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Review

Air Quality as a Key Factor in the Aromatisation of Stores: A Systematic Literature Review

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Abstract: Scientific literature on indoor air quality is categorised mainly into environmental sciences, construction building technology and environmental and civil engineering. Indoor air is a complex and dynamic mixture of a variety of volatile and particulate matter. Some of the constituents are odorous and originate from various sources, such as construction materials, furniture, cleaning products, goods in stores, humans and many more. The first part of the article summarises the knowledge about the substances that are found in the air inside buildings, especially stores, and have a negative impact on our health. This issue has been monitored for a long time, and so, using a better methodology, it is possible to identify even low concentrations of monitored substances. The second part summarises the possibility of using various aromatic substances to improve people's sense of the air in stores. In recent times, air modification has come to the forefront of researchers' interest in order to create a more pleasant environment and possibly increase sales.

Keywords: indoor air; retail stores; aromachology; volatile compounds; scents

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1. Introduction

Air is the common name for the atmosphere of Earth. Dry air contains, by volume, 78.09% nitrogen, 20.95% oxygen, 0.93% argon, 0.04% carbon dioxide, 0.0018% neon and small amounts of other gases. The concentration of water vapour varies significantly from around 10 ppm by volume in the coldest portions of the atmosphere to as much as 5% by volume in hot, humid air masses [1].

Filtered air includes trace amounts of many other chemical compounds. Many substances of natural origin may be present in, locally and seasonally variable, small amounts as aerosols in an unfiltered air sample, including dust of mineral and organic composition, pollen and spores. Various contaminants, often industrial, may also be present, including chlorine (elemental or in compounds), fluorine compounds and sulphur compounds, such as hydrogen sulphide and sulphur dioxide.

During the last few decades, there has been a growing concern by people and scientists over the quality of the air not only in cities, towns and villages but, also, in buildings where we live, work and shop. Modern homes, offices and shops are insulated much better than they were previously. The methods with which buildings are constructed and operated have changed [2]. New materials are tested, ventilation has improved and the temperature and other parameters are monitored so that the environment and air in buildings does not have a negative impact on our health. In addition to monitoring the air quality and potentially harmful compounds, new possibilities are being developed to improve the purchasing environment of customers. In addition to improving the environment in shops, such as the appropriate temperature, light level, music, decorations and so on, the choice of an appropriate aroma fora shop is becoming increasingly apparent. This article examines the contents of substances the air in shops may contain and then describes the possibilities of how air can be affected in connection with pleasant odours.

2. Materials and Methods

The object of research in the present study was the space of retail stores, where goods and services are sold directly to the consumers who will use them. Commercial properties used for retail purposes include single-tenant stores, grocery stores, restaurants, strip malls and shopping malls. Retail spaces come in a variety of shapes and sizes and may be located in free-standing buildings, enclosed malls, strip shopping centres, downtown shopping districts or mixed-use facilities. Retail spaces are also situated in airports and other transportation facilities, hotel lobbies, sports stadiums and temporary or special event venues.

The second object of this study was the indoor air quality, which has been systematically addressed since the late 1970s. The impact on human health has been discussed several times by the World Health Organization (WHO) [3,4]. In Europe, by demand of the European Commission, the Scientific Committee on Health and Environmental Risks (SCHER) prepared an opinion on the risk assessment on indoor air quality [5]. There is an urgent need for a change that is innovative and takes a systemic, skills-based multidisciplinary approach. At present, the legislation varies from one EU Member State to another, with the absence of standards and control mechanisms. To fill this gap, harmonisation initiatives need to be taken, setting out strategies and parameters at the same time, to control indoor pollutants [6]. The main factors related to indoor air were observed to be:

- Chemicals for intended use or unintentional emissions from different sources [7–12];
- Radon [13,14];
- Particles [15–20];
- Microbes [21];
- Pets and pests [22–29];
- Humidity [30,31];
- Ventilation [32–35];
- Temperature [36–38].

