AIR QUALITY IN SCHOOLS: A DUTY FOR ALL, A RIGHT FOR CHILDREN

ANNEXES

MINISTERO DELL'AMBIENTE
DELLA TUTELA DEL TERRITORIO E DEL MARE

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CHAPTER 1

MAIN INDOOR POLLUTANTS AND ALLERGENS

a. Biological agents

- √ Mites
- √ Molds
- √ Animal allergens
- √ Bacteria
- √ Pollen

Many of these biological contaminants are small enough to be inhaled. They can be found in areas that provide food and moisture (e.g. cooling coils, humidifiers, condensed tanks, non-ventilated bathrooms). Or where dust accumulates (e.g. curtains, household linen, carpets).

MITES

Mites have been identified as the main indoor allergens. Mites, in particular the dermatophagoides pteronyssinus (DPP) and dermatophagoides farinae (DPF), lurk and proliferate in mats, carpets, upholstered furniture and dust.

Sources. This is the ideal environment for the growth and proliferation of dust mites: a temperature between 15 and 30°C and a relative humidity ranging between 60% and 80%.

These conditions are commonly present in mattresses and pillows, this is understandable as the warmth of the human body raises both the internal temperature and the humidity of this material, moreover it collects human dandruff in abundance, which nourishes mites.

Effects on health. They can cause rhino-conjunctivitis and bronchial asthma in sensitive individuals. Symptoms may occur throughout the year.

MOLD

Molds are micro-organisms that do not belong to the plant or animal kingdom but to that of fungi. During growth, they produce spores of spherical shape and very small size (very similar to pollens), which are dispersed in the air during the period of sporulation (mainly in summer and autumn) and cause allergic symptoms.

Sources. Molds can grow both indoors and outdoors: indoors they can be found on damp walls and floors, wallpaper, soil and the leaves of ornamental plants, air conditioning systems and humidifiers.

The optimal temperature for growth is between 18-32°C with a relative humidity of at least 60%. They are also commonly found in foods that are not adequately conserved and on wool, cotton or kapok garments. Outdoors they are found mainly on the ground and decaying vegetation: fruit, wood, leaves, etc.

Effects on health. While the large spores (> 10 μm) are deposited in the upper airways (nose and pharynx) causing symptoms such as hay fever, small spores (diameter <10 μm, especially <5 μm) can penetrate through the lower airways causing allergies and asthma. Finally, the fungal allergens, which have ultrafine dimensions (<0.1 μm) can penetrate into the deeper parts of the respiratory system. These allergens are fungi proteins ranging in size from 10,000 to 50,000 Daltons that are found on the surface of fungal spores.

Continuous inhalation of spores or volatile components of filamentous fungi in indoor air may cause: allergies (asthma and rhinitis, mixed-type hypersensitivity, extrinsic allergic alveolitis (EAA) or hypersensitivity pneumopathy (HI') comparable to farmer's lung).

ANIMAL ALLERGENS

“Epidermal derivatives” of animals are generally understood to be proteins with high sensitizing activity that stem from the epidermis, saliva and especially dandruff of animals such as dogs, cats and horses.

Sources. Animal allergens are particularly concentrated in dust, cushions, mattresses, blankets and duvets. These particles can also be found in environments not inhabited by animals but transported by clothes or objects of people who are in contact with them.

Effects on health. Animal allergens may cause breathing difficulty with wheezing and/or coughing and sneezing in allergy sufferers, with possible itching of the eyes, eczema, allergic rhinitis and conjunctivitis.

BACTERIA

Bacteria are divided into two categories: gram-negative and gram-positive. The former produce endotoxin, which is an integral component of such bacteria, so endotoxin levels are directly related to the presence of gram-negative bacteria.

[1] Series of symptoms experienced by the occupants of a specific building in case at point. Signs include malaise, irritative effects and sensory discomfort.

[2] These pathologies are directly correlated with building occupancy. Unlike the “sick building syndrome”, the identity of the specific etiologic agent contained in the indoor environment is known.

This is an inflammatory substance associated with diseases typical of indoor pollution such as the “sick building syndrome[1]”and the “building related illness[2]”. Gram-positive bacteria, on the other hand, include various species such as those of Staphylococci and Micrococci, whose main carrier is humans but are also found in conditions of high humidity such as in air conditioning and dehumidification systems and in damaged buildings. In many cases the presence of these bacteria indicates the presence of humans and they can be found in high concentrations in highly populated buildings.

Sources. Bacteria are transmitted by people and animals but are found in places with temperature and humidity conditions that favor their growth.

Effects on health. Health effects vary depending on the bacterium. Air can serve as a vehicle of many bacteria like for some species of Legionella Pneumophilla, Pseudomonas, Acinectobactor, Staphilococcus and Candida. In fact, these multiply and propagate in air conditioning and hydro-sanitary systems, leading to possible contagion of pneumonia and other serious diseases.

POLLEN

Pollen is an essential component in the life cycle of the most advanced plant organisms that have developed the ability to produce seeds. Pollen is the male reproductive cell (gametophyte) that is diffused by plants and transported by insects, animals and the wind to fertilize the female reproductive system of another plant of the same species.

It is a typically an outdoor allergenic substance, but its great capacity for diffusion and transport along with the property of remaining suspended in air for lengthy periods of time also make it an indoor pollutant.

Sources. Given that pollen comes mainly from outdoor plants, indoor levels are generally much lower than those outdoor. Pollen can penetrate indoor environments through doors, windows and cracks, or be deposited on clothes, shoes and pets.

The plant families involved in pollen allergies (also called pollinosis) include: grasses (wheat, rye, barley, weed and Logliarello), flowering period from March to September; Oleaceae (olive, ash), which have flowering periods between April and July, betullaceae (birch, alder) which have a pollination between February and May, Salicaceae (willow, poplar) which have a flowering period between February and April; Platanacee (platanus) with flowering periods ranging from February to April, Fagaceae (beech, chestnut, oak, Quercus ilex, oak), with flowering periods between March and May, Urticaceae (parietaria), which are often the cause of allergies between April and October, Composites (wormwood, margarita, sunflower) which flower from August to October.

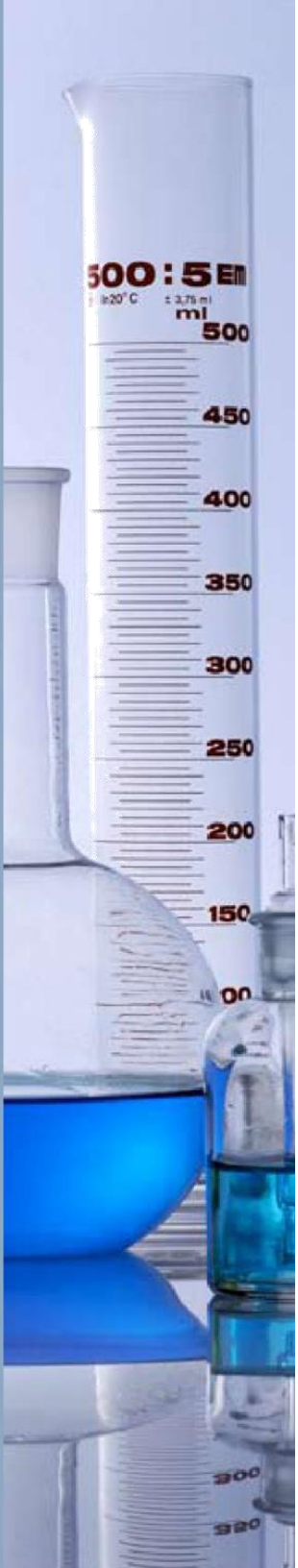
Effects on health. The main health effect due to exposure to pollen is allergy. The characteristic symptoms are: rhinitis, conjunctivitis, cough, dyspnea and asthma.

