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ENVIS NEWSLETTER

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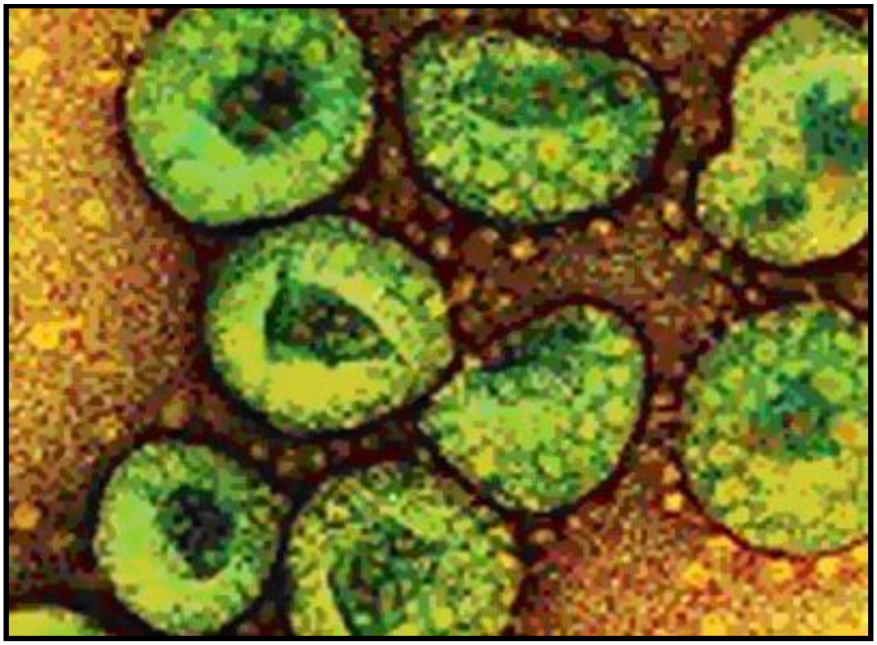
Special Issue on Airborne Disease



CSIR- Indian Institute of Toxicology Research
Lucknow, India

IN THIS ISSUE

EDITORIAL

Every person has been exposed to nanometer sized foreign particles; we inhale them with every breath, and consume them with every drink. In truth, every organism on Earth continuously encounters nanometer-sized entities. Nanomaterials are materials that have structural components smaller than 1 micrometer in at least one dimension. While the atomic and molecular building blocks (~0.2 nm) of matter are considered nanomaterials. Because of quantum size effects and large surface area to volume ratio, nanomaterials have unique properties compared with their larger counterparts. They have the ability to enter, translocate within, and damage living organisms. This ability results primarily from their small size, which allows them to penetrate physiological barriers, and travel within the circulatory systems of a host. Study of the toxicity of nanomaterials is called nanotoxicology. Not all nanoparticles produce these adverse health effects - the toxicity of nanoparticles depends on various factors, including: size, aggregation, composition, crystallinity, surface functionalization, etc. In addition, the toxicity of any nanoparticle to an organism is determined by the individual's genetic complement, which provides the biochemical toolbox by which it can adapt to and fight toxic substances. Since there is no authority to regulate nanotech-based products, there are many products that could possibly be dangerous to humans. Scientific research has indicated the potential for some nanomaterials to be toxic to humans or the environment. As the use of nanomaterials increases worldwide, concerns for worker and user safety are mounting. To address such concerns, the Swedish Karolinska Institute conducted a study in which various nanoparticles were introduced to human lung epithelial cells. The results, released in 2008, showed that iron oxide nanoparticles caused little DNA damage and were non-toxic. Zinc oxide nanoparticles were slightly worse. Titanium dioxide caused only DNA damage. Carbon nanotubes caused DNA damage at low levels. Copper oxide was found to be the worst offender, and was the only nanomaterial identified by the researchers as a clear health risk. Exposure monitoring and control strategies are necessary. The development of nanotechnology and the study of nanotoxicology have increased our awareness of environmental particulate pollution generated from natural and anthropogenic sources, and hope that this new awareness will lead to significant reductions in human exposure to these potentially toxic materials.