This review is organised as a research paper based on the PRISMA Extension (PRISMA-ScR) approach [39]. A comprehensive literature search from the Scopus and ScienceDirect databases was performed in May 2021 and was limited to articles published in English since 2000. The data was searched in the databases in the fields Article title, Abstract and Keywords. Terms such as indoor, air quality, stores, shops, sensory marketing, scent marketing, aromachology, behaviour and consumer were, among others, used. The most attention was given to studies published in journals included in Journal Citation Reports.

3. Results and Discussion

By entering the term indoor air quality, 13,714 scientific manuscripts (reviews and articles) were found in the ScienceDirect database and 14,863 in the Scopus database since 2000. From this selection, we extracted, using the keyword "shop", 232 results from ScienceDirect and 89 articles from Scopus. The keyword "store" identified 119 and 134 additional results, respectively. The articles that met our selection criteria were subjected to a detailed analysis. As this is a new area of scientific analysis, the number of scientific studies is very limited, with the absence of standardised procedures, as we discuss below.

3.1. Indoor Air Health Risk Substances in Stores

The air quality in buildings is monitored from various perspectives. It is certainly very important to monitor the air quality from a health point of view. There are many works that deal with which substances are found in the air in buildings, why they are found there and how they can affect our health. In 1999, Jones [2] published a review in which he summarised information from more than 200 papers and discussed the current understanding of the relationship between indoor air pollution and health. The article was divided into sections that dealt with the most frequent pollutants, such as carbon dioxide (CO_2), carbon monoxide (CO), total hydrocarbon (THC), formaldehyde (HCHO), respirable

particulate matter (PM10) and airborne bacteria. He discussed what kinds of pollutants could influence the quality of indoor air, the range of sources and the measured concentrations of individual substances in the air. Table 1 shows the most observed pollutants, their sources, health effects and some measured concentrations from selected works.

Table 1. Chemical compounds in the air in buildings, their sources and their potential health effects [2].

Chemical Compounds	Sources	Potential Health Effect	Some Finding Concentration
Allergens	House dust, domestic animals, insects	Asthma	
Asbestos	Fire retardant materials, insulation	Asbestos-related lung cancer, mesothelioma, skin irritation	
Benzene	Smoke cigarette, petrol with benzene evaporisation, combustion,	Carcinogenicity and haematotoxicity, genotoxicity	1 $\mu g/m^3$ and 5–20 $\mu g/m^3$
Carbon dioxide	Metabolic activity, combustion activities, motor vehicles in garages	Asphyxiant, and can also act as a respiratory irritant, headaches, dizziness, and nausea	54,860 mg/m^3
Carbon monoxide	Fuel burning, boilers, stoves, gas or kerosene heaters, tobacco, smoke	Headache, fatigue, dizziness, and nausea	3657 mg/m^3
Formaldehyde	Particleboard, insulation, furnishings	Sneezing, coughing, skin irritation and minor eye irritation	0.08–2.28 mg/m^3
Microorganisms	People, animals, plants, air conditioning systems	Rhinitis (and other upper respiratory symptoms), asthma, atopic dermatitis	
Nitrogen dioxide	Outdoor air, fuel burning, motor vehicles in garages	Potential danger for asthmatics	Outdoor annual mean range of 20–90 $\mu g/m^3$ indoor may have 200 $\mu g/m^3$
Organic substances	Adhesives, solvents, building materials, volatilisation, combustion, paints, tobacco smoke		
Ozone	Photochemical reactions	Pulmonary function, respiratory diseases, asthmatics	40–300-$\mu g/m^3$ concentrations per hour
Particles	Resuspension, tobacco smoke, combustion products		
Polycyclic aromatic hydrocarbons	Fuel combustion, tobacco smoke		
Pollens	Outdoor air, trees, grass, weeds, plants		
Radon Soil	Building construction materials (concrete, stone)	Lung cancer	45.3–150 Bq/m^3
SO_2	Burning coal, fuels	Chronic respiratory complaints, respiratory symptoms	(52–78 $\mu g/m^3$)
	burning of wood and fossil fuels	Respiratory illness	respirable particles of different sizes
	cigarettes	Eye, nose, and throat irritation	53.2 $\mu g/m^3$ in a study of 7 restaurants, whilst a median concentration of 355 $\mu g/m^3$
Fungal spores	Soil, plants, foods, internal surfaces	Atopic dermatitis, asthma, rhinitis (and other upper respiratory symptoms)	

