05
	Natural gas	0.03-0.20	0.06	0.04	0.02-0.12	0.05	0.02	>0.05
	Methane	0.03-0.07	0.04	0.01	0.03-0.06	0.04	0.01	>0.05

Table 3. The investigation results of polluted in air. Unit: mg/M³

Pollution	Type of fuels	Bedroom			Kitchen			Outdoor		
		range	average	standard deviation	range	average	standard deviation	range	average	standard deviation
SO_2	Coal	0.07-4.55	0.81	1.06	0.05-29.03	2.55	4.46	0.02-0.68	0.25	0.17
	Natural gas	0.01-0.10	0.04	0.03	0.01-0.18	0.04	0.05	0.03-0.18	0.08	0.06
	Methane	0.01-0.11	0.03	0.03	0.00-0.17	0.03	0.04	0.02-0.11	0.05	0.03
	P	P<0.01 (F=20.27)			P<0.01 (F=12.59)			P<0.01 (F=11.68)		
NO_2	Coal	0.01-0.30	0.05	0.05	0.01-1.95	0.07	0.91	0.01-0.24	0.04	0.04
	Natural gas	0.01-0.10	0.04	0.02	0.01-0.06	0.04	0.02	0.01-0.05	0.03	0.01
	Methane	0.01-0.29	0.02	0.005	0.01-0.22	0.02	0.04	0.01-0.02	0.01	0.005
	P	P<0.01 (F=11.65)			P>0.05 (F=1.89)			P<0.05 (F=3.90)		

Table 4. The results of Ames test.   Unit: number/plate

Type of fuels		Bedroom (m³/plate)			Kitchen (m³/plate)			Outdoor (m³/plate)			Contrast test
		7.5	15	30	7.5	15	30	7.5	15	30	
-S9	Coal	46	55	81	33	50	64	32	45	67	17
	Natural gas	43	43	83	47	57	82	40	50	67	
+S9	Coal	48	51	49	35	46	61	25	50	57	18
	Natural gas	35	48	77	55	46	93	39	35	50	

Table 5. The measurement results of children's Saliva lysozyme activity (%)

Type of fuels	Number of persons	Range	Average	Standard deviation	95% cinfidence interval range
Coal	67	70-108	76.87	15.80	73.65-80.08
Natural gas	80	8-220	110.80	43.03	102.79-118.80