Editors:

Dr. Shailendra K Gupta

ENVIS Team:

Dr. Anvita Shaw, Mr. S.H.N. Naqvi, Ms. Vidisha Srivastava, Mr. Krishna Pal Singh, Mr. Bashir Akhlaq Akhoon, Ms. Madhumita Karmakar

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Environmental Information System (ENVIS)

Centre on Toxic Chemicals at

CSIR - Indian Institute of Toxicology Research,

Lucknow India

Prevalence of obstructive lung disease in a general population: relation to occupational title and exposure to some airborne agents

The importance of occupational exposure to airborne agents in the development of obstructive disease is uncertain. Studying the relation in a community population has the benefit of reducing the healthy worker effect seen in studies of working populations.

The prevalence of obstructive lung disease was examined in a Norwegian general population aged 18-73 in a two phased cross sectional survey. In the second phase a stratified sample (n = 1512) of those responding in the first phase was invited for clinical and spirometric examination (attendance rate 84%). Attenders were asked to state all jobs lasting greater than 6 months since leaving school and to say whether they had been exposed to any of seven specific agents and work processes potentially harmful to the lungs.
The prevalence of asthma and chronic obstructive lung disease was 2.4% and 5.4%, respectively; spirometric airflow limitation (FEV1/FVC less than 0.7 and FEV1 less than 80% of predicted values) was observed in 4.5% of the population. All jobs were categorised into three groups according to the degree of potential airborne exposure. Having a job with a high degree of airborne exposure increased the sex, age, and smoking adjusted odds ratio for obstructive lung disease (asthma and chronic obstructive lung disease) by 3.6 (95% confidence interval 1.3 to 9.9) compared with having a job without airborne exposure; the association with spirometric airflow limitation was 1.4 (0.3 to 5.2). Occupational exposures to quartz, metal gases, aluminium production and processing, and welding were significantly associated with obstructive lung disease after adjusting for sex, age, and smoking habit, the adjusted odds ratios varying between 2.3 and 2.7. Occupational exposure to quartz and asbestos was significantly related to spirometric airflow limitation in people older than 50.
[Thorax. 1991 Dec;46(12):863-70**]**

Airborne allergens associated with asthma: particle sizes carrying dust mite and rat allergens measured with a cascade impactor

Patients with asthma may develop acute symptoms after exposure to domestic or laboratory animal allergens; however, they are usually not aware of a direct relationship between their acute attacks and exposure to pollen or dust mite allergens. The present experiments were designed to study whether the differences in symptoms could be explained by differences in the number or size of particles carrying airborne allergens. Airborne particles were collected with a filter or on the stages of a cascade impactor, and allergens were measured by use of inhibition radioimmunoassays. In rat rooms and during disturbance of rat litter, a large proportion of rat urinary allergen (45.9%) was collected on the second stage of the impactor (mean size approximately 7 microns diameter). When sampled 15 to 35 minutes after disturbance, 16% of these medium-sized particles were still airborne. By contrast, during disturbance of house dust, a significantly larger proportion of dust mite, antigen P1 (80.6 +/- 11.8%; p less than 0.001) was collected on the first stage of the impactor, and in keeping with the apparent size of these particles (diameter greater than 10 microns), very little of this allergen (less than 4%) was still airborne when sampled 15 to 35 minutes after disturbance. With nebulized diluted rat urine, approximately 75% of the allergen was collected on the fourth and final stages of the cascade impactor in keeping with the expected size, 0.5 to 3 microns in diameter. These results demonstrate that natural exposure to both allergens is strikingly different from the conditions used for bronchial provocation.

[J Allergy Clin Immunol. 1986 Jun;77(6):850-7.]

Educational level and obstructive lung disease given smoking habits and occupational airborne exposure: a Norwegian community study

