

COPE WITH CHEMICAL SENSITIVITY: TREATMENT (HEALTHY HOUSE AT ASAHIKAWA)

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ABSTRACT

A chemical sensitivity (CS) treatment house was built at Asahikawa, Japan in 2001. The objectives for the house are to study the CS mechanism, the relationship between indoor environment and the symptoms, as well as care of the patients. It is expected that CS patients will recover and return to normal life through their temporary stay at the CS treatment house. In this paper, the results of the indoor environment measurements since the construction are described. The formaldehyde concentration in each room was less than 20 ppb just after the construction and since then. VOC levels were also low. We feel the indoor environment of the house is good for CS with regard to chemical contamination, although we have discovered another environmental problem: biological contamination. Patients who started their treatment stay at the CS house were fairly satisfied with staying at the house and with indoor environment

Keywords: Chemical Sensitivity; Treatment; Indoor Environment

INTRODUCTION

The city of Asahikawa is located in Hokkaido, a northern island of Japan. The chemical sensitivity (CS) treatment house was built at Asahikawa for care of CS patients and for studying CS from various perspectives such as mechanism of CS, effect of treatment, relationship between indoor environment and CS, establishment of a support system for CS patients, etc.

Our goals are to (1) measure and maintain the indoor environment, (2) investigate the relationship between the indoor environment and the change in health status of CS patients who will temporarily stay at the CS house for treatment, and (3) establish good standards for the indoor environment to prevent CS occurrence. In this paper, the results from the indoor environment measurements since the construction are described.

METHODS

House Characteristics

The house is built at Saito ranch in the city of Asahikawa. The ranch has offered a piece of land for the CS treatment house. No pesticides are used at the ranch. Air pollution levels are also very low. The CS treatment house was donated by Kinoshiro Taisetsu Corporation, a member of the study group. It is a three-story house, built with a wall panel skeleton system (Figure 1). The total floor area is 172.16m². Chemical substances such as adhesive are mostly unused in the building process. There are six rooms: one room (room 1) on the

1st floor, two (room 2,3) on the 2nd floor, and three (room 4-6) on the 3rd floor. There is also a living room on each floor, and a kitchen and bathroom are on the 2nd floor. The equivalent leakage ratio is $6.27\text{cm}^2/\text{m}^2$, which was measured by the blower door method with depressurization.



Figure 1. Appearance of CS treatment house

Measurement of indoor environment just after construction

The house was completed on January 5, 2001, and the indoor environment was measured on January 11, 2001. All doors were closed for 24 hours before measurement. Measurement locations were in the 6 rooms and the living rooms on the 1st and 3rd floors. Formaldehyde was measured using a DNPH cartridge for 30 minutes (sampled at 1.0L/min), which was eluted with acetonitrile and analyzed by HPLC. Samples of VOCs were collected on PEJ-02 tube for 30 minutes (sampled at 20mL/min) and the chemical analysis was carried out by the thermal desorption GC/MS method. The temperature and relative humidity in the rooms during the sampling were also measured.

Longitudinal measurement of indoor environment

VOCs, aldehydes, temperature, and relative humidity were measured. A passive gas tube for organic solvents (Sibata Scientific Technology Ltd., No.8015-066) is used to analyze for VOCs and a Sep-Pak XPoSure aldehyde sampler (Waters Corporation, No.047205) is used for aldehyde sampling. Each sampler is placed in each room and living room, and outdoors. The measurement period is one week per month. VOCs, extracted from activated charcoal by CS_2 , are analyzed with GC-MS. Aldehydes are eluted with acetonitrile and analyzed by HPLC. Temperature and relative humidity during VOC and aldehyde sampling are measured using HOBO H8/H8 Pro (Onset computer corporation). The monitoring of the indoor environment of the CS patient house will be continued until the end of this project.

Questionnaire survey

To investigate the impression of the patients for the CS house, a questionnaire survey was conducted at the entering and at the leaving.