MAIN INDOOR POLLUTANTS AND ALLERGENS

b. Chemical substances

The main indoor chemical pollutants are:

- √ Carbon dioxide (CO_2)
- √ Carbon monoxide (CO)
- √ Nitrogen dioxide (NO_2)
- √ Sulfur dioxide (SO_2)
- √ Volatile Organic Compounds (VOC)
- √ Formaldehyde
- √ Benzene
- √ Polycyclic Aromatic Hydrocarbons (PAH)
- √ Ozone (O_3)
- √ Airborne particulate (PM - $PM_{2.5}$)
- √ Environmental tobacco smoke
- √ Asbestos



CARBON DIOXIDE (CO_2)

It is a colorless and odorless gas produced by the combustion of carbon, human metabolic processes and all combustion processes of carbon fuels (e.g. motor vehicles).

Sources. In school classrooms the largest source of CO_2 emissions is exhaled air. At concentrations higher than 1.5% (15,000 PPM) it causes concentration disturbances.

Effects on health. CO_2 has immediate acute toxic effects on the respiratory system: for exposure times of up to 15 minutes and with concentrations in the atmosphere that reach 5%, CO_2 causes vasoconstriction and increased respiratory activity; concentrations >10% cause respiratory paralysis and fainting; while concentrations >25% cause immediate death.

CARBON MONOXIDE (CO)

It is a product of incomplete oxidation of carbon in combustion processes. It is a colorless and odorless gas.

Sources. Worn down or poorly set combustion devices (e.g. boilers, ovens) or an improperly graduated, clogged, detached or even discharged exhaust pipe of motor vehicles from garages and/or roads and/or parking lots next to school buildings .

Effects on health. The toxicity of carbon monoxide is due to the increased affinity of binding to hemoglobin (forming carboxyhemoglobin (COHb) with respect to oxygen and the consequent reduction of oxygen transport in the blood. Low concentrations of carbon monoxide in the air cause fatigue and chest pain in heart patients, while exposure to moderate concentrations induce coordination problems, headaches, nausea and dizziness. Exposure to high concentrations can be fatal.

NITROGEN DIOXIDE (NO_2)

Nitrogen oxides are toxic gases and NO_2 is also a highly corrosive oxidizing agent.

Sources. The primary indoor sources are combustion processes (e.g. malfunctioning combustion devices such as gas stoves, welding and tobacco smoke). The primary outdoor sources are vehicles and several types of specific machinery for garden and lawn care.

Effects on health. Nitrogen dioxide is an irritating gas for mucous membranes of eyes, nose, throat and respiratory tract. A high dose of NO_2 exposure may cause pulmonary edema and widespread lung injury. Continuous exposure to elevated NO_2 levels may contribute to the development of acute or chronic bronchitis. NO_2 at low level of exposure may cause increased bronchial reactivity in some asthmatics, reduced pulmonary function in patients with chronic obstructive pulmonary disease, and increased risk of respiratory infections, especially in young children.

SULFUR DIOXIDE (SO_2)

Sulfur dioxide (SO_2) is a colorless, water-soluble, irritating, non-flammable gas that has a pungent odor. It derives from the oxidation of sulfur during the combustion processes of substances that contain this element both as impurity (for example fossil fuels) and as a fundamental constituent. As it is heavier than air, it tends to stratify in the lower areas.

Sources. The main natural sources are volcanoes, which contribute to increase environmental concentrations, while the anthropic sources, as for particulate, derive from the combustion of solid fuels (coal) or liquids (petroleum) used for domestic heating, motor vehicles or industrial applications (emissions from processing of plastics, desulfurization of natural gas, roasting of pyrites and incineration of waste).

In indoor environments, as for other combustion products, concentration depends on the presence of indoor sources that are linked to the use of stoves, ovens, gas and kerosene heating systems and tobacco smoke. The concentrations of SO_2 in indoor environments are usually much lower than those found in the air, both because the SO_2 is absorbed on the surfaces of drapery and furniture, and because it is neutralized by ammonia present in indoor environments resulting from the presence of people.

Effects on health. At low concentrations the damage from exposure to sulfur dioxide mainly concerns the respiratory system (chronic bronchitis, asthma and tracheitis) and the skin and mucous membranes.

Short exposure to high concentrations may cause tachypnea, tachycardia and irritation of the eyes, nose and throat.

VOLATILE ORGANIC COMPOUNDS (VOC)

The term “Volatile Organic Compounds” (VOC) refers to a set of substances in liquid or vapor form, with a boiling point ranging from a lower limit of 50-100°C to an upper limit of 240-260°C. The term “volatile” refers to the ability of these chemicals to evaporate easily at room temperature.

Indoor sources Cleaning products, paints and associated products, pesticides, insecticides and disinfectants, glues and adhesives, personal hygiene products and cosmetics, car care products; furniture and fabrics, building materials, printers and photocopiers and tobacco smoke. Outdoor sources: industrial and vehicle emissions.

Effects on health. Exposure to VOCs can cause acute effects, which may lead to irritation of the eyes, nose and throat, headache, nausea, dizziness and asthma depending on their concentration. Exposure to high concentrations, on the other hand, can cause chronic effects such as renal or hepatic failure, damage to the central nervous system, and cancer. Among the Volatile Organic Compounds (VOC), the most frequent cause of discomfort in internal environments is:

FORMALDEHYDE

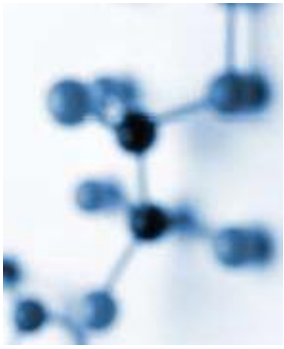
It is a colorless gas with a characteristic pungent and irritating odor that acts on the eyes and the respiratory tract.

Main sources. Upholstery, shavings, insulators, dyes, plastics, carpets, fabrics, detergents, preservatives, disinfectants and tobacco smoke.

Effects on health. As formaldehyde is extremely soluble in water, it easily causes irritation to the mucous membranes with which it comes into contact. They affect the nose, throat and respiratory tract, eyes and skin. Exposure can also have neurological consequences, manifesting with fatigue, distress, headaches, nausea, drowsiness or dizziness. Accidental ingestion is the main cause of acute intoxication.

High concentrations can also rapidly lead to death. Chronic intoxication was observed mostly by inhalation or contact. Formaldehyde is a carcinogenic compound.

BENZENE



Benzene is an aromatic hydrocarbon contained in products derived from coal and petroleum. At room temperature it has the appearance of a colorless liquid that evaporates extremely quickly in air; as all Volatile Organic Compounds (VOC), it is characterized by a pungent and sweet odor that can be perceived by most people when at a concentration of 1.5- 4.7 ppm. It is a highly flammable substance, but its hazard nature is mainly due to the fact that it is recognized as a human carcinogen.

Indoor sources. Tobacco smoke, incomplete domestic combustion of coal and oil and vapors released from products containing benzene, such as glues, paints, furniture waxes and detergents.

Outdoor sources: Exhaust gases of motor vehicles and industrial emissions come from the combustion of natural products.

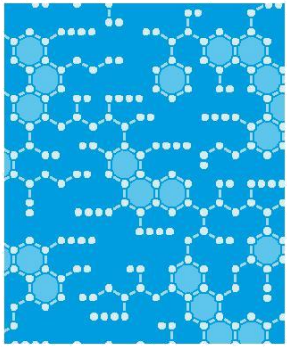
Effects on health. Exposure to benzene occurs essentially by inhalation and may also happen through cutaneous contact or ingestion.