The relation of educational level to obstructive lung disease, spirometric airflow limitation, and respiratory symptoms was examined in a two-phase cross-sectional study of a Norwegian general population aged 18-73 years in 1985-1988. The first phase was a questionnaire survey. In the second phase, a stratified sample of those who responded in the first phase was invited to a clinical and respiratory physiologic examination. Altogether, 714 subjects attended, representing 84% of those invited. The prevalences of obstructive lung disease and spirometric airflow limitation were 7.8% and 4.5%, respectively. A total of 18% of the population had completed college, a further 60% had completed secondary school, and 21% had obtained a primary school education alone. The prevalence of both smoking and occupational airborne exposure decreased with increasing educational level. The sex-, age-, smoking-, and occupational exposure-adjusted odds ratio of obstructive lung disease in primary-versus university-educated subjects was 2.9 (95% confidence interval (CI) 1.3-6.5); in secondary- versus university-educated subjects it was 1.4 (95% CI 0.7-2.8). The corresponding values for spirometric airflow limitations were 5.2 (95% CI 2.0-13.4) and 1.8 (95% CI 1.2-2.7). All of the respiratory symptoms except breathlessness grade 2

were significantly associated with educational level after allowing for sex, age, smoking, and occupational airborne exposure. The survey indicates that educational level is a risk factor for airway disorders independent of smoking and occupational airborne exposure.

[Am J Epidemiol. 1995 Jun 1;141(11):1080-8.]

Breast milk-mediated transfer of an antigen induces tolerance and protection from allergic asthma

Allergic asthma is a chronic disease characterized by airway obstruction in response to allergen exposure. It results from an inappropriate T helper type 2 response to environmental airborne antigens and affects 300 million individuals. Its prevalence has increased markedly in recent decades, most probably as a result of changes in environmental factors. Exposure to environmental antigens during infancy is crucial to the development of asthma. Epidemiological studies on the relationship between breastfeeding and allergic diseases have reached conflicting results. Here, we have investigated whether the exposure of lactating mice to an airborne allergen affects asthma development in progeny. We found that airborne antigens were efficiently transferred from the mother to the neonate through milk and that tolerance induction did not require the transfer of immunoglobulins. Breastfeeding-induced tolerance relied on the presence of transforming growth factor (TGF)-beta during lactation, was mediated by regulatory CD4+ T lymphocytes and depended on TGF-beta signaling in T cells. In conclusion, breast milk-mediated transfer of an antigen to the neonate resulted in oral tolerance induction leading to antigen-specific protection from allergic airway disease. This study may pave the way for the design of new strategies to prevent the development of allergic diseases.

[Nat Med. 2008 Feb;14(2):170-5. doi: 10.1038/nm1718. Epub 2008 Jan 27.]

Environmental urban factors (air pollution and allergens) and the rising trends in allergic respiratory diseases

Respiratory allergic diseases such as rhinitis and bronchial asthma appear to be increasing worldwide, affecting in particular subjects living in urban areas, and the reasons for this increase are still largely unknown. Although the role played by air pollution has yet to be clarified, a body of evidence suggests that urbanization, with its high levels of vehicle emissions and a westernised lifestyle are linked to the rising frequency of these diseases observed in most industrialized countries. Laboratory studies confirm the epidemiological evidence that inhalation of some pollutants, either individually or in combination, adversely affect lung function in asthmatics. Air pollutants may not only increase the frequency and intensity of symptoms in already allergic patients but may promote airway sensitization to airborne allergens in predisposed subjects. By attaching to the surface of pollen grains and of plant-derived paucimicronic particles, pollutants can modify the morphology of these antigen-carrying agents and alter their allergenic potential. In addition, by inducing airway inflammation, pollutants may overcome the mucosal barrier and so "prime" allergen-induced responses. In other words airway mucosal damage and impaired mucociliary clearance induced by air pollution may facilitate the access of inhaled allergens to the cells of the immune system.

[Allergy. 2002;57 Suppl 72:30-3.]

DID YOU KNOW?

- During the lifetime of an average person, they can contract a number of airborne illnesses starting from a very young age. This can range from the common cold, to curable diseases such as chickenpox and measles, and more severe illnesses like pneumonia and tuberculosis. Out of all of these, tuberculosis is often the most dangerous, causing millions of deaths worldwide.

- When a person sneezes or coughs, they emit a spray that can travel as far as 15 feet! The droplets in this spray or mist are easily inhaled by others nearby, thus transmitting the virus to them as well. Airborne illnesses are most commonly spread in enclosed areas containing a large amount of people in close contact. This typically includes places such as schools, daycare centers, airplanes, offices, and even hospitals. It is worse in buildings with unsanitary conditions or little to no ventilation.