RESULTS

The results of the indoor environment measurements just after the construction of the CS house are shown in Table 1. The formaldehyde concentration at each sampling location was less than 20 ppb. Measured VOC levels were also relatively low, and were far less than Japanese guidelines for indoor formaldehyde and VOCs.

Table 1. Indoor environment parameters just after construction

	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	1F LV	3F LV
Formaldehyde (ppb)	8.0	14.0	13.0	13.0	16.0	12.0	13.0	12.0
Toluene ($\mu\text{g}/\text{m}^3$)	2.5	3.1	5.5	4.9	3.4	4.2	4.6	4.8
Ethylbenzene ($\mu\text{g}/\text{m}^3$)	1.1	0.9	1.3	2.7	1.8	2.3	2.0	4.0
Xylene ($\mu\text{g}/\text{m}^3$)	2.0	2.2	3.2	4.6	2.7	3.9	3.7	5.3
Styrene ($\mu\text{g}/\text{m}^3$)	0.4	0.5	0.9	0.8	0.6	0.7	0.8	0.9
α -Pinene ($\mu\text{g}/\text{m}^3$)	62.3	82.8	129.0	123.8	54.8	128.8	107.2	117.3
Limonene ($\mu\text{g}/\text{m}^3$)	9.1	10.0	14.6	11.3	13.2	17.3	12.6	10.7
Temperature ($^{\circ}\text{C}$)	10.8	16.7	16.7	21.7	22.2	22.6	27.2	30.5
Relative humidity (%)	47	44	47	33	33	32	20	19

LV: Living Room

Figure 2 displays the results of formaldehyde concentrations since October 2001. All pollutant levels were less than 15 ppb. Most of VOCs were less than detection limits. Personal exposure levels of aldehydes and VOCs were similar as indoor concentration.

Patients who started their treatment stay at the CS house were fairly satisfied with staying at the house and indoor environment, although there are a few places where they felt discomfort.

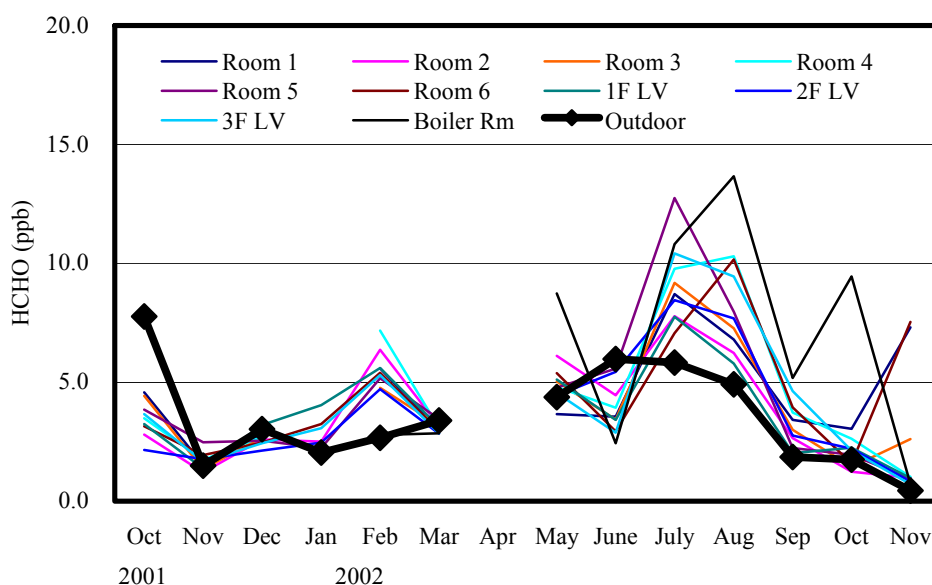


Figure 2. HCHO concentrations

DISCUSSION

Indoor chemical pollutant levels in the CS patient house are very low. We feel the level is good for CS patients. However, although chemical pollution is not a concern, biological contamination may be a problem. Mold and mildew spread through the house in the summer of 2001 and 2002, and the patients reacted to the odor. It should be necessary to keep both indoor chemical and biological pollutant levels low for the health of the CS patients and also the public.