Brief exposures at high concentrations (10,000-20,000 ppm) cause acute toxic effects and can lead to death. Lower concentrations (700-3,000 ppm) may cause dizziness, drowsiness, increased heart rate, tremors, confusion and loss of consciousness.

Exposure to minor but longer-lasting concentrations may cause memory disturbances and psychic alterations. Repeated exposure to benzene concentrations of some ppm for tens of years may cause cancer.

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)

Polycyclic Aromatic Hydrocarbons (PAH) are a wide range (about 500) of organic compounds with two or more condensed benzene rings. Due to their lower volatility they are not considered VOCs, except for some cases (naphthalene), and are instead classified as semi-volatile organic compounds (SVOC).



PAHs consisting of three to five rings may be present in the atmosphere as both gas and particulate, while those characterized by five or more rings tend to appear mostly in solid form. They are characterized by their low degree of solubility in water, high capacity to adhere to organic material and the good solubility in lipids and in many organic solvents.

Sources. The sources of PAHs are external; they derive mainly from the burning of fossil fuels and from industrial processes. Other temporary sources are forest fires and agricultural fields. The indoor sources are represented by wood ovens, fireplaces and tobacco smoke. Other indoor sources are the fumes of foods cooked over flames, smoked, etc.

Effects on health. The toxicological properties vary in function of the spatial arrangement and of the number of condensed rings. Benzo[a]pyrene (BaP) is the one most studied and information on toxicity and abundance of PAHs is often referred to this compound. These substances have a carcinogenic action.

OZONE (O_3)

Ozone is a pale blue, poisonous, unstable gas with a pungent odor. It is present in the upper layers of the atmosphere (stratosphere, situated at an altitude of 15-60 km), but also, in small quantities, in the air we breathe (troposphere). The ozone layer in the stratosphere has a protective effect from the ultraviolet radiation of the sun; the one in the troposphere, on the other hand, contributes to air pollution and is harmful to humans and the environment. Ozone in the lower atmosphere is formed due to reactions, in the presence of sunlight, nitrogen oxides and volatile organic substances, which is why they are known as “precursors” of the tropospheric ozone in the presence of solar radiation. It is easy to understand how ozone is a worrisome pollutant, especially during the summer in the Mediterranean region of Europe, where favorable conditions (strong insulation and poor ventilation) come together to form ozone.

Sources. Indoor sources of ozone are represented by equipment operating at high voltage or by ultraviolet rays, such as photocopiers, laser printers or ultraviolet lamps but also by some types of air purifiers.

In the absence of specific internal sources and in normal building ventilation conditions, the main source of indoor ozone is outdoor air.

Effects on health. Ozone exposure does not occur by ingestion or transdermal absorption because the chemical reactivity of ozone is so high that its half-life in solids or liquids is almost negligible. Exposure in humans is by inhalation. Nasal or oral absorption is overlapping and is about 30-40% of the inhaled amount. A total of 20% of the inhaled ozone is removed by the upper airways.

As O_3 is a powerful antioxidant, it reacts with numerous cellular components and biological materials at minimal concentrations and can cause variable reactions from individual to individual. The most frequent symptoms are coughing, throat irritation, deep inhalation pain, retrosternal pain, headache and nausea, and exposure is also a cause of increased bronchial hyperreactivity.

Short-term effects include: increased airway responsiveness, airway inflammation, reduced respiratory function, exacerbation of existing diseases such as asthma, increased respiratory hospitalizations and excess mortality. At low concentrations, sensitivity to ozone manifests through fatigue, headache and limitation of respiratory capacity; while at higher concentrations individuals experience coughing and irritation of the mucous membranes.

FINE PARTICLES ($PM_{2,5}$)

$PM_{2.5}$ is a component of diesel engine exhaust and it is less than 2.5 microns in diameter. They can consist of a small solid or liquid drop containing various types of residues.

Sources. The main source is vehicular traffic. During the winter months emissions from domestic heating systems also lend a significant contribution. Cooking of food, household cleaning products, housework and the presence of people causes the resuspension of coarse particles.

Effects on health. $PM_{2,5}$ is associated with a variety of serious effects on health, including lung diseases, asthma and other respiratory problems.

Children are particularly sensitive to atmospheric particulate pollution. Fine particles represent the greatest health risk because they can pass through the nose and throat and settle in the lungs. This results in an irritating effect on the respiratory tract (asthma, chronic bronchitis, reduction of pulmonary function, obstruction of the alveoli, etc.), cardiac disorders and potential alterations to the immune system, thus facilitating onset of chronic diseases such as increased sensitivity to allergens.

TOBACCO SMOKE

Exposure to environmental tobacco smoke (or passive smoking) refers to the inhalation of smoke exhaled by other people, produced during the combustion of tobacco products. It consists of a component known as “mainstream”, i.e. the smoke inhaled and exhaled by the smoker and the other known as “sidestream” emitted by the cigarette. Environmental tobacco smoke (ETS) is generated by the combustion of tobacco products. ETS is composed of side streams (SS) emitted by burning tobacco and smoke exhaled in the main streams by smokers (MS). Approximately half of the smoke generated by a smoked cigarette is SS and the other half MS.

ETS, SS and MS are a group of mixtures of more than 4,000 substances. These include more than 40 known or suspected elements of human carcinogenesis, such as 4-aminobiphenyl, 2-naphthylamine, benzene, nickel, and a variety of polycyclic aromatic hydrocarbons (PAHs) and N-nitrosamine. There are also a number of irritants, such as ammonia, nitric oxide, sulfide dioxide and various cardiovascular aldehydes and intoxicants, such as carbon monoxide, nicotine and various PAHs.

Sources. The only source of ETS is the burning of tobacco products.

Inhalation is the only true manner of exposure to ETS.

Effects on health. Active smoking is the main predictable cause of morbidity and mortality in Italy as in the entire Western world. Passive smoking has been classified by the EPA (U.S. Environmental Protection Agency) and IARC (International Agency for Research on Cancer) as one of the causes of cancer in non-smokers.

Non-carcinogenic effects. There is an association between ETS and chronic respiratory symptoms or chronic obstructive pulmonary diseases, including asthma. Smoking is responsible for a considerable number of childhood respiratory diseases, which encompass otitis, asthma and bronchial pneumonia.

Active smoking by pregnant women, or exposure to secondhand smoke, causes a significant reduction in birth weight and is associated with SIDS (Sudden Infant Death Syndrome), which is the sudden, unexpected and inexplicable death of infants between 1 month and 1 year of age usually during sleep.

Cardiovascular effects. A reduced oxygen transport capacity allows a reduced effort and ischemic tolerance, an increase in platelet activation, endothelial damage, alteration of lipoprotein levels and thickening of the arterial wall, which can cause atherosclerosis and, in the case of platelet activation, thrombosis. Ischemia, atherosclerosis and thrombosis increase the risk of myocardial infarction and other serious cardiovascular effects.

LEAD (PB)

Lead is a highly toxic metal.

Sources. Drinking water, food, soil, dust and air, lead based paint.

Toxicity. Lead can cause serious damage to the brain, kidneys, nervous system and red blood cells. Children are particularly vulnerable. Lead exposure in children can result in delays in physical development, low levels of IQ, decreased attention span and increased behavioral problems.

Asbestos

“Asbestos” is a generic term that contains a group of silicates (minerals containing silicon) in a fibrous form, resistant to heat, humidity and chemical agents. The main minerals can be divided into two groups according to the

Crystalline structure: amphibole fibers (linear in shape that penetrate to the pulmonary alveoli); serpentine fibers (sheet or layered structure and are more easily intercepted by the bronchi and bronchioles).

