Public Comment

LATE DIST

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LAW OFFICE OF MARC CHYTILO, APC

ENVIRONMENTAL LAW

July 6, 2019 - Errata

Chairman Steve Lavagnino
Santa Barbara County Board of Supervisors
105 E. Anapamu Street, Fourth Floor
Santa Barbara, California 93101

RE: Item 2, July 9, 2019, LUDC/CZO Amendments – Cannabis
Item 3, July 9, 2019, Business License Ordinance Amendments – Cannabis

Chair Lavagnino and Members of the Board of Supervisors:

A legal citation was incorrect in the following paragraph of the letter my office submitted to your Board yesterday. The County's ordinance defining legal nonconforming cannabis grows is § 35-1003, not 35-1004. The changed text is underlined.

b. County Nuisance Authority – Nonconforming Uses

Santa Barbara County Municipal Code § 35-1004 provides that "Any act or practice contrary to the provisions of this article shall be and the same is hereby declared to be unlawful and a public nuisance." Santa Barbara County Municipal Code § 35-1003.B establishes that medical marijuana operations in existence on January 19, 2016 are legal nonconforming uses, but those uses are terminated by operation of law no later than June 15, 2019. Id., § 35-1003.C.1.a & b. A further extension is possible for continuation (but not expansion) of a narrow category of medical cultivation locations if they are actively seeking a County permit. Id., § 35-1003.C.2. Aside from that narrow exemption, all other legal nonconforming cannabis grows are terminated and are not allowable. The county lacks the power to waive or consent to violation of the zoning law. *Hansen Bros. Enters. v. Bd. Of Supervisors* (1996) 12 Cal. 4th 533, 564.

In addition, I attached herewith the complete article Terpenes and Terpenoids in Chemical Sensitivity – I previously submitted only the abstract.

Sincerely,

\S\
Marc Chytilo

Exhibit – Supplemented with complete article

3. Rea WJ, Restrepo C, Pan Y, Terpenes and Terpenoids in Chemical Sensitivity, Altern. Ther. Health Med. 2015 July-Aug.21(4): 12-7.

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ORIGINAL RESEARCH

Terpenes and Terpenoids in Chemical Sensitivity

William J. Rea, MD, FACS, FAAEM; Carolina Restrepo, MD; Yaqin Pan, MD

ABSTRACT

Context • Terpenes and terpenoids are a diverse class of organic compounds produced by a variety of plants, particularly conifers. Chemically sensitive patients can be targeted by terpenes and terpenoids, resulting in a triggering of symptoms and pathology. Often patients cannot clear their symptoms from exposure to chemicals unless terpenes and terpenoids are avoided and neutralized along with chemical avoidance and treatment.

Objective • This article evaluates the presence, diagnosis, and treatment of terpenes exposure in chemically sensitive patients.

Design • A double-blind, placebo-controlled, 2-part study was designed to establish the chemically sensitive state of the patients in part 1, followed by a second set of challenges to determine each patient's concurrent sensitivity to terpenes and terpenoids in part 2. In all of the challenges, normal saline was used as a control. A case report illustrates the history of 1 patient and describes the authors' treatment methods.

Setting • The study was developed and conducted at the Environmental Health Center of Dallas (EHC-D) because the environment within the center is 5 times less polluted than the surrounding environments, as determined by quantitative air analysis and particulate counts.

Participants • A total of 45 chemically sensitive patients at EHC-D with odor sensitivity to terpenes. The cohort included 18 males and 27 females, aged 24-62 y.

Intervention • Patients were deadapted (4 d) and evaluated in a 5-times-less-polluted environment, which was evaluated using air analysis and particulate counts. After deadaptation, the patients were challenged by inhalation in a controlled, less-polluted glass steel booth inside an environmentally controlled room with an ambient air dose of the toxics in the order of parts per billion (PPB) and parts per million (PPM). These toxics included formaldehyde, pesticide, cigarette smoke, ethanol, phenol, chlorine, newsprint, perfume, and placebo. They were also challenged intradermally with extracts of volatile organic compounds (VOCs), including formaldehyde, orris root, ethanol, phenol, cigarette smoke, chlorine, newsprint, perfume, terpenes, terpenoids, and placebo.

Outcome Measures • Inhaled challenges recorded pulse, blood pressure, peak bronchial flow, and other signs and symptoms 30 min before and at 15-min intervals for 2 h postchallenge. Intradermal challenges recorded wheal size and the provocation of signs and symptoms.