Substances known as volatile organic compounds (VOCs) are likely to be very important. They can arise from different sources, including paints, varnishes, solvents and preservatives. The most studied substances are: benzene, toluene, n-decane, limonene,

o-xylene, 1,1,1-trichloroethane, p-dichlorobenzene, 1,2,4-trimethylbenzene and p-xylene, undecane, 1,3,5-trimethylbenzene, dichloroethane and trichloroethane [2,5,6,8,11,40,41].

In 2010, the World Health Federation published WHO guidelines for indoor air quality selected pollutants in which the individual substances are discussed in more detail. The substances considered in this review, i.e., benzene, carbon monoxide, formaldehyde, naphthalene, nitrogen dioxide, polycyclic aromatic hydrocarbons (especially benzo[a]pyrene), radon, trichloroethylene and tetrachloroethylene, have indoor sources, are known for their hazardousness to health and are often found indoors in concentrations large enough for health concerns [41]. Fifteen years after the publication of Jones's work, another review was published by Zaatari et al., who focused on the effect of ventilation on the air quality in retail stores [42]. The authors first described the methodology and databases they used for the review. They went through databases such as the ISI Web of science, Compendex and Science Direct and, also, government reports and Google Scholar. They chose the most-known pollutants as keywords and words like retail, mall, shopping, supermarkets, stores and so on. The authors went through more than 110 papers and chose 28 with the most important information connected to measurements in retail spaces. They also discussed some ANSI/ASHRAE Standards, which are the recognised standards for ventilation system design and acceptable indoor air quality (IAQ). The standards specify the minimum ventilation rates and other measures in order to minimise adverse health effects in the occupants. One part of the study was devoted to individual substances (see Table 2). In the second part, they compared the health impact from exposure to VOCs and discussed the individual concentrations found in the works. In another, they discussed substances such as ozone, radon, fungi and bacteria. In the discussion and conclusion of the paper, they summarised their findings: half of the stores exceeded the recommended standards for acrolein, formaldehyde, acetaldehyde, benzene and trichloroethylene. They pointed to acrolein and PM2.5 as potential risks [42].

Table 2. Chemical compounds in the air in buildings, their sources and their concentrations [42].

Chemical Compounds	Sources	Some Finding Concentration
Aromatic compounds Group benzene, toluene, ethlbenzene, xylenes, styreve	Motor vehicle, newspapers in photocopy centers	15 ± 41 ng/g (mean + standard deviation)
Halogenated compounds	Chlorinated cleaning agents, deodorisers	1 ± 1 ng/g
Terpenoids-limonene	Cleaning products	5 ± 5 ng/g
C1–C2 aldehydes		13 ± 10 ng/g average
Formaldehyde		26 ng/g maximum
Carbonyls	Medical, cosmetic products	3 ± 4 ng/g
Aceton		14 ng/g maximum

Over the past two decades, numerous field studies on indoor air quality and Sick Building Syndrome (SBS) have been conducted. The symptoms of SBS are usually nonspecific and are often somewhat particular to the building being occupied by the workers. In their work, the Chinese authors looked at the link between the temperatures in shops in selected large cities in the west of China in relation to the concentrations of carbon dioxide, formaldehyde and total volatile organic compounds (TVOC). They also did a survey of the employees who worked at the stores to see if there were links between the air quality and SBS. This syndrome has been associated with headaches, tearing and other medical conditions. It turns out that, in large stores such as shopping malls, these symptoms can occur and accumulate. In the summer, the values for some substances are higher and vary between shopping malls. [43].