Main sources. Asbestos has been widely used in the building industry (slabs or panels, for pipes, for tanks and flues, coating of metal structures and beams, plasters, panels for false ceilings, floors made of vinyl-asbestos) in the industry (raw material for many products and objects, thermal insulation in industrial cycles at high and low temperatures, sound-absorbing material) in household products (hair dryers, ovens and stoves, irons, oven gloves, ironing cloths, flame-friction elements, cartons places to protect heating systems, furnace doors, in blackout and fireproof curtains) and in means of transport (insulation of trains, ships and buses, brakes and clutches, flame arrester screens, gaskets).

Effects on health. The health effects due to asbestos are linked to its fibrous nature: the fibrous particles that are released are so thin that, when inhaled, they can reach the pulmonary alveoli; moreover, they can also remain suspended in the air for a long time. Exposure to asbestos fibers is associated with respiratory diseases (asbestosis, lung carcinoma) and serous membranes, mainly the pleura and the peritoneum (mesotheliomas). The diseases show signs numerous years after exposure: from 10 to 15 for asbestosis and even 20-40 for lung cancer and mesothelioma. According to the classification of the IARC (International Agency for Research on Cancer), asbestos is considered a carcinogen.

MAIN INDOOR POLLUTANTS AND ALLERGENS

c. Physical agents

The physical agents responsible for poor indoor air quality are:

- √ Radon
- √ Electromagnetic fields (EMF)
- √ Noise

RADON

Radon is a radioactive gas, belonging to the family of so-called noble or inert gases, colorless, extremely volatile produced by the decay of three parent nuclides which give rise to three different radioactive families; they are Thorium 232, Uranium 235 and Uranium 238. It is colorless, odorless and tasteless. It is produced by “nuclear decay” of radium which in turn originates from uranium.

Sources. Radon is an inert gas, therefore it does not react chemically with the surrounding environment. Radon is continuously generated by several types of rocks of the earth's crust and in particular by lava, tuff, pozzolan, several types of granites, etc.

Effects on health. Radon is a carcinogen. The World Health Organization (WHO), through the International Agency for Research on Cancer (IARC), has classified radon in Group 1 since 1988. The main health effect is lung cancer.

ELECTROMAGNETIC FIELDS

The term electrosmog was coined in 1980 and includes all the magnetic and electromagnetic electric fields that public opinion believes can have biological effects.

Sources:

extremely low frequency fields (ELF), (from> 0 to 300 Hz): all devices used in the generation, distribution and use of electrical energy such as computers and home appliances (usually 50 or 60 Hz);

intermediate frequency (IF) fields, (from> 300 Hz to 10 MHz): safety and alarm devices, induction heaters and video display units;

radiofrequency and microwave fields, (from> 10 MHz to 300 GHz): mobile phones and telecommunications transmitters, radars and diathermic units and medical use and microwave ovens.

Effects on health. The effects of low-frequency electric or magnetic fields and of high-frequency electromagnetic fields are different. High intensity and low frequency electric fields cause tingling of the skin, while those having high frequency penetrate into the

body stimulating muscle and nerve cells. Depending on their frequency, high-frequency electromagnetic fields can penetrate the body at different depths. Radiation absorption causes a thermal effect.

NOISE

Noise is now considered an important environmental problem, especially due to its harmful effects on health.

Sources. The main sources of environmental noise are road traffic (motorways, urban roads, trucks, motorcycles), rail traffic (railways, metro, trams), air traffic (civil, military) and industry.

Effects on health

√ Auditory effects: continuous exposure to noise at levels between 85-90 dB (A), particularly in the industrial field, can lead to progressive hearing loss, with increased hearing threshold. Hearing loss due to noise is a direct consequence of the effects of sound energy on the inner ear.

√ Non-auditory effects: disturbance of sleep and rest, interference with verbal communication, psychophysiological effects, effects on mental health, performance and learning, disturbance or general annoyance, this last being defined as a feeling of discontent related to noise that the individual knows or believes is able to have a negative effect on him or her. “Cosa & Vicoli 1998”.

CHAPTER 2

LIVING WITH ASTHMA SEVERAL HELPFUL TIPS

a. At school

b. Playing sports

a. AT SCHOOL

Inform teachers and non-teaching staff in advance of the possible risks that a child with asthma faces, along with the potential seriousness of any related asthma crisis; this should best be done by submitting a certificate issued by a pediatrician that specifies the therapies and instructions to follow in the event of an attack, also including any foods and drugs to which the child is allergic.

- √ The child must always carry the necessary medicines on normal school days or on trips.
- √ The school canteen must be duly alerted to particular diets and therefore to ingredients to avoid when preparing meals.
- √ Constant and thorough cleaning, also using detergents and sanitary agents, of the school premises is strongly advised, in particular to prevent the proliferation of mites and molds.
- √ The physical education instructor should support the child's participation in the activities (better if not outdoors) making sure that the child carries and preventively takes any necessary medication, paying attention to the possible onset of symptoms during the lesson such as to impose immediate suspension.

B. PLAYING SPORTS

The preschool child experiences physical activity spontaneously, putting emphasis on the more playful aspect.
During the schooling age this activity tends to organize itself progressively until acquiring a more competitive nature that can, in some cases, lead to all out competition. It is therefore essential to ensure that this motor requirement is a contribution to the harmonious physical and mental development of the child.
The task of the parent/educator takes on a particularly delicate role when faced with children affected by respiratory illnesses, asthma in particular.

In this case it is essential to contact the pediatrician to correctly manage the problem that can heavily influence the physical activity of the child.

Physical exercise, in fact, is often a cause of asthma attacks in people with asthma, especially in children and adolescents, and is a condition that limits the habits of life.

The fear of asthma attacks induced by exercise leads parents towards overprotective behavior, triggering a vicious circle that affects the disease itself. This in turn fosters a sedentary lifestyle with problems of obesity and the progressive isolation of the child.

On the other hand, the bronchial asthma, properly treated, does not represent a big limit to physical exercise. The pediatrician will know how to provide therapy and the most appropriate indications.

In any case, certain general precautions and general rules must be taken into account.

- √ Consult a pediatrician to evaluate the possibility of carrying out physical activity and the relative manners (type of exercises, duration and precautions).
- √ The educator must be informed of the pathology of the child, the indications of the pediatrician regarding physical activity, the necessary precautions and the methods of intervention in case of attack.
- √ Avoid physical activity in environments where there is a strong allergenic load, such as in gyms with carpets, or, for the subject sensitive to pollens, in the countryside during the flowering period of the plants.
- √ Avoid the activity in environments with high pollution levels (in the midst of traffic in the city) and in severe climatic conditions: favor a warm and humid environment.
- √ Not all sports are the same: the characteristics for which an activity can more likely cause an asthmatic attack are:
    - √ *aerobic activity;*
    - √ *a continuous sub-maximal intensity;*
    - √ *a duration of more than 6-8 minutes.*

The best-tolerated and therefore preferable sports are:

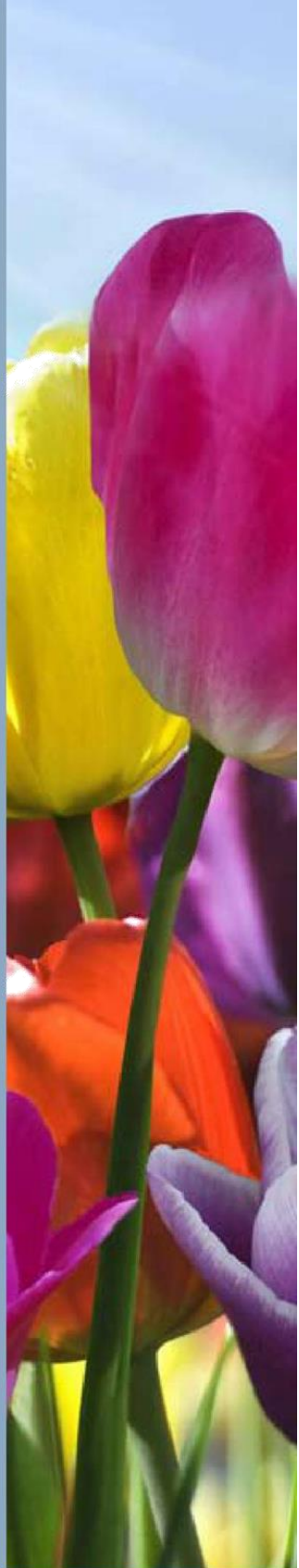
- √ *those that do not involve hyperventilation and oral respiration with a lack of "nasal conditioning";*
- √ *power and dexterity sports that involve short-term efforts and with little increase in respiratory rate;*
- √ *in any case, the principle at stake is that a child who exhibits exercise-induced asthma is a child with poorly controlled asthma and, therefore, the family and the attending physician should be advised in order to change or supplement the treatment.*

The increase in respiratory rate (hyperventilation), moreover, necessarily involves breathing through the mouth: particular attention should be paid to maintaining the optimal function of the nose and paranasal sinuses.

- √ Always warm up: a period of warming up, even if not particularly intense (at least 10 minutes) before playing sports can avoid the onset of exercise-induced asthma.
- √ The interruption of physical activity must take place gradually.
- √ Train with submaximal workloads to increase maximum endurance capacity, raise the anaerobic threshold, and re-dimension the ventilation level for a given effort.
- √ Use the nose as "conditioner": breathing through the nose, aimed at filtering, heating and humidifying the air, is essential to prevent exercise-induced asthma attacks.
- √ Suspend physical activity in case of respiratory infections (e.g. cold, flu) and evaluate when to resume exercise with the pediatrician.
- √ Pay attention to the obesity factor which is a negative factor. The overweight asthmatic child exhibits easy "fatigue" for a lower level of physical effort.

CHAPTER 3

IMPROVING AIR QUALITY WITH PLANTS



USE OF MANGIAVELENI PLANTS

NASA scientists, in the course of studies on air and wastewater recycling, sought to find an answer to how Earth produced and kept air clean: through the biological processes of plants.

Starting from this basic knowledge, experts began to study closed ecological structures in order to support vital functions. They discovered that houseplants were able to purify and renew the air inside sealed rooms.

Indoor plants can therefore become an integral and indispensable component of the ecologically healthy building. The cultivation of plants inside and outside buildings can be the most effective cure for improving the psychological and physical well-being of people. Not only do they have a decorative function but they also make the environment comfortable and seem to exert a calming effect. The presence of some houseplants, we have seen, also reduces indoor pollution.

In 1980 the John C. Stennis space center of NASA discovered that houseplants were able to eliminate the chemicals from the atmosphere of airtight experimentation chambers. At the time, the Associated Landscape Contractors of America (ALCA - a US association of nurseries and floriculturists) together with NASA funded a two-year study to evaluate the efficacy of 12 species of common houseplants in removing formaldehyde, benzene and trichlorethylene from the atmosphere of isolated environments. The studies were aimed at finding possible solutions for the elimination of these substances, in anticipation of human crews serving lengthy missions in permanent space stations.

Plants add color to the apartment, give off a good scent and also have beneficial effects on health. “Studies conducted on fifty of the main houseplants, to test the ability to absorb the pollutants present in closed environments”, he explains, ”have revealed that some are able to eliminate substances that are toxic for the body, such as formaldehyde, xylene or benzene, contained in building materials and furnishings.

The most effective", continues the Ibimet-Cnr researcher, "are the dracena, philodendron, spatifillo and gerbera, which absorb more than 80% of indoor pollutants. Aloe, cyclamen, begonia and the "Christmas star" are also quite active."

To further deepen these studies, NASA created the "bioHome", a prototype of a hermetically insulated dwelling and built with synthetic materials that actually provided symptoms of intolerance (burning eyes and throat and breathing problems) to people who entered it. The researchers took some samples of air both before and after introducing houseplants. Air analyzes carried out after several days showed an effective reduction of harmful volatile substances. People who entered the experimental home after the plants remained no longer experienced the same unpleasant symptoms. Plants can thus become a rather effective component in the air purification process of closed environments.

The extraordinary capacity of these plants can be advantageously exploited even in our homes, where there are so many sources of pollution that poison domestic air: chipboard furniture, glues and stain removers.

In the past, houseplants were sought only for their beauty and for their therapeutic value from a psychological point of view; today their property of improving the quality of the air we breathe has in fact been scientifically proven.

Formaldehyde is the most common toxin in indoor air, the property of eliminating this substance has been used as a reference standard to assign an evaluation to the specimens studied. The table below shows the formaldehyde removal rates of 50 plant species studied by Wolverton.

Plant	µg/h	Plant	µg/h
Boston Fern *(Nephrolepis exaltata)*	■■■■■■■■■■■■■■■■■■■■	Aglaomena	■■■■■■■
Chrysanthemum	■■■■■■■■■■■■■■■	Spider plant *Chlorophytum*	■■■■■■■
Gerbera daisy	■■■■■■■■■■■■■■■	Dwarf Banana *(Musa cavendishii)*	■■■■■■■
Dwarf Date Palm *(Phoenix roebelenii)*	■■■■■■■■■■■■■■■	Philodendron Emerald *(Philodendron 'Emerald Queen)*	■■■■■■
Dracena Janet Craig *(Dracaena deremensis "Janet Craig")*	■■■■■■■■■■■■■■■	Dieffenbachia Camilla	■■■■■
Bamboo Palm *(Chamaedorea seifritzii)*	■■■■■■■■■■■■■■■	Elephant Ear Philodendron	■■■■■
Kimberly Queen Fern *(Nephrolepis obliterata)*	■■■■■■■■■■■■■■■	Pothus Aureu	■■■■■
Ficus	■■■■■■■■■■■■	Pino Norfolk *(Araucaria heterophylla)*	■■■■■
Ivy	■■■■■■■■■■■■	Begonia	■■■■■
Ficus Beniamino *(Ficus benjamin)*	■■■■■■■■■■	Maranta	■■■■
Spathiphyllum	■■■■■■■■■■	Cissus	■■■■
Areca Palmata *Chrysalidocarpus lutescens*	■■■■■■■■■■	Epiphillum	■■■■
Dracena "Massagena" *(Dracaena massagena)*	■■■■■■■■■■	Filodendrum selloum	■■■■
Rhapis Excelsa	■■■■■■■■■	Singonio *(Syngonium)*	■■■■
Schefflera	■■■■■■■■■	Green Pathos	■■■■
Dracaena Marginata *(Dracaena marginata)*	■■■■■■■■	Anthurium *(Anthurium)*	■■■■
Dracena Warnekei	■■■■■■■■	Peacock plant *(Calathea)*	■■■■
Liriope	■■■■■■■■	Poinsettia *(Euphorbia pulcherrima)*	■■■■
Dendrobium	■■■■■■■■	*Cyclamen*	■■■■
Dieffenbachia	■■■■■■■■	Phalenopis	■■■
Tulip	■■■■■■■	Aechmea	■■■
Ficus Alii	■■■■■■■	Croton	■■■
Homalomena	■■■■■■■	Sanseveria	■■
Camadorea *(Chamadorea)*	■■■■■■■	Aloe vera *(Aloe barbadensis Miller)*	■■
Azalea	■■■■■■	Kalanchoe	■■

The Xylene and toluene tests were jointly conducted as these substances have similar chemical properties.

