

## **ARTICLE 3: Influence of Scents to avoid drowsy driving**

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### **Abstract:**

Although the effects of olfactory stimuli on consumers have been the subject of much research over the last two decades, there is a general lack of theoretical specification as to how scents influence drivers' actual behavior and which essence is the most suitable for preventing traffic safety. Preventing and treating the reasons for sleep behind the wheel may have considerable contribution in traffic safety. Therefore we should attend more closely to the issue of sleep related disorders and their implications for driving in cases with notoriously high risk. Considering the increasing number of road traffic accidents per day, a new scientific approach in order to avoid those accidents is much needed. The influence of scent on the driver's psychosomatic state was examined using a fixed-based driving simulator by through biological measurements including electrocardiogram. Taste in scents is so individual that blood flow of brain activity is measured in order to estimate the reaction of scent on the subject. As for brain activity of olfactory cortex, the multi-channel near-infrared spectroscopy (MNIRS) has been shown to enable the evaluation of changes in hemodynamic. The MNIRS was also used to monitor the activity of the frontal cortex as mirrored by hemodynamic responses subjected to olfactory stimulation. Methods of presenting fragrances have been proposed as a means of preventing drivers from dozing and helping them remain alert.

## Introduction:

Each year, more than 500,000 people are killed and 15 million are injured worldwide by traffic accidents\*. There are many causes of such events, but growing evidence indicates that driver behavior is responsible for more than 90% of these events. Specifically, drivers make a wide range of errors that contribute to the occurrence of vehicle crashes. They fail to engage in adequate scanning of the road, misjudge their own speed or the distance between their own vehicle and other vehicles, take unwarranted risks, respond slowly to signs or warnings, and make incorrect attributions concerning the intentions of other drivers.

The sense of smell has a remarkable ability to conjure up memories, change our mood - even affect our ability to concentrate. But even more than that, smells have a unique link directly to our emotions. Think of a "good" smell (fresh baked cookies or bread, fresh-cut flowers, etc.) and chances are that you start to feel a boost in your mood. Then think of a "bad" smell (pollution, rotten meat, etc.) and the opposite is likely to occur. This is because, no other sensory system has direct access to the amygdala-the emotional center of your brain.

Fragrances are instantly – and mostly unconsciously – connected to emotions, mood, and memory which subconsciously affect consumer purchase behavior.

It's astounding how much the smell in a car can affect a driver's mood and actions. Smell is a very powerful sense and could result in a lack of concentration or over - reaction to minor irritations on the road - which can turn into potentially life threatening incidents."

In fact, the "right" smell in a car can help the driver:

- Recognize dangers sooner
- Stay focused on the road ahead
- Forgive other people's driving errors
- Find a bit of romance

But, get a whiff of the "wrong" smell, and the driver may be compelled to:

- Speed
- Doze off
- Succumb to road rage
- Get in a serious accident

Based on several driving tests and their influence on driving ability and performance, the BHRI Institute researchers might have found the mysterious bio scents, which might increase alertness and driving performance. In related research, found that exposure to several different pleasant fragrances increased participants' self-reports of alertness and activation, and also significantly elevated their performance on several cognitive tasks.

BHRI Institute has developed the following Bio Scents:

- **Sourcing essence ED510:** They improve concentration levels and make drivers less irritable.

- **Sourcing essence ED660:** These, too, help drivers achieve high concentration levels and clear thinking.
- **Sourcing essence ED720:** This tends to make people more cautious about their driving and improves concentration.
- **Sourcing essence ED880:** A breath of salty sea air may make drivers breathe deeply, which helps relieve stress, relax the muscles and calm the mind.

## Research:

The research was carried out on technologically advanced device – Scent Generator Car, which has been developed by BHRI Institute researchers for many years. SG Car operates in a manner of simulating the natural circulation of essences in nature – with the preservation of authentic molecules as well as with the exact imitation of natural processes of air circulation, such as those found in nature. Through the effects of aerodynamic laws SG Car stimulates essences to fill the place in the same way as it happens outdoors. The result is that the essences retain their original effects. Therefore, the penetration of essences in people happens exactly in the same way as in nature: at a sufficiently high concentration, when we breathe, we enter them through the cerebral left hemisphere and the lungs, then the body mechanisms regulate the absorption.

Long term monotonous driving has been often found to decrease the driver's arousal level and effect his/hers property of perception, cognition and judgment. It is preferable to apply arousal assist for the driver instead of huge stimulus such as warning sound and vibration to the driver while driving. On the other hand, the effect of the bio scent is also reported as an environmental stimulus for driver. In this study, the four kinds of bio scents were used as olfactory stimulation and the influence of scent on the driver's psychosomatic state was examined using a fixed-based driving simulator by measuring biological measurements including electrocardiogram and finger plethysmograph. As for brain activity of olfactory cortex, the multi-channel near-infrared spectroscopy (MNIRS) has been shown to enable the evaluation of changes in hemodynamic. The MNIRS was also used to monitor the activity of the frontal cortex as mirrored by hemodynamic responses subjected to olfactory stimulation. As a result, it is verified that not only characteristics of the bio scent but also the driver's preference and subjective judgment of bio scent changes affect on the each driving performance. The brain change by olfactory stimulation and the brain change by other stimulation were also investigated. The effects of the functional brain imaging of olfactory activity were measured and the comfortable scent was effective for maintaining the arousal level.