Results • Different numbers of patients were tested for each terpenes source because of time-related factors or the cumulative effect of testing, which made patients unable to continue. Of 45 chemically sensitive patients in the study, 43 demonstrated sensitivity to terpenes.

Conclusions • This particular patient group was positive for a number of toxic and nontoxic chemicals provoking their symptoms. This study shows there was a connection between VOCs, other chemicals, and terpenes in chemically sensitive patients in a prospective cohort study. It has also shown the potential for terpenes to exacerbate symptoms of chemical sensitivity. Further research on this topic is recommended. (*Altern Ther Health Med.* 2015;21(4):12-17.)

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While diagnosing and treating chemically sensitive patients at the Environmental Health Center of Dallas (EHC-D) under less polluted conditions, the authors observed some patients complain that the odor of plants (terpenes) caused their chemical sensitivity to exacerbate and manifest by spontaneous bruising, petechia, edema, acne, or inability to walk a straight line with eyes open or closed. These patients' chemical sensitivity could not be controlled until the odors were recognized and then eliminated or neutralized by injection.

Terpenes and terpenoids are 2 of the most common natural incitants involved in chemical sensitivity, along with toxic chemicals such as natural gas, pesticides, herbicides, volatile organic chemicals, and metals. Terpenes are a class of natural hydrocarbons having a relationship to isoprenes, which are building blocks of natural substances. Isoprene consists of 5 carbon atoms attached to 8 hydrogen atoms (C_5H_8).[1] The most common isoprene is 2-methyl-1,3-butadiene, which was found in the breath analysis of the patients by Guenther et al.[2] Terpenoids are an oxygenated derivative of hydrocarbons or new compounds structurally related to isoprene. More than 5000 structurally determinate terpenes are known. Terpenes have an odor that appears to be pleasant to normal people but is toxic to chemically sensitive patients.[3] The odors of pine or cedar are examples of natural terpenes that can trigger many reactions in the body, including all the major systems, as seen in the authors' series of patients. Not only are the terpenes released from natural plants such as pine, cedar, hogwort, juniper, eucalyptus, and camphor, or natural plant derivatives, such as turpentine, but they are in the air from oil refineries, natural rubber factories, and isopentenyl pyrophosphate and dimethylallyl pyrophosphate factories.

Isoprenes are emitted in almost equivalent quantities as fumes from plants as methane gas is from the earth, accounting for almost one-third of all natural hydrocarbons released into the atmosphere.[2] Chemically sensitive patients can be targeted by terpenes and terpenoids resulting in triggering of symptoms and pathology, just as toxic chemicals do. Often chemical avoidance and treatment do not clear these patients' symptoms until they have been treated by elimination and intradermal neutralization of terpenes.

Camphor is a terpenoid known as 1,7,7-trimethylbicyclo(2.2.1)heptan-2, with the chemical formula $C_{10}H_{16}O$. It is found in the wood of the camphor laurel *Cinnamomum camphora*, a large evergreen tree very common in California and the southern United States.[1] Camphor contains volatile chemical compounds in all plant parts. Camphor has 6 chemical variants including (1) camphor; (2) linalool; (3) 1,8-cineole; (4) nerolidol; (5) safrole; and (6) borneol. Another common source is synthetic disinfectants.

MATERIALS AND METHODS

Participants

The cohort was composed of 45 patients at EHC-D who demonstrated chemical sensitivity to ambient doses of chemicals such as natural gas, pesticides, formaldehyde, phenol, chlorine, cigarette smoke, newsprint, and/or ethanol. In addition, each of the participants also complained of terpene sensitivity, particularly the odors of pine, mountain cedar, ragweed, hogwort, eucalyptus, and mint, as well as natural rubber. Even though they avoided exposure to and the authors retreated for the chemicals, the participants remained ill because of their sensitivity to the odors of the terpenes, which persisted 365 days per year. The cohort included 18 males and 27 females, aged 24 to 62 years.

Setting

The study was developed and conducted at the Environmental Health Center of Dallas (EHC-D) because of the less polluted environment, as determined by quantitative air analysis and particulate counts. EHC-D was designed to minimize chemical and particulate emissions. Surfaces and structural materials of copper, porcelain, steel, aluminum, and glass were used for this reason. A recirculating ventilation system was used to prevent outside air toxics from entering. High-quality, charcoal, paper, and steel filters were used in the ventilation system to shield patients from fumes of any outgassing, extraneous gasses, and extraneous particulates that entered. Employees and patients were also not allowed to use any chemicals including perfume and scented cosmetics inside the facility. The resulting environment within EHC-D is 5 times less polluted than the environment outside the facility.