- Numerous techniques have been used to measure the viability and infectivity of airborne pathogens. Four major classes of techniques include Animal tests, culture methods, viability and physical losses of pathogenic aerosols and, molecular methods.

- Airborne levels are measured in terms of colony-forming units (cfu) of bacteria or fungi per cubic meter. Some hospital operating rooms are designed to maintain levels as low as 10 cfu/m3, although this level often proves difficult to achieve. Levels in homes and offices need not be this low, making solutions there less cost-prohibitive.

CURRENT CONCERNS

- Although there is no sure way of completely evading airborne diseases, there are several steps that we can all take to minimize the risk of

contracting them. One of the first things is to ensure that you and your children are vaccinated appropriately. If someone in your immediate area is sick, try to avoid contact with them. Isolation is a technique used successfully in hospitals to limit the spread of contagions.

- Airborne infections can be controlled and prevented by use of :-

HEPA filtration - The control of microorganisms and other pollutants and particulates at the source is the most effective way to maintain clean air. HEPA filters are at least 99.97 percent efficient for removing particles 0.3 µm (as a reference, Aspergillus spores are 2.5 to 3.0 µm in diameter), and their efficiency can be increased to 99.99 percent where needed.

Ventilation - Ventilation guidelines are defined in terms of air volume per minute per occupant and are based on the assumption that occupants and their activities are responsible for most of the contaminants in the conditioned space. Most ventilation rates for healthcare facilities are expressed as room air changes per hour (ACH). Peak efficiency for particle removal in the air space occurs between 12 ACH and 15 ACH. Ventilation rates vary among different patient-care areas of a healthcare institution and ventilation standards are provided in guidelines from the American Institute of Architects or the American Society of Heating, Cooling and Air-conditioning Engineers (ASHRAE).

- The key to regulation is the development of aerobiological air quality standards. Several organizations and government agencies are involved in the control of disease epidemics, including the Centers for Disease Control and Prevention (CDC), National Institute of Occupational Safety and Health (NIOSH), and World Health Organization (WHO), but none of them is responsible for regulating the living environments in which these diseases are transmitted.

ON THE LIGHTER SIDE

A little boy was standing in front of a mirror in the restroom at John F. Kennedy Airport, when in walked a Marine staff sergeant, dressed in his dress blues. The little
boy turned to the Marine and said, "Wow! Are you a Marine?"
The Marine replied, "Why, yes I am, young man. Would you like to wear my hat?"
"Boy, would I!," said the little boy. He took the hat and placed it on his head and turned to admire himself in the mirror.
As he was looking in the mirror, he heard the door open and through a ray of bright light, a man entered the room. But, this was not just a man -- he was more than a man. He was an Airborne Ranger.
The little boy turned and went over to the soldier. As he approached him, he could see the reflection in his boots. His eyes widened as he stared up at the soldier's chest full of medals and combat ribbons. He tried to speak, but he couldn't. Finally, he took a deep breath, and managed to say, "Excuse me, Sir. Are you an Airborne Ranger?"
The Ranger replied with a thunderous voice, "Why yes, I am!! Would you like to shine my boots?"The little boy smiled, and said, "Oh, no sir!! I'm not a Marine. I'm just wearing his hat!

ON THE WEB

- http://curiosity.discovery.com/question/diseases-commonly-spread-airborne-transmission
- American Academy of Orthopeadic Surgeons (AAOS) (2011). Bloodborne and Airborne Pathogens. Jones & Barlett Publishers. p. 2. Retrieved 21 May 2013.
- "Immunization Works". Center for Disease Control and Prevention (CDC). July 2011. Archived from the original on 2011-10-21. Retrieved 21 May 2013
- http://ecdc.europa.eu/en/healthtopics/climate_change/health_effects/Pages/air_borne_diseases.aspx
- www.slideshare.net/terriweller/airborne-pathogens-3047885
- www.nj-ptc.org/training/materials/SBMC/AirbornePathogens.ppt

CONFERENCES

1) 11th Annual AirBorne Neonatal and Pediatric Transport Conference

http://www.int-bio.com/userfiles/2013-Neonatal-Pediatric-Transport-Conference.pdf

2) 44th Union World Conference on Lung Health

Country:France

October 30-November 3, 2013 Paris, France

The 44th Union World Conference on Lung Health will be held at the Palais des Congres in Paris, France on 30 October–3 November 2013.