The following study was designed to investigate whether the presence of specially prepared sourcing essence under the scientific code ED510 (that has proven to be the best) affects driving alertness and associated driving measures. Participants were monitor during simulated driving under two conditions. These conditions were consist of the presentation of sourcing essence ED510, and a non-scent control condition. While driving, measures of alertness, mood, and task workload have been assessed.

Research with ED510 odors has shown effects on an individual's mood, attention, and ability to perform cognitively - and physically - based tasks. Thus, it is reasonable to expect that the presentation of these odors were result in a general stimulation of the central nervous system. If so, participants should be able to maintain attention and motivation to the driving task, have decreased workload demands, and show decreased fatigue and increased alertness while driving.

Past research indicates the odors of sourcing essence No. ED510 enhance motivation, performance, and alertness, decrease fatigue, and serve as central nervous system stimulants. Given these results, it is reasonable to expect that the presentation of presented odor while driving may produce a more alert and conscientious driver, and minimize the fatigue associated with prolonged driving. In the present study, participants were monitored

during simulated driving under two odor conditions (present sourcing essence ED510, non-odor control). Odors were added to low flow oxygen (1.3L/min) via an oxygen concentrator and presented at the rate of 30 seconds every 15 minutes. Measures of cognitive performance, wakefulness, mood, and workload were also assessed. Presented sourcing essence ED510 led to increased ratings of alertness, decreased temporal demand, and decreased frustration over the course of the driving scenario. In addition, this kind of sourcing scent reduced anxiety and fatigue. Periodic administration of these odors over prolonged driving may prove beneficial in maintaining alertness and decreasing highway accidents and fatalities. Essence ED510 administered either retronasally or orthonasally, improved participants' scores on tasks related to attentional processes, virtual recognition memory, working memory, and visual motor response speed. In addition, participants rated their mood and level of vigor higher, and their level of fatigue lower, in the essence condition.

## Conclusions:

This study verified fragrance presentation technique to alert drowsy driving. In addition, our BHRI Institute's researchers experimentally developed a fragrance presentation system, a special device called SG Car, which can be practically installed on actual vehicle and assessed the effectiveness using a driving simulator. The SG Car is highly technologically performed device, which should be in our opinion the mandatory serial equipment of each car.

From this experiment, fragrance presentation to drivers at the wheel can induce wakefulness and sourcing essence ED510 presentation is suggested to be the most effective. 30 second interval presentation ensured 16 minute wakefulness. Compared to 60 second interval, 30 second interval can provide longer alertness level because repeated fragrance presentation revived wakefulness before sleepiness came back to drivers. However, shortened presentation interval likely causes olfactory adaptation.

Examination on effective presentation frequency should be considered. Likewise, although presentation intervals remained fixed in this study, effectiveness of irregular presentation frequency and even real - time change of fragrance type need to be examined in order to put olfactory adaptation under better control. Our future work includes finding more effective sequence in fragrance presentation techniques.

\*Source: Except as noted, National Safety Council, Itasca, IL, Injury Facts

For more information:

<http://www.nsc.org/>

<http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.a0bd5d5a23d09ec24ec86e10dba046a0/>

<http://www-nrd.nhtsa.dot.gov/CATS/index.aspx>

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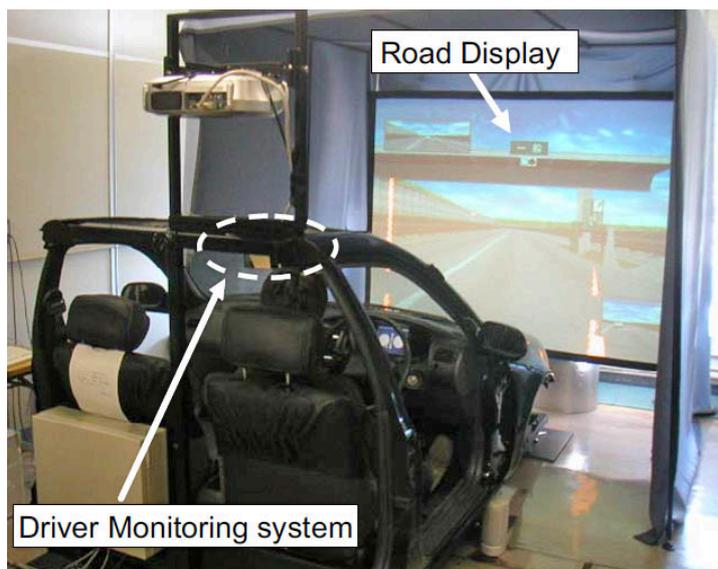


Fig.1 Driving Simulator

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