The air was evaluated for pollutants at the EHC-D and quantified on a daily basis with standard tests that identify fine particulate matter (10 parts per billion [PPB], 2.5 PPB), sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, pollen, mold, benzene, arsenic, cadmium, polycyclic aromatic hydrocarbons,[4] and others. Using the same air pollutant tests, the results were compared with other areas of the building that were not designed and ventilated in the same manner. The air within the clinic was free of pesticides, solvents, and terpenes.

Design

The study was divided into 2 parts, both conducted within the less-polluted environment of the EHC-D. Double-blind procedure was employed for both parts, using normal saline as a placebo.

A chemically sensitive cohort of 45 patients exhibiting odor sensitivity to terpenes and terpenoids was evaluated under less-polluted, environmentally controlled conditions for diagnosis and treatment. These patients lived in a specially designed, 5-times-less polluted, environmentally controlled wing of the hospital or outpatient living facility, as determined by air analysis and particulate count. They were deadapted by fasting for 4 days. Their total burden of toxics was reduced as they eliminated some chemicals and particles from their bodies while reducing intake by breathing less-polluted air and ingesting no food. During deadaptation, they also became extremely aware of ambient odors.

The first challenge was an ambient dose of inhaled chemicals in a glass steel booth inside an environmentally controlled room. Ambient doses in the order of PPB were

Table 1. Double-blind Inhalant Challenge of Ambient Chemicals in 45 Terpene-sensitive Patients With Chemical Sensitivity in a Less-polluted Room of the Less-polluted Wing at EHC-D

Chemical	Tested (N)	Positive (n)	% Positive	Dosage (PPM)
Perfume	45	45	100.0	Ambient
Newsprint	40	40	100.0	Ambient
Pesticides	21	18	85.7	<0.0034
Formaldehyde	18	15	83.3	<0.20
Cigarette smoke	42	35	83.3	Ambient
Ethanol	21	16	76.2	<0.50
Phenol	22	15	68.2	<0.20
Chlorine	23	12	52.2	<0.33
Placebo	45	0	0.0	Normal saline

Abbreviations: EHC-D, Environmental Health Center of Dallas; PPM, parts per million.

Table 2. Double-blind, Intradermal Challenge of Ambient Chemicals in 45 Terpene-sensitive Patients With Chemical Sensitivity

Chemical	Tested (N)	Positive (n)	% Positive	Dosage (PPM)
Formaldehyde	18	18	100.0	<0.20
Orris root	42	40	95.2	0.05
Ethanol	41	35	85.4	<0.50
Cigarette smoke	42	35	83.3	0.05
Newsprint	39	28	71.8	0.05
Perfume	39	26	66.7	0.85
Phenol	17	9	52.9	<0.20
Chlorine	11	6	54.5	<0.33
Placebo	45	0	0.0	Normal saline

Abbreviation: PPM, parts per million.

obtained by setting each chemical in an open glass container inside the booth for 10 minutes. Patients were challenged with perfume, newsprint, pesticides, formaldehyde, cigarette smoke, ethanol, phenol, chlorine, and placebo to prove their chemical sensitivity. Patients had pulse, blood pressure, peak bronchial flow, and other signs and symptoms recorded 30 minutes before and at 15-minute intervals for 2 hours postchallenge. The second challenge in part 1 was an intradermal provocation challenge in the environmentally controlled room. Patients were challenged with formaldehyde, orris root, ethanol, cigarette smoke, newsprint, perfume, phenol, chlorine, and placebo. Each intradermal test was measured for wheal size and the provocation of signs and symptoms.

In part 2, the intradermal challenge conditions of part 1 were replicated and the challenges consisted of pine, trees, ragweed, mountain cedar, grass, and placebo. Each intradermal test was, again, measured for wheal size and the provocation of signs and symptoms.

RESULTS

The patients of this series were positive for numerous chemicals, toxic and nontoxic, establishing the chemical sensitivity when challenged in the deadapted state in a less-polluted, specially designed, controlled environment. They were also proven sensitive to the terpenes by intradermal challenge, confirming these patients' responses to the odors of pine, cedar, grass, tree, ragweed, and mountain cedar terpenes.