Original Announcement: http://www.worldlunghealth.org/conf2013/

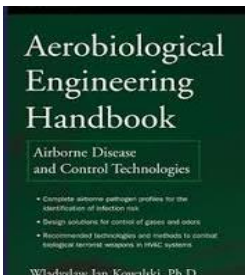
Categories: Chronic Diseases, Clinical Research, Disease-Specific Research, Global Health, HIV/AIDS, Infectious Diseases, Lung, Nicotine, Preventive Medicine, Public Health, Tuberculosis

Audience:

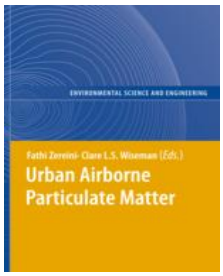
Community Activist, Health Services Researcher, Physician, Physician Researcher, Policy Analyst, Public Health Expert, Public Health Worker, Public Servant, Pulmonologist

BOOK STOP

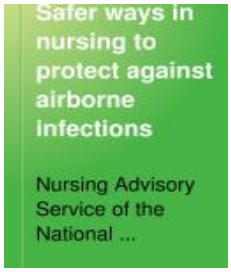
1) **Aerobiological Engineering Handbook: Airborne Disease and Control Technologies**
Author: Wladyslaw Kowalski, Wladyslaw Kowalski
Publisher: McGraw Hill Professional, 2006
Pages: 846 pages
A complete reference for the design of air filtration systems and HVAC systems used in homes, schools, hospitals, laboratories, or animal facilities, this book offers complete descriptions of each of the major technologies currently used for air disinfection. Each subject, chemical or microbial, is treated in sufficient detail to allow the design of these components to solve specific building air quality problems.



2) **Urban Airborne Particulate Matter: Origin, Chemistry, Fate and Health Impacts**
Author: Fathi Zereini , Clare L. S. Wiseman
Publisher: Springer-verlag Berlin Heidelberg
Pages: 537
ISBN: 978-3-642-12278
Study conducted on European air indicates that the concentration of Cd if assessed according to land use characteristics (such as rural, urban background and industrial sites),exhibit a broad range of values(0.1-0.4,0.2-2.5 and 2-20ng/m^{-3} respectively)

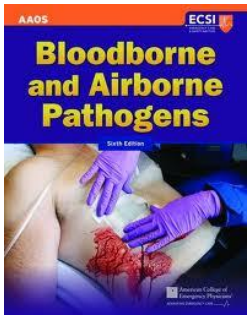


3) **Safer Ways in Nursing to Protect Against Airborne Infections:** Tuberculosis and Other Respiratory Diseases; a Guide to Precautions in the Care of Patients
Author: Nursing Advisory Service of the National Tuberculosis Association and the National League for Nursing
Publisher: National Tuberculosis Association, 1962



Length: 100 pages
In Staphylococcus, streptococcus and other respiratory infections, transmission occurs by direct contact with infected person. Kissing or handling and ingesting materials contaminated with discharges. such transmission probably not common in tuberculosis.

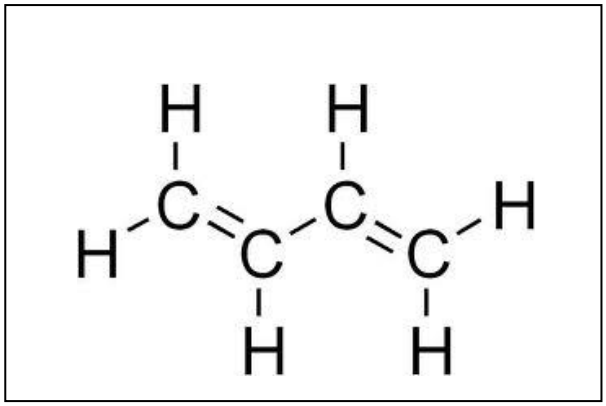
4) **Blood borne and Airborne Pathogens**
Author: Jeffrey Lindsey, Benjamin Gulli, Jon R. Krohmer
Publisher: American college of emergency physicians
ISBN: 10-1-4496-0948-1
Length: 110 pages
The occupational safety and health administration (OSHA) and the centers for disease control prevention (CDC) have identified several strategies to prevent or reduce exposure to blood borne pathogen and other potentially infectious material (OPMs).