Li et al. [44] studied the air in Hong Kong, which is said to be one of the most attractive shopping paradises in the world. Good indoor air quality is, therefore, very essential to shoppers. In order to characterise the indoor air quality in shopping malls, nine shopping

malls in Hong Kong were selected for the study. The indoor air pollutants included carbon dioxide (CO_2), carbon monoxide (CO), total hydrocarbons (THC), formaldehyde (HCHO), respirable particulate matter (PM10) and the total bacteria count (TBC). The results showed that more than 40% of the shopping malls had 1-h average CO_2 levels above the 1000 ppm of the ASHRAE standard on both weekdays and weekends. Additionally, they had average weekday PM10 concentrations that exceeded the Hong Kong Indoor Air Quality Objective (HKIAQO). The highest indoor PM10 level at a mall was 380 $\mu g/m^3$. Of the malls surveyed, 30% had indoor airborne bacteria levels above the 1000 cfu/m^3 set by the HKIAQO. The elevated indoor CO_2 and bacteria levels could result from high occupancy combined with insufficient ventilation. The increased PM10 levels could probably be attributed to illegal smoking inside these establishments. In comparison, the shopping malls that contained internal public transport drop-off areas, where vehicles were parked with idling engines, and had their major entry doors closed to heavy traffic roads had higher CO and PM10 indoor levels. In addition, the extensive use of cooking stoves without adequate ventilation inside food courts could increase the indoor CO_2, CO and PM10 levels [44].

Li et al. [44] also described the methodology in their paper in detail. They used an air bag sampling method to sample the CO and THC. The CO was analysed with a Thermo Electron (model 48) Gas Filter Correlation CO Ambient Analyser. A methane (MHC) and nonmethane hydrocarbon (NMHC) analyser (model Thermo-Electron 55C) analysed the THC. The measurement results from air bag sampling at the sampling locations at the selected levels in a shopping mall were averaged to obtain the final concentrations.

In their work, the authors Lei et al. [45] designed and described a method for assessing the air quality based on the use of a wavelet neural network. The model can be applied to the evaluation of indoor air quality in large shopping malls.

Du et al. [46] compared the indoor environment quality of green and conventional shopping mall buildings based on customers' perceptions, but they especially paid more attention to the temperature conditions. Differences were found in the indoor environmental quality objective (IEQ) and in the customers' subjective satisfaction between the two buildings. The measurement results showed that a green shopping mall building is superior to a conventional one in terms of the indoor thermal environment, indoor illumination, relative humidity, carbon dioxide concentration and noise level. Moreover, the results of the questionnaire found that customers showed a higher tolerance toward the IEQ when they recognised that a building was green and that their age and/or duration of time spent in the building also affect evaluations of environmental satisfaction [46].

3.2. The Smell in the Stores

Another aspect is how we can affect the air quality and the types of smells and how they affect our mental state. Research in this area is still in its infancy. In the area of trade, there has been great development in recent decades. There was a shift from small shops to large supermarkets. The competition is great, and therefore, the effort to attract the customers lies in the environment. The air quality and smell in a store also play a role here. Nowadays, people spend more time indoors in shopping centres than in outdoor markets. Therefore, the air is a very essential part of the shopping experience. Belgian authors described in their introduction a lot of environmental effects on the pleasantness of the shopping experience for customers, but they focused on the relationship with a distinct and particularly negative emotion—namely, irritation [47].

There has been a growth of literature on perceptions of places through smells in the last decade. Smells are inevitable in people's everyday experiences in cities, variously sourced from human activities to building materials and the landscape, forming an invisible world around us [48].

One of the first summary articles on this theme was published in 2012. The aim of the authors was to discuss the findings from the literature regarding the effects of odours on shopping behaviour and the methodology of individual studies and comments on the results related to perception [49].