Different numbers of patients were tested for each toxin or terpenes because of time-related factors, such as patients who had to leave with other obligations or the cumulative effect of testing, which made patients unable to continue. The group of patients tested in the inhalant challenge (Table 1) was significantly sensitive to perfume (100%), newsprint (100%), pesticide (85.7%), formaldehyde (83.3%), cigarette smoke (83.3%), ethanol (76.2%), phenol (68.2%), and chlorine (52.2%), whereas the intradermal challenge was significant for formaldehyde (100%), orris root (95.2%), and ethanol (85.4%). Cigarette smoke (83.3%) showed similar results in both intradermal and inhalant challenges. The intradermal challenge of terpenoids and terpenes (Table 2) showed a significantly high percentage of patients sensitive to pine (60.5%), trees (38.9%), ragweed (27.8%), mountain cedar (18.9%), and grass (8.1%). None of the patients reacted to the placebo (normal saline) in the inhalant or intradermal challenges in part 1 of the study.

In part 2, the terpenes intradermal challenges (Table 3) showed 23 of 38 (60.5%) patients were sensitive to pine terpenes, 14 of 36 (38.9%) were sensitive to tree terpenes, 10 of 36 (27.8%) were sensitive to ragweed terpenes, 7 of 37 (18.9%) were sensitive to mountain cedar terpenes, and 3 of 37 (8.1%) were sensitive to grass terpenes; therefore, it was established that these patients were not only sensitive to toxic chemicals but also the odor of plant terpenes. None of the patients reacted to the placebo (normal saline) in the intradermal challenge in part 2 of the study. The results show that 43 of 45 (95.6%) chemically sensitive patients were sensitive to terpenes.

Patient management included massive avoidance of pollutants, including terpenes in the air; oxygen therapy (4-8 L/min of oxygen for 2 h/d for 18 d); intradermal immunotherapy (consisting of histamine 05/5 dilution [1:3000] 4 times/d using a dose of 0.10 cm^3);

Table 3. Double-blind Intradermal Challenge of Sensitivity to Various Types of Terpenes and Terpenoids

Terpenes and Terpenoids	Tested (N)	Positive (n)	% Positive	Dosage (PPB)
Pine	38	23	60.5	0.05
Trees	36	14	38.9	0.05
Ragweed	36	10	27.8	0.05
Mountain cedar	37	7	18.9	0.05
Grass	37	3	8.1	0.05
Placebo	38	0	0	Normal saline

Abbreviation: PPB, parts per billion.

serotonin (05/4 dilution 4 times/d using a dose 0.10 cm^3); capsaicin (0.05/4 dilution using a dose of 0.10 cm^3 every 4 d); and terpenes antigens (0.05/3-0.05/6 dilution every 4 d). Intradermal treatment for terpenes and terpenoids was done with optimum testing doses including pine, trees, grass, ragweed, and mountain cedar terpenes. The patients did well with treatment and 43 of 45 improved their symptoms as a result.

CASE REPORT

A 71-year-old, white female teacher with a history of chronic anemia came to EHC-D with the complaint of a 25-year history of frontal headache, described as a sharp band of pain that was episodic, presenting 2 to 3 times per week for approximately 20 minutes. Spontaneous exacerbations and remissions had occurred in the prior several years, particularly during the winter. She also reported tinnitus, tingling, numbness, and paresthesias that were related to episodes of dyspnea, epistaxis, nasal discharge, postnasal drip, eye itch, wheezing, and cough.

She had been treated with a variety of medication and had a medical history of chronic sinusitis, anemia, hypothyroidism, hypercholesterolemia, small-calcified intramural leiomyomas, ovarian cysts, and irritable bowel syndrome. No surgery or hospitalization had occurred.

The patient had a history of hypersensitivity to trees, including mountain cedar and pecan trees, and to grasses including Bermuda, Johnson, and Timothy grasses. Her symptoms were triggered by the odor of pine and cedar trees 365 days per year. She smelled a strange odor each time she walked into the house, which had been built in 1968 in a pine/cedar forest, with the interior of the house made primarily of pine and cedar. Table 4 shows test results and evaluation of her house related to an indoor air sample taken on November 11, 2013. The sample was analyzed for the presence of volatile organic compounds (VOCs) and aldehydes, including terpenes and camphor.

This patient was proven to have chemical sensitivity by inhaled challenge and intradermal provocations. When a breath analysis was performed, the patient had levels of camphor, α-pinene, and acetic acid. She also had a positive inhaled provocation to α-pinene and acetic acid. She also had a positive intradermal provocation to α-pinene. Camphor and acetic acid were not tested because of the unavailability of these antigens.