MINI PROFILE OF 1, 3-BUTADIENE

NAME OF CHEMICAL: 1, 3-BUTADIENE

SYNONYMS: Butadieen; buta-1,3-dieen; butadiene; butadiene monomer; alpha-butadiene; alpha, gamma-butadiene; buta-1,3-diene; butadiene-1,3-uninhibited; buta-1,3-dien; butadien; methylallene; 1-methylallene; vinylethylene



RTECS NUMBER (NIOSH): EI9275000

CASRN: 106-99-0

MOLECULAR FORMULA: C_4H_6

MOLECULAR WEIGHT: 54.090000000000003

COLOUR/FORM: Colorless gas

ODOUR/TASTE: Mild aromatic or gasoline-like Odor.

Solubility: Soluble in organic solvents; alcohol dissolves about 40 vol at room temp; soluble in ether and ethanol; very soluble in acetone; water solubility: 735 mg/l at 20˚C.

B. P.: -4.5˚C at 760 mm Hg

M.P.: -108.966˚C

FLASH POINT: -105˚F

DENSITY: 0.6149 g/cm^3 at 25˚C

V. P.: 2,110 mm Hg at 25˚C

ANALYTICAL METHOD: Infrared & gas chromatographic analytical methods

USES: Used in the synthesis rubber, plastics, latex paints and resins.

FORMULATIONS: Technical 98.0%; chemically pure 99.8%

HAZARDS: May decompose explosively when heated above 200 ^{o}C. When heated to decomposition it emits

acrid smoke and fumes.

ECOTOXICITY: One can be exposed to 1,3-butadiene by breathing air, drinking water, or eating food contaminated with it. Also, people most likely to be exposed to 1,3-butadiene are workers in the production of rubber, plastics, and resins. It has been detected in gases.

PHARMACOKINETICS: In rat liver microsomes, 1,3-butadiene was metabolized to butadiene monoxide, which was subsequently transformed into 3-butene-1,2-diol by microsomal epoxide hydrolase. In the metabolism of butadiene oxide in microsomes, 4 metabolites were detected.

TOXICITY DATA:
Oral-Rat: LD50: 5480 mg/kg Inhalation-
Human: TCLo: 8000 ppm Inhalation-
Mouse: LC50: 270 g/m^3/2H.

Route	**Symptoms**	**First aid**	**Target organ**
Inh. & Ing.	Cough, sore throat, dizziness, headache, drowsiness, nausea, unconsciousness.	Fresh air, rest. Refer for medical attention.	Respiratory tract, Central nervous system
Cont.	Redness, pain & blurred vision.	Rinse with plenty of water, do not remove clothes. Refer for medical attention.	Skin & Eyes

TREATMENT: If contact of the liquid form of 1,3-butadiene with the skin occurs, frostbite may develop. Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or in respiratory rest. Positive pressure ventilation technique.

IRRITANCY AND SENSITISATION: May cause irritation of nose and throat with coughing; and irritation of the eye with chemical burns.

CARCINOGENICITY: There is limited evidence in humans for the carcinogenicity of 1,3-butadiene. 1,3-Butadiene is probably carcinogenic to humans.

MUTAGENICITY: 1,3-Butadiene is mutagenic in somatic cells of both mice and rats, the mutagenic potency was greater in mice than rats.

TERATOGENICITY: 1,3-Butadiene is teratogenic in experimental animals following maternal or paternal exposure or that it induces significant fetal toxicity at concentrations below those that are maternally toxic.

PERSONAL PROTECTIVE EQUIPMENT: Safety goggles and cold-insulating gloves.

PREVENTION: All sources of ignition should be eliminated. When the cylinder is empty, close the cylinder valve and follow the supplier's directions for cylinder return, after informing the supplier of the defect.

STORAGE: Store in a cool, dry, fireproof, well-ventilated location. Isolate from oxidizing materials. Separated from food and feedstuffs. Storage temperature: ambient.

DISPOSAL: Butadiene is a waste chemical stream constituent which may be subjected to ultimate disposal by controlled incineration.