A year later, another review of authors Roxana et al. on that topic was published [50]. The main purpose of their paper was to present an extended literature review of the relevant empirical studies that examined the effect of ambient scent on consumers' perceptions, consumers' emotions and consumers' behavioural responses in the context of retailing. The paper also concentrated on identifying the principal dimensions of ambient scents (presence versus absence, congruity versus incongruity and pleasantness versus unpleasantness) and examined the impact of these dimensions of ambient scents on the evaluation of a product, of a store or of a shopping mall and their impact on the shopping behaviour within a store [50].

A perceptual model of smell pleasantness was introduced by Chinese authors in 2018 [51]. Their paper, taking pleasantness as a perceptual quality dimension, aimed to explore indicators influencing people's pleasantness of smell in a selected case. A grounded theory was used as a methodological approach in their study in the selected case. Nineteen participants were recruited for smell walking with semi-structured interviews. Overall, nine indicators emerged from participants' descriptions that contributed to their smell pleasantness: cleanliness, preference, appropriateness, naturalness, freshness, familiarity, calmness, intensity and purity. The perceptual model, in line with the smell concept, also provides a communicational tool among urban planners and designers to describe and assess the qualities of a smell [51].

In 2012, Guéguen [52] published an article about the effects of pleasant ambient fragrances on women. In his work, he also mentioned other studies that were done in the nineties. Baron [53] discussed the influence of fragrance and willingness to help in the longer term. His preliminary study already showed that people are more responsive to partners' needs in the presence of pleasant scents. In his work, he showed the positive influence of fragrance on certain activities, e.g., Grimes [54] found that students volunteered to spend more time on work when they were exposed to a vanilla or lavender odour before the request. Other authors also showed that participants exposed to a pleasant odour during a learning task were more willing to comply with the experimenter's request for help at the end of the task. Similarly, it was also found that undergraduate students who answered a questionnaire that had been saturated with a lavender or peppermint aroma were more likely to take part in a telephone survey [52]. All of the mentioned studies observed that pleasant smells can help improve behaviour and the willingness to help. [52–54]. For a majority of these authors, this effect could be explained by mood. Pleasant ambient odours could have activated a positive mood, which, in turn, led the participants to respond more favourably. The activation of a positive effect linked to the presence of a pleasant odour has been confirmed by mood measurements. Daily associations with smells, such as the smell of fresh bread from a bakery on the way to bus station in the morning and the smell of breweries and cigarettes from pubs on the way back home after work, enrich our experiences and make us know better the places we live [52]. Recently, new works have been published. In 2019, Lenders assessed consumer behaviours in real trade. The conclusions of his work showed that the most important factor is the intensity of the scent. Only above the thresholds did they affect the behaviours of the customer. For one thing, he was willing to spend more time in the store, and some unscheduled purchasing behaviour also applied [55]. Lenders also discussed the papers of other authors [55]. He summarised that the studies were usually conducted in diverse settings, such as laboratories, malls, clothing stores and clubs, and used different reasonings for selecting a specific scent. Scents such as lemon, orange, grapefruit, bergamot, basil, tea, lemon, chocolate, vanilla, cinnamon, seawater, peppermint, ginger, food-based lavender, rosemary, liquorice, coffee and, additionally, some aromas such as faint mint, flora and wood were all studied [54].

The authors from Monash University in Australia [56] looked at the possibility of better competitiveness through the application of music in conjunction with fragrance. Through experimental testing in a fashion store, it turned out that young people can be

influenced and that it is necessary to choose the right level of music and fragrance. In their case, vanilla was chosen [56].