The patient reduced her chemical load and used her available antigens for treatment (Table 5). She removed as much camphor from her house as possible. As a result, she became free of headaches and other symptoms for the first time in 28 years. She has since lived a vigorous life.

Table 4. VOC Air Analysis[a] in House of Participant as Described in Case Report

Chemical	Patients House Interior	Normal House (Control)
Acetic acid	15 PPB	6.1 PPBV
α-Pinene	2 PPB	0.4 PPBV
β-Pinene	1 PPB	0.2 PPBV
Acetic acid, ethyl ester	4 PPB	1.1 PPBV
Acetic acid, butyl ester	2 PPB	0.4 PPBV
Limonene	27 PPB	4.9 PPBV
4-Terpineol	1 PPB	0.2 PPBV
L-Camphor	14 PPB	2.3 PPBV
DDE[b]	2.86 PPB	0 PPB

Abbreviations: VOCs, volatile organic compounds; PPB, parts per billion; PPBV, parts per billion by volume; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane; PPM, parts per million.

[a]Air analysis by Philips method: a detection of VOC in alveolar breath for the presence of chemicals by chromatography and mass spectrometry.[5]

[b]DDE is an organochlorine pesticide metabolite of DDT.[6] DDT is highly persistent in the environment, with a reported half-life of 50 y. Expected DDE levels are 0 PPM. Finding this substance is significant because it exposes suppresses levels of serum immunoglobulin and antibody titers.[7] It inhibits leucocytes and macrophage migration at the cellular level and increases chemical overload leading to hypersensitivity.

Table 5. Intradermal Neutralization Case Report

Intradermal Neutralization	Dosage
Antigen: pine terpene	0.5 cm^3 of the 1/0.25 dilution
Antigen: tree terpene	0.5 cm^3 of the 1/3000 dilution
Antigen: ragweed terpene	0.5 cm^3 of the 1/1.25 dilution
Antigen: mountain cedar terpene	0.5 cm^3 of the 1/3000 dilution
Antigen: grass terpene	0.5 cm^3 of the 1/1.25 dilution
Antigen: placebo	Normal saline

DISCUSSION

This study found a relationship among the sensitivities to the terpenes of pine mountain cedar, tree terpenes, and airborne chemical pollutants. It has shown that a connection exists between VOCs and terpenes in chemically sensitive patients.[8]

The various chemicals and the terpenes acted on all patients based on their individual susceptibilities. Therefore, some had persistent responses to more terpenes than others or identified the chemicals that triggered each patient's symptoms as was illustrated in the case report.

The research team was particularly surprised by how camphor became airborne and apparently was made by the combination of acetic acid and odor from pine terpenes in the house. Camphor can be made in the air by a combination of acetic acid and pinene (α and β) and can be a significant factor in terpene sensitivity, a result that the current study found and that it is significant to chemical sensitivity. Camphor may have been in more houses than were reported in our study, but the patients did not report the distinct odor in their houses. Its significance should be observed in further evaluations.

Both chemicals and terpenes can be part of the chemical sensitivity and if the terpenes are ignored and not treated by elimination and intradermal neutralization, these types of chemical sensitivity patients will not improve.

By decreasing each patient's overload in combination with other substances such as pesticides and formaldehyde, 43 of 45 patients improved their symptoms with treatment. This result is attributed to the total decrease in body pollutant load from the controlled environment, the intradermal neutralization, and avoidance of chemicals and terpenes.

This phenomenon of mixed toxins occurring within a room's ambient air was unidentifiable until the effects of chemicals were eliminated by placing the patients in a less-polluted, controlled environment and allowing them to become deadapted. Then an individual's sensitivity to pollutant and terpenes could be seen as the patient was unmasked from the toxic environment and then was presented with individual challenges.

The current study's participants are among the first to report terpenes and terpenoid sensitivity among their triggering agents for chemical sensitivity. The authors do not know whether the participants' sensitivity to terpenes came first or followed the onset of the chemical sensitivity. Either is possible because the terpenes and terpenoids from plants are as prevalent in ambient air within the outdoor environment as is methane gas, which is emitted from the earth[2] and is the number-one trigger, along with pesticides, of the chemically sensitive. These exposures could have occurred when the patients were living in a home that contains terpenes offgassed by the pine furniture,[9] flooring, or cabinetry; in a home that generated camphor when pine was combined with ambient acetic acid; or in a home in the midst of a terpene polluted forest.[10] It has been shown that VOCs, pesticides, and other toxins can disturb the cell membrane, allowing Ca^{++} and Na^{+} into the cell. When the Ca^{++} combines with protein kinases A and C and is phosphorylated, it can increase sensitivity by a factor of 1000.[11] This may be what happened to those patients who developed terpene sensitivity. Perhaps this mechanism explains both VOC and terpene sensitivity.