Xylene and Toluene removal rate		Ammonia removal rate	
Plant	µg/h	Plant	µg/h
Areca Palmata *Chrysalidocarpus lutescens*	■■■■■■■■■■■■■■■■■■■■	Rhapis Excelsa	■■■■■■■■■■■■■■■■■■■■
Dwarf Date Palm *(Phoenix roebelenii)*	■■■■■■■■■■■■■■■■■■	Homalomena	■■■■■■■■■■■■■
Phalenopis	■■■■■■■■■■■■■■■■	Liriope	■■■■■■■■■■■
Dieffenbachia Camilla	■■■■■■■■■■	Anthurium *(Anthurium)*	■■■■■■■■■■
Dracaena Marginata *(Dracaena marginata)*	■■■■■■■■■■	Chrysanthemum *(Chrysanthemum)*	■■■■■■■■■
Dendrobium	■■■■■■■■■■	Peacock plant *(Calathea)*	■■■■■■■■
Dieffenbachia	■■■■■■■■■■	Dendrobium	■■■■■■■■
Philodendron Emerald *(Philodendron 'Emerald Queen)*	■■■■■■■■■■	Tulip	■■■■■■■
Kimberly Queen Fern *(Nephrolepis obliterata)*	■■■■■■■■■■	Camadorea *(Chamadorea)*	■■■■■■
Dracena Warnekei	■■■■■■■■■	Singonio *(Syngonium)*	■■■■■
Anthurium	■■■■■■■■	Ficus Beniamino *(Ficus benjamin)*	■■■■
Dracena "Massagena" *(Dracaena massagena)*	■■■■■■■■	Peace Lilly *(Spathiphyllum)*	■■■■
Ficus Beniamino *(Ficus benjamin)*	■■■■■■■■	Dracena "Massagena" *(Dracaena massagena)*	■■■
Peace Lilly *Spathiphyllum*	■■■■■■■■	Azalea	■■■

House plants are able to increase the ability to remove toxins from the atmosphere of isolated environments after 24 hours of exposure. Plant species play an essential role in air purification, transporting toxins to the radical microbes of the rhizosphere that demolish them. The environmental adaptability of microbes, and therefore their specialization in this particular function, is the reason why indoor plants fight atmospheric pollution effectively and are able to improve their presentation over time.

Plants are not only able to remove bio-effluents (ethanol, acetone methanol, acetic ether) emitted by man during the breathing process, but also release phytochemicals that suppress mold spores and environmental bacteria. The latest research shows that plant-rich rooms contain 50-60% less spores and bacteria than plant-free rooms, plants actually release harmful components to protect themselves from attacks by harmful micro-organisms carried by air currents.

Most ornamental plants belong to species native to tropical rainforests. Their habitat is warm and moist with scarce illumination. Their roots and surrounding soil host colonies of microbes able to decompose the complex organic structures present in the dead leaves. The foliage is able to absorb gaseous organic substances that are assimilated and transported to the roots as nourishment for microbes. Transpiration is yet another tool used by the plant to convey atmospheric pollutants to the colonies of rhizosphere microbes. Transpiration creates convection currents that cause air movements, so the water is transferred to the roots and the air is pushed towards the ground in the rhizosphere. The plant in this way provides oxygen and nitrogen to the microbes of the roots, the latter instead convert nitrogen into nitrate, which is nourishment for the plant. Starting with the introduction of plants in the individual breathing area (area sized 0.17-0.23 cubic meters surrounding the person) up to the biotechnological progress represented by the filter container system, plants are helping to win man’s battle for a healthy and clean environment, especially indoors.

These researches show that plants are effective for improving indoor air quality and are no longer only a form of luxury, but an essential factor for human health and are real living air purifiers.

Some houseplants are able to metabolize the harmful substances that contribute to creating indoor pollution. They are often called air purifying plants. The most advisable solution is to place medium-large plants for every 9 square meters of area of the room.

The most useful species are: gerberas, chrysanthemums, chlorophytes, smoke-eating plants, sanseveria, philodendrons, pothos, trunks of happiness, in particular schefflera is an excellent detector of unhealthy air as it gives immediate signs of suffering in the presence of pollutants. The philodendron instead tolerates many types of gas, also surviving in unhealthy working environments.

Plants should not be placed in bedrooms, they require light for photosynthesis and instead absorb oxygen when in the dark.

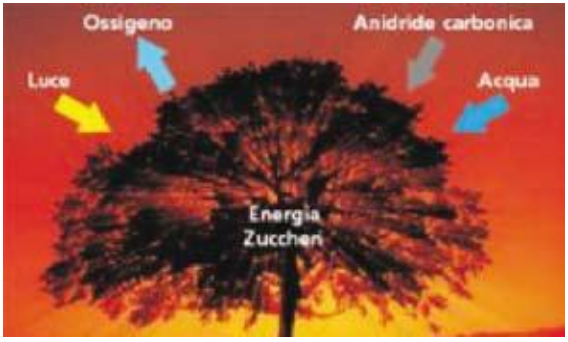
CHAPTER 4

IMPROVING AIR QUALITY USING THE RIGHT PAINTS: PHOTOCATALYTIC PAINTS

IMPROVING INDOOR AIR QUALITY USING THE RIGHT PAINTS: PHOTOCATALYTIC PAINTS

Photocatalysis is the natural phenomenon in which a substance, called photocatalyst, changes the speed of a chemical reaction through the action of light (either natural or produced by special lamps). A strong oxidative process is activated in the presence of air and light, which leads to the decomposition of the organic and inorganic polluting substances that come into contact with these surfaces.

The Dream City
Source:
www.infinitytio2.com/
fotocatalisi.php

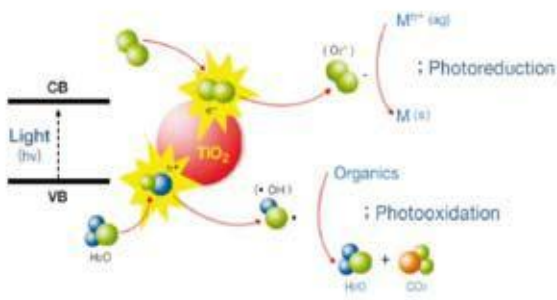


Source:
www.bettinelliluciano.it/
materiali/pitturefotocatalitiche.htm

How it works. If we try to go into details, let's find out how its operation mimics a natural phenomenon: chlorophyll photosynthesis (transforms substances considered harmful to humans into inert substances). The chemical process at its base is in fact an oxidation that starts thanks to the combined action of light (solar or artificial) and air.

The two elements (light and air), in contact with the surface coating, favor the activation of the reaction and the consequent decomposition of organic and inorganic substances (similar to all fine particulate - PM_{10}), microbes, oxides of nitrogen, polycondensate aromatics, benzene, sulfur dioxide, carbon monoxide, formaldehyde, acetaldehyde, methanol, ethanol, benzene, ethylbenzene, mexylene, monoxide and nitrogen dioxide.

The polluting and toxic substances, as shown in the figure below, are transformed, through the process of photocatalysis, into sodium nitrate ($NaNO_3$), sodium carbonates (Na_2CO_3) and limestone ($CaCO_3$), harmless and measurable in PPB (parts for billion). The result is a significant reduction in toxic pollutants from cars, factories, domestic heating and other sources.