Authors from Switzerland published a paper about perceptions induced by coffee. Coffee is one of the most popular beverages in the world. People like to spend time in cafes. The smell of coffee is mostly associated with breakfast, relaxation and sitting with friends. The aroma of coffee is often observed in studies, because it belongs to typical aromas. The aim of the Swiss scientists was to study not only the hedonic motivation but, also, the so-called functional motivation. They looked at the impact of both the motivations on customer responses, as well as performances in terms of satisfying other senses [57]. Another very nice smell for people is chocolate. The scent of chocolate, for instance, can evoke pleasure and arousal for most consumers. The aroma of chocolate, compared to the smells of other foods, changes the activity in the human central nervous system, and the scent of chocolate can also reduce consumers' attention, perhaps implying that, during their shopping trip, consumers evolve from shopping for a specific product to enjoying the whole shopping experience [58]. Belgium authors combined these findings with the prediction of the Stimulus–Organism–Response paradigm and assumed that the scent of chocolate would lead to approach behaviour. They selected a chocolate scent to be diffused in the store. A first pre-test was conducted to verify the affective and arousing quality of the chocolate scent used in the study. Twenty participants (10 men and 10 women) were asked to sniff the scent (which was put on a cotton-tipped stick in a dark glass bottle) and to evaluate its pleasantness and its level of arousal on a 7-point semantic differential scale (i.e., unpleasant/pleasant and unaroused/aroused). Before the other experiment, the chocolate scent was dispersed in the bookstore at different levels of intensity and for several durations. Forty-eight customers replied to two questions: Did you notice something special in the store atmosphere? Now that we have mentioned the presence of a scent, do you detect the scent? A field study with 201 participants showed that a chocolate scent positively influenced the general approach behaviour and negatively influenced the goal-directed behaviour in a bookstore [58].

Another study examined whether diffusing pleasant scents could overcome consumers' negative responses to a messy store. They investigated the effect of pleasant scents (un)related to neatness on consumer evaluations of a tidy versus a messy store. An experiment with 198 respondents revealed that a pleasant scent not associated with neatness functions as a positively valanced prime, causing consumers to evaluate the products in the tidy store more positively than the products in the messy store. Additionally, when diffused in a messy store, a pleasant ambient scent has a negative effect on consumers' product evaluations because of the mismatch between the pleasant scent and the unpleasant messy layout. However, this negative effect can be cancelled out by diffusing a pleasant scent that is associated with neatness [59].

One of the latest articles on olfactory marketing was published by Spanish authors in 2020 [60]. The aim of their work was to get answers about the influence of smell on the evaluation and behaviour of museum consumers. Three rooms in two different floors of the museum were filled with scents. They used a cloth scent for the historical dressing room, the scent of apple pie for the kitchen and the scent of aftershave for the barber shop. For five days, they tested the suitable concentrations. The authors described the experiment in detail, including the selection of concentrations, a questionnaire and the scale. The museum was visited by 3960 people during the study, and the authors received 234 observations. The obtained results were statistically processed with the help of MANCOVA and showed that the scents had a direct effect on the perception of the environment and on the individual evaluations. The people who visited the museum and its rooms with scents evaluated the museum more positively [60].

This study [60] was also valuable because the literary overview of the subject was very well-presented (a total of 100 links). The individual sections were devoted to the olfaction of marketing and perception, marketing and evaluation and marketing in relation to gender. Out of 100 references, one part was devoted to the functioning of the senses,

especially smell and another part to marketing, and of the works published after the year 2000, about 40 were directly devoted to the relationship between odour and consumer emotions in shops [60]. Concerning shops, the studies focused on medical facilities (dentists and hospitals), bookstores, malls, cafes, museums, fashion stores, etc.