Because all of these studies were performed in a controlled, 5-times-less polluted environment and because 43 of 45 patients improved with initial and long-term treatment of not only the reduction of the total environmental toxic load but intradermal neutralization of the terpenes, our observations appear valid. Terpenes sensitivity exits and can be eliminated by avoidance and intradermal neutralization.

The case report emphasizes the complexity of the chemical exposure in the home as shown in Figure 1, where ethanol is made when one mixes acetic acid with other chemicals yielding ethanol or acetyl chloride. In our series ethanol was positive in 76.2% of patients by the inhalant challenge and in 85.4% of patients by intradermal challenge. The sensitivity from exposure could be from petrochemicals or combining acetic acid and terpenes, such as the formation of camphor (Figure 2).

The puzzling phenomenon in the current case study was the presence of camphor in the patient's home air and its significance in relationship to sensitivity. The majority of the camphor usually comes from camphor dermal applications.[12-15] What is unusual about the results of the current study is that the toxic camphor was in the indoor air of the case study patient's indoor air. Her symptoms had a strong ambient air association with camphor exposure; however, she had used no camphor. The ambient air apparently created or contained the camphor, probably by a combination of α-pinene, β-pinene, and acetic acid, which is known for creating camphor, as shown in Table 4 and Figure 2.[16,17] Apparently the camphor in the air was enough to sensitize the patient.

Figure 1. Mixing acetyl chloride with acetic acid forms ethanol.

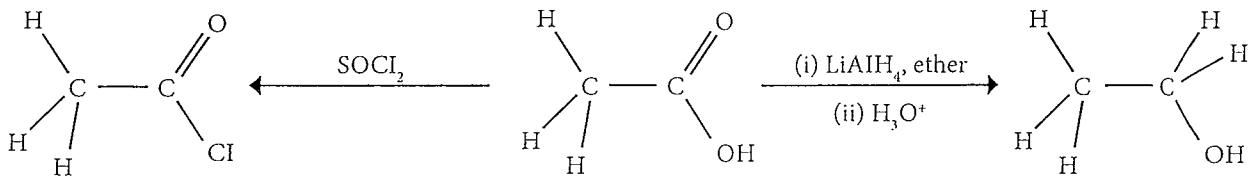
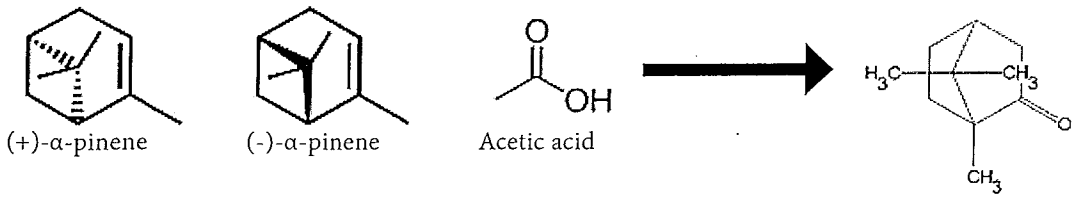


Figure 2. Mixing α-pinene or β-pinene with acetic acid forms camphor.



CONCLUSION

The current study is the first in which chemically sensitive and terpene sensitive patients were studied in a less-polluted, environmentally controlled area of the EHC-D clinic and hospital, revealing case data that contained information about low levels of VOCs and terpene sensitivity. The patients exhibited signs and symptoms from some of their exposures, which illustrated the response in the whole series of patients.

The study found a potential source of sensitivity to terpenes in pine, mountain cedar, and tree terpenes as air pollutants. A particular patient was discussed in the case study who showed a significant frequency of symptoms from chronic inhalant exposure to air in which camphor was made from a combination of α- or β-pinene and acetic acid in her home's environment. The case study showed that camphor was toxic and compromised the patient's daily activities and exacerbated her chemical sensitivity. Further research on this topic is recommended.

The participants in the study showed positive responses to a number of toxic and nontoxic chemicals that provoked symptoms. This study has shown that a connection exits between VOCs, other chemicals, and terpenes in some chemically sensitive patients.

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