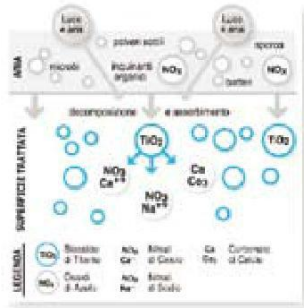


Source:
www.infinitytio2.com/
fotocatalisi.php

In other words, photocatalysis is an accelerator of the oxidation processes that already exist in nature and favors faster decomposition of the pollutants in the environment avoiding their accumulation.
The process is effective against nitrogen oxides, aromatic polycondensates, sulfur dioxide, fine particulate matter, carbon monoxide, formaldehyde, acetaldehyde, methanol, ethanol, benzene, ethylbenzene, toluene, xylene, organic and inorganic substances.

It also works against microbes and bacteria. All these substances, through the photo-oxidation reaction, are transformed into common inorganic salts (sodium nitrates - $NaNO_3$, sodium carbonates - Na_2CO_3, limestone $CaCO_3$).

Photocatalysts do not lose their properties over time, since they act only as process activators; they do not bind to pollutants and remain available for new photocatalysis cycles. Three minutes of light radiation is enough to reduce pollutants by 75%. Photocatalysts are effective for both outdoor and indoor pollution. Correct activation of the photocatalytic surfaces requires the installation of an adequate lighting system that allows the emission of light in wavelengths between 380 and 400 nm (Ultraviolet).



Photocatalytic process for transformation of pollutants. Source: http://www.bettinelliluciano.it/materiali/pitturefotocatalitiche.htm

TiO_2 can attack and decompose organic compounds and polluting gases. Source: http://www.rinnovabili.it/presidio-antismog-nelle-nostre-citta-500311

Among the most used photocatalytic materials, Titanium Dioxide (TiO_2) has the very peculiar characteristics that makes it extremely suitable for the preparation of cement mortars that can be applied immediately as a wall coating or decoration or as a substance to be applied on previously available surfaces.

The eco-coating associated with light sources allows the use of this technique even in closed environments and is an instrument

able to provide an important contribution in solving the indoor air pollution problem, in a simple and direct manner and without any particular technological intervention.

REAL AND IMMEDIATE BENEFITS

The advantage of using photocatalysis involves the occurrence of three realities:

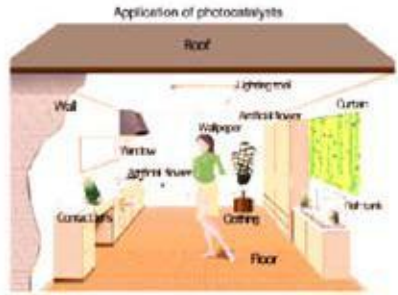
- √ Anti-pollutant
- √ Anti-soiling
- √ Anti-bacterial

These properties, which we have deliberately explained in practical terms, are the simple result of the oxidation of substances that come into contact with a photocatalytic surface. It is possible to speak of an anti-pollution reaction in the case of polluting substances (Nitrogen dioxide, Sulfur dioxide, Carbon monoxide, fine particulate matter), these are known as anti-soiling reaction if they are soiling substances (soot, dyes) and antibacterial reactions if they are bacteria, molds, fungi and microorganisms.

Photocatalysis provides an exceptional opportunity for the development of practical applications that may be used for everyday applications. From the first timid Japanese applications of photocatalytic self-locking tile flooring, today we have come to expect an extremely long series of products that use the concept of photocatalysis to improve the environment in which we live, while also being compatible with the needs and style of the modern world. The list goes from the photocatalytic glasses, coated with transparent Titanium Dioxide films that make the glass brilliant without glare, and purify water inside the containers of those materials that eliminate odors in the air and which reduce the production of indoor pollutants, also decomposing grime that accumulates on lights giving them full illuminating potential. The list includes photocatalytic plants, obviously fake, but with additives of titanium dioxide for the reduction of indoor pollution and paper deodorizing filters containing TiO_2 that are four times more active than conventional filters containing activated carbon, developed by K.G. Pack. Products also include photochemical chambers to kill bacteria and dirt-resistant

and anti-fog polyester film. The line of products also includes protective paints for car bodywork, self-cleaning fabrics, tiles or ceramics in general photocatalytic or water treatment by using photocatalytic filters and active surfaces.

As can be seen from the image below, there are several products that could potentially be included in daily use and which would significantly improve the air we breathe.



Source:
La Fotocatalisi al servizo dell'ambiente.
(Photocatalysis at the service of the environment).
Global Engineering and Trade

PHOTOCATALYTIC ECO-PAINT

Water-based paints are the simplest and at the same time the most effective method for introducing photocatalysis in the context of eco-architecture, i.e. architecture that uses products that can react actively to the environment.

Today, there are potassium silicate and siloxane based washable paints, each one indicated by type of surface both outdoor and indoor, with multiple colors, as long as they are light (maximum photocatalysis effectiveness of the surfaces is ensured when they are light). Their applications, like their physical characteristics, follow those of commonly used paints, therefore with a guaranteed yield, a degree of elasticity and breathability, but also with the photocatalytic properties. As well as water paints, even photocatalytic plasters have the characteristics typical of traditional plasters, but with an extra plus.

They are all really able to reduce the pollution present in a house, maintaining color over time outside or inside a building, or on the vault of a gallery, and generating antibacterial processes that result in an important reduction of odors and molds that proliferate in the environment.

To date, several applications have already been carried out with such paints for the coating of railway stations, the exterior or interior surfaces of residential complexes, offices, public venues such as restaurants or gyms, and not least, in hospitals.

We can therefore conclude by saying that the main benefits expected from the use of photocatalytic materials are:

1. air purification - transformation of polluting substances into harmless residues;
2. aesthetics of buildings - reduction of pollution soiling (reduction of nitrogen oxides and benzene, decomposition of greases, dust, rain and other agents that soil buildings);
3. deodorizing action - decomposition of organic toxic gases that are perceived by their odor;
4. antimicrobial action - breaking down of bacteria and fungi.

LONG LIFE

An interesting aspect is that photocatalysts do not lose their functional properties over time, since they act only by activating process agents; they are always available for new photocatalysis cycles as they do not bind with pollutants.

MECHANISM OF POLLUTANT DEGRADATION BY ECO-COATING

The surface reactions involve hydroxyl radicals and other reactive particles which result in the formation of molecular fragments (type R) which in turn are transformed or transformable into inert compounds. The degradation of Nitrogen Dioxide forms nitrates soluble in water with possible formation of low amounts of nitrites. Calcium nitrate molecules, resulting from the photo-oxidation reaction, remain in the eco-coating as inert substances.

Formaldehyde is degraded into carbon monoxide or carbon dioxide. Any oxidation of formaldehyde leads to the formation of carbon dioxide and traces of formic acid that is absorbed by the alkaline substrate of the eco-coating.

Sulfur dioxide is oxidized to sulfuric acid, which is absorbed by the alkaline substrate of the eco-coating. The result is the formation of calcium sulfate, weakly soluble in water. Calcium sulfate (plaster) is not a problem for the environment. Oxidation of carbon monoxide leads to the formation of carbon dioxide, an inert substance.

CO can also be oxidized by OH radicals forming hydrogen radicals (H), these react quickly with oxygen forming hydroperoxide radicals ($H+O_2 \rightarrow H_2O$), this radical has stronger antioxidant properties than OH, so carbon monoxide could amplify the oxidizing properties of eco-coating. Regarding ozone, eco-coating could affect its formation or destruction. The likelihood of its formation is rather remote. Ozone derives from the photolysis of nitrogen dioxide, whose molecules react quickly with the OH radicals present on the surface of the eco-coating, so that the rate of ozone formation is less than or equal to the amount contained in the atmosphere. Eco-coating is more likely to contribute to the destruction of ozone on the surface. The availability of electric charges and free radicals causes reactions that lead to ozone degradation with probable oxygen formation.