A particularly interesting article was printed in 2020 [61]. The authors introduced a new device for measuring odours that can be used also for marketing studies. qPODs (Portable Olfactive Devices, Curion) are novel olfactory delivery systems that allow the sampling of a wide variety of stimulus types. Participants evaluate odours by opening a port at the top of the qPOD and sampling a controlled air stream. Thirty-one participants in this study smelled and evaluated the pleasantness and intensity of citral, citronellol, geraniol, PEA, nonalactone and vanillin delivered via qPODs and by traditional sniff jars. The hedonic and emotional responses were compared. Their emotional reactions to the odours were captured with the PANAS (Positive and Negative Affect Schedule) at the beginning of each testing session and then again after exposure to each odour. They also completed the newly developed Mood Signature Questionnaire, which asks participants to assign a mood to each odour rather than reporting how it makes them feel. Though the odours presented in the sniff jars were rated as significantly more intense ($p < 0.001$), there were no differences between the presentation types for perceived pleasantness, changes in positive or negative mood following odour exposure or the emotional descriptors (mood signatures) participants assigned to the odours [61].

3.3. Possibilities for Improving Indoor Air Quality

New technologies need to be developed in the industry so that less and less health-threatening substances are released into the air. Industrial plants must use new technologies for air purification. They can use mechanical methods of air cleaning (centrifugal cleaning, water cleaning and wet cleaning) or physicochemical methods of air purification (condensation, filtration and precipitation). The main technologies for the prevention of air pollution include, for example, gravity settling chambers and separators of various types, such as electrostatic and cyclone. Selective catalytic reduction systems and various types of filters, including biofilters and washing machines, are also used.

There are three approaches to improving the air quality; it is necessary to reduce emission sources, develop new technologies for air purification and pay close attention to ventilation systems. Due to the wide range of substances that pollute the air, scientists are focusing on the possibilities of effectively cleaning the air, especially in buildings, but usually, there is not only one possibility. The air purification technologies are constantly being improved. Firstly, adsorption filters are used for air purification, which differ in the material used, the amount and the combination of layers and size of pores. For example, different ones used are as nylon, cotton, polyester nonwoven fabric filter, flax and hemp filters, a multi-layered structure of cellulose fibre and particles of perlite. Combinations of the materials were described in an Indian work [62].

The methods used vary, of course, depending on which substances need to be removed from the air. For example, polypropylene and polystyrene are used to remove particles, but there are also new materials, such as a porous material named SUNSPACE ("SUstaiNable materials Synthesized from by-Products and Alginates for Clean air and better Environment") and silica fume (SF), which are tested for cleaning the air [63].

In their review, Chinese authors described different materials that are used as adsorbents, such as carbon, zeolite and metal–organic framework materials (MOFs). The authors described, in great detail, the advantages and disadvantages of materials, paying close attention to the power and development of other new structures and their potential uses [64].

Another work described using a porous membrane consisting of birnessite-type MnO_2 that was filled in with polystyrene porous nanofibers (MnO_2/PS HPNM) fabricated by a versatile electrospinning method [65].

In 2020, a review was published concerning indoor air pollution also relating human diseases and summarising the current trends and possibilities for air control and air quality improvement. The review was divided into corresponding sections and summarised the findings from 211 works [66]. In addition to the use of filters, attention was also focused on new technologies such as oxidation processes (AOPs), of which it appears that photocatalysis will have the greatest use, during which indoor air pollutants are distributed due to the exposure of semiconductor photocatalysts under sufficiently energetic exposure. The advantage of this method is the direct degradation of gaseous pollutants (especially volatile organic compounds) into CO_2 and water and the applicability of removing low-concentration pollutants. The semiconductors used as photocatalysts in this technology include titanium dioxide (TiO_2), polymer (or graphite), tungsten oxide (WO_3), carbon dioxide (CN), bisexual Ag, cadmium sulphide (CdS) and other MO_x metal oxides (M = Fe and Zn) [66,67].

4. Conclusions

People are spending more leisure time in indoor shopping centres than in the past, so creating a positive environment for them can be a big advantage for retailers. A pleasant smell seems to be one of these circumstances. Our findings may contribute to a better understanding of shoppers' emotions and their behaviours in response to in-store scents. We need to study what can influence people, as it is known that shoppers differ in their sensitivities to smell and the emotions evoked due to, for example, gender, age, mood at the time of shopping or length of time spent shopping.

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