化学物質過敏症への対処：旭川化学物質過敏症一時転地住宅

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はじめに

旭川市に化学物質過敏症患者一時転地住宅が建設され、昨年6月より患者の転地療養が開始されている。この住宅（一棟）は北海道の住宅メーカーである榊木の城たいせつの寄付により建設されたもので、この家に居住する患者の療養生活を通して、今日まだ科学的知見が十分とはいえない化学物質過敏症について様々な側面（転地療養の効果、室内環境と症状緩和の関係など）からの研究を進めていくことを目的としている。また研究的側面からだけでなく、生活面などに関するサポート体制の検討なども行われる。筆者らは住宅内の環境測定、室内環境基準などに関する研究を分担しており、ここでは継続して測定している室内環境測定結果を中心に報告する。

一時転地住宅の概要

建設された研究住宅は壁パネル軸組構法による3階建ての住宅で、延べ床面積は172.16m²、隙間相当面積は6.27 cm²/m²である。この住宅が竣工したのは2001年1月5日であり、1月11日に北海道立衛生研究所により築直後の室内環境測定が実施された。ホルムアルデヒドの濃度はすべての測定箇所でも20 ppb以下、またVOCも含めてすべての項目について指針値をはるかに下回っており、新築家屋としてはかなり低い濃度値が得られていると考えられる。

継続室内環境測定

室内環境レベルおよびその変化を調べるために、毎月1週間ずつの室内環境測定を実施している。測定項目は、温湿度（オンセット社HOBO）、アルデヒド類（Waters社SepPak XPosure）、VOC（柴田科学パッシブガスチューブ）であり、パッシブ法により測定した。なお、窓の開閉なども含む日常生活に特に制約は設けていない。

1) 温湿度測定結果

室内の温度は年間を通じて大きな変化がなく、また各居室間の温度差はほとんど認められなかった。一方室内の湿度（相対湿度）に関しては、冬期は20%程度にまで減少するが、夏期はほぼ一日を通して80%程度以上の値を示した。

2) アルデヒド類測定結果

測定を開始して以来、ホルムアルデヒドは一貫して15 ppb以下であった。

3) VOC 測定結果

-ピネン、リモネンなど一部の物質を除き、これまでの期間を通じて、（測定可能な）VOCのほとんどが検出限界以下であった。観察されたVOCは木材由来、あるいはボイラー室で観察された石油由来の物質（ウンデカンなど）であると考えられる。

なお、アルデヒド類、VOCともに、個人曝露量も室内濃度と同様の値を示していた。

その他の測定

患者住宅に対する印象や不快感の有無などに関する自記式調査票を作成し、入居時及び退去時に記載してもらった。入居時および退去時の状況を把握し住宅改善や、今後必要となる室内環境基準策定等の資料とするとともに、各患者の不快感等の変化、さらには室内環境等との関連性を探ることとした。入居時の状況に関しては、大半は自宅と比べて患者住宅の空気環境の方がよい（かなりよい、多少よい）と答えており、家の周りの環境に関しても同様であった。対象者全員が、家の中に不快感を感じたり、気分が悪くなった場所があると回答していたが、入居時には入居できたことにまあまあ満足と回答していた。

また当初の予定外であったが、居住者が室内環境に関して不快感等を訴えたことが数度あった。その都度、カビ・ダニ測定を中心に緊急対応的な測定を実施した。

これまでのまとめ

これまでのところ、アルデヒド類、VOC とともに、クリーンルームのような特殊な環境下を除き、他では観察されていないくらい低濃度であると考えられる。また入居時には患者の住宅に対する印象は概ね良好であったと考える。しかし、低い濃度レベルにも関わらず、種々の症状・徴候や不快感を訴えた人がいたことには注意すべきであるとともに、化学物質汚染のみならず、生物的汚染をも考慮して、住宅の室内環境を整えていくことも必要となる。