The degradation of benzene on photocatalytic surfaces proceeds at very low speeds. The oxidized molecules can be transformed into simpler compounds such as aldehydes or bivalent acids that do not pose any problem for the environment. Benzene could also bond to OH radicals and turn into phenol, a soluble substance in water and of little environmental interest due to its low concentrations.

The reaction of particulate matter one co-coating still remains unknown. The particles, attracted by the surface due to the presence of free charges, could potentially react with free radicals or with molecules of water and oxygen, degrading to water-soluble oxygenated organic substances. The inorganic component should not undergo any alterations.

CHAPTER 5

PREVENTION AND MANAGEMENT FOR INDOOR SCHOOL ENVIRONMENTS:

MAIN LEGISLATIVE MEASURES IN ITALY

PREVENTION AND MANAGEMENT FOR INDOOR SCHOOL ENVIRONMENTS: MAIN LEGISLATIVE MEASURES IN ITALY

Italy does not have specific legislation on the quality of the environment and on health care in schools, even though there have been signs of change over the last few years.

As far as housing is concerned, Municipalities can set specific rules in the "Hygiene and Health Regulations" according to the general instructions issued by the Italian Ministry of Health.

As regards the air quality of workplace air, the norms indicated by the Legislative Decree 81/08 "Implementation of Article 1 of the Law of August 3, 2007, n. 123, concerning the protection of health and safety in the workplace", which identifies employers as the figures responsible for safety.

The school structures are considered "work environments" and as such the "employers" are the school leaders, identified by the Decree of the Ministry for Education dated June 21, 1996, n. 292, they are therefore responsible for the "management" of security and health measures.

The Local Authorities (Municipalities and Provinces), are responsible for the provision of rooms for schooling and must fulfill the obligations of ordinary or extraordinary maintenance aimed at achieving and maintaining "compliance" of buildings, as regulated by the Law of 11 January 1996, n. 23.

As can be easily understood, this division of competences and responsibilities can generate consistent problems regarding opportunity for intervention by school leaders for the "management" of "continuous compliance" and the adaptation of the schooling structures assigned to them.

This situation was made even more clear following the issue of the report drafted by the Ministry of Education of University and Research. It published its findings in Circular no. 85 of 8 May 2001 “Monitoraggio sulla sicurezza nelle scuole” (Monitoring of safety in schools), February 2002 (carried out through the administration of questionnaires to the School Executives), and contained in the dossier entitled “la cultura della sicurezza nella scuola, il punto sullo stato di applicazione della legge 626/94” (The culture of safety in schools, the state of application of the law 626/94).

The survey received a significant response by 98% of autonomous educational institutions on all levels (10,800 educational institutions located in 41,000 buildings, attended daily by roughly 8,000,000 pupils/students and 1,000,000 operators). It highlighted how the vast number of Italian school buildings did not enjoy good health. This situation still persists today as clearly shown by the findings of the survey carried out in recent years by civic organizations to protect citizens and by recent news stories that testify how many schools fail to meet ideal hygienic and environmental conditions and often are burdened by serious structural problems.

With the aim of indicating the tools to reduce the concentration of indoor pollutants and therefore mitigate their harmful effects, in 1998 with Ministerial Decree 08/04/1998 a technical-scientific Commission was set up at the Ministry of Health, which drafted the “Linee Guida per la tutela e la promozione della salute negli ambienti confinati” (Guidelines for the protection and promotion of health in indoor environments) published in the OJ of 27 November 2001, n. 252; within this Commission, an “Allergy” Working Group has been set up that has formulated criteria for the control of indoor air quality in relation to allergological risk in domestic and public environments and has developed a proposal for a specific program for schools.

The 2006-2008 Health Plan should be underlined, in line with the European SCALE (Science Children Awareness Legislation Evaluation) strategy on environment and health, which opened a path oriented towards the prevention of chronic diseases, with particular attention to children, as more vulnerable than adults to environmental exposures.

The plan proposes as priorities, interventions to improve indoor air quality, particularly in schools where children spend 4 to 8 hours a day for at least 10 years.

With the aim of encouraging the implementation of the 2006-2008 Health Plan, the Ministry of Health produced in 2008, an update of the "Guidelines for the implementation in schools of an indoor risk factor prevention program for allergies and asthma", currently under the attention of the State-Regions Conference.

Proper implementation of this document into the regional plans and regulations would be an excellent contribution for the planning, financing and implementation of actions aimed at promoting healthy air quality and compliance of Italian school buildings with the current laws in force.

In Italy there are still, however, very few national provisions in regard to health care in schools.

The number of children affected by allergies is rather high, which should signal the need to implement adequate health care in school buildings, obviously also capable of coping with other "health problems".

In fact, environmental prevention alone is not sufficient to ensure the protection of people suffering from allergic and respiratory diseases. Furthermore, the administration of medication during school hours is an extremely difficult problem in Italy to overcome as there is currently no law that calls for the presence, during school hours, of personnel qualified to administer said medication as in other countries of Europe and the United States. In Italy, this activity is permitted only to professionally qualified personnel.

Also, the Legislative Decree 9 April 2008, n. 81 (ex Legislative Decree 626/94) "Implementation of Article 1 of the Law of 3 August 2007, n. 123, concerning the protection of health and safety in the workplace "published in the Official Gazette no. 101 of 30 April 2008 - Ordinary Supplement n. 108, which defines the criteria for the protection of health and safety in the workplace does not help in solving this problem.

Our legislation, equating schools to companies (workplaces), is regulated by the provisions of Legislative Decree 81/08 (previously Legislative Decree 626/94) above, whose application is regulated by Decree D.Lgs.388/2003 “regulation containing provisions on the company's emergency department, in compliance with art. 15 paragraph 3 of Legislative Decree 626/94 “published in the Official Journal no. 27 of 3 February 2004 and does not grant personnel involved in first aid the right and power to administer medication. The decree provides:

- first aid to be implemented pending the arrival of the emergency/ first aid units (118);
- minimum requirements of first aid equipment;
- requirements of personnel involved and training.

The regulation classifies companies into three groups, taking into account the type of activity carried out, the number of workers employed and the risk factors:

- Group A: companies at significant risk (for example thermoelectric plants), companies with more than five workers belonging to or linked to INAIL (National Insurance Institute for Accidents at Work) tariff groups with a permanent disability index of over four and companies or production units with over five permanent workers in the agricultural sector;
- Group B: companies with three or more workers who do not belong to Group A;
- Group C: companies with less than three workers who do not belong to Group A.

Starting from 3 August 2004, the date of entry into force of the regulation, in the companies or production units of Group A and Group B, the employer must guarantee a first aid kit containing the base equipment required (indicated in annex 1 of the Decree). The organization of first aid and training of employees vary according to the category they belong to. First-aid staff must receive theoretical and practical training for the implementation of internal first-aid measures and for the execution of first aid interventions.

Schools are included in Group B companies, in accordance with the accident index of reference of INAIL, and as such they must ensure: first aid kits, a means of communication suitable to quickly activate the emergency system of the NHS and the appointment of adequately trained employees.

The regulation provides the following base criteria for training:

- course of 3 modules of 4 hours each = total 12 hours (of which 8 theoretical and 4 practices);
- the 4 hours practice module repeated every 3 years;
- training carried out will remain valid until entry into force case valid;
- individuals who have received training prior to February 2002 must at least take the 4-hour modules (practice).

As health care is addressed by the NHS, in case of need the schools' task is merely limited to implementing the first aid measures as in the training courses for class B companies, without administering drugs and calling the emergency/first aid services (118 in Italy).