IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 4, April 2022
Impact Factor: 6.252

Short Review on the Sneezing Bio-Aerosols

Sayed Altaf Ahmed A. R[1], Syed Mohammad Shoaib[2], H Aleem Basha[3], Anil Kumar Chaudhary[4]
Department of Physics, Maulana Azad National Urdu University Gachibowli, Hyderabad, Telangana, India[1,3]
Maulana Azad National Urdu University Polytechnic,
Kadpa Satellite Campus School of Technology, Hyderabad, Telangana, India[2]
Advanced Center of Research in High Energy Materials,
University of Hyderabad Gachibowli Hyderabad, Telangana, India[3]

Abstract: *In this short review the physical and biological properties of sneezing bio aerosols where discus .bio aerosols released during sneezing are a sub category of particles belongs to terrestrial and marine Eco system into the atmosphere .this bio aerosols consist both living and nonliving components such as fungi ,pollen, bacteria and viruses [1] It was identified that the biological and physical properties of bio aerosols realized through sneezing are silent to determine its diffusion deposition, control and measurement by various technics.*

Keywords: Sneezing Bio-Aerosols.

I. INTRODUCTION

The scientific common term for sneezing is sternutation .the phenomena sneezing can be written as 'semi-autonomous convulsive expulsion of air from the lungs thought the nose and mouth, generally due to foreign particles irritating the nasal mucosa. During this pandemic times sneezes become measure spread diseases through infectious aerosols droplets, so government of India strictly instructed to cover ones mouth and nose with the mask, it is also recommended to cover ones mouth and nose with the four arms, inside of the elbow, a tissue or handkerchief while sneezing.

As per Bernoulli's principal, while sneezing air ejected front the lungs is accelerated through the mouth thus creating a low pressure point at the back of the nose .in this why air is forced in through the front of the nose and the expelled mucus and contaminants are lunched out the mouth.so sneezing cannot occur during sleep due to REM ATONIA .the scientific nature of a sneeze is attributed to its participation of various organs of ENT parts of upper body.

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It is an automatic response in involving the face, throat, and chest muscles. In the literature the common suggestion that it is impossible to sneeze with open eyes [2] in may trigger PSR, or the ACHOO (autosomal dominant compulsive helio-ophthalmic outbursts of sneezing) syndrome as it's also called.[3] The tendency to sneeze upon exposure to bright light is an autosomal dominant trait and affects 18-35% of the human population.[6]

A rarer trigger, Observed in some individual [4] Sneezes unfurl disease through the infectious aerosol droplets usually ranging from 0.5 to 5 micro meter .a sneeze can produce 40000 droplets. [5] This Infection can spread through human contact [such as hand shaking] or commonly touched objects [most notably door knobs] [6] as per literature report the maximum visible ·the maximum visible distance over which the sneeze plumes (or puffs) travel was observed at 0.6 meters (2.0 ft.), and the maximum sneeze velocity derived was4.5 m/s (about 10 mph). [10] In2020, sneezes were recorded generating plumes of up to 8meters (26 ft.).[7] as shown in figure

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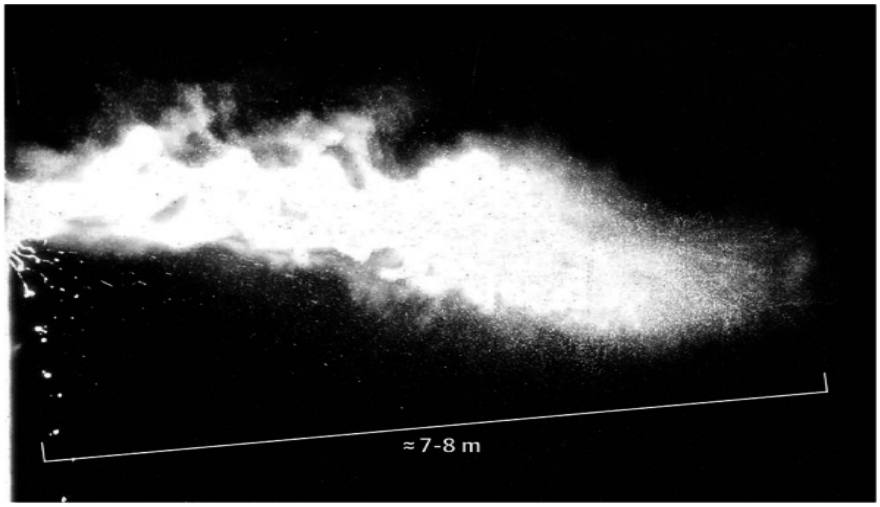

The practice among Islamic culture, in turn, has largely been based on various prophetic traditions and the teachings of the prophet Muhammad [pbuh]

An example of this is Al-Bukhaari's [8] narrations from Abu Hurayrah that Muhammad [pbuh] once said:

"When one of you sneezes, let him say, "Al-hamdu-Lillah" (Praise be to God)*, and let his brother or companion say to him, "Yarhamuk Allah"*(May God have mercy on you). *If he says, "Yarhamuk-Allah", then let [the sneezer] say, "Yahdeekum Allah WA yuslihubaalakum"*(May God guide you and rectify your condition)

According to Dr. Holly Boyer from the University of Minnesota, there is a pleasurable effect during a sneeze, where she states, "the muscle tension that builds up in your chest causes pressure, and when you sneeze and the muscles relax, it releases pressure [9] Sneeze bio aerosols may have both living and nonliving organisms. Bio aerosols are secondary divisions of biological particles obtained from land habitats (e.g., microorganisms such as bacteria, fungus, pollen, and virus) and aquatic ecosystems [10]

Bio aerosols also consist of dead cells .however very little research work had been carried out about dead cells of sneeze bio aerosols.

Research shows that there is a relatively higher diffusion of these bio aerosols through birds such as pigeons, bats, etc. [11]. Viral Bio aerosols may be considered a more dangerous bio aerosol because they are smaller than others and travel quickly and faster when released into the air. It can manifest as a severe acute respiratory syndrome (SARS), H1N1 influenza, and the H5N1 avian influenza, etc., [12]

Nazaraf clearly explain particle deposition in different regions of the respiratory track about the particle sizes with the help of Brownian diffusion of the bio aerosols in the lungs. Ren, P et.al discovered that bio aerosols concentration is relatively higher in indoor environments than outdoor environments. In the present study sneeze bio aerosols concentration may be same as outdoor usually have at list a little free space unlike an indoor place. Another silent characteristic of sneeze bio aerosols is that it varies from person to person both for male and female

III. Material and Methods

Sneezing is common thing both for male and female. Sneezing is not confined to humans or even mammals. Many animals including cats [13], dogs [14], chickens [15] and iguanas [16] sneeze. African wild dogs use sneezing as a form of communication, especially when considering a consensus in pack on whether or not to hunt. [17]The common size of sneeze bio aerosols is in between 1 µm to 100 µm. ''Boris Gorbunov'' is suggested a metric based on aerosol particle size distribution and ICRP lung deposition model. Adams et al [18] illustrated that indoor particle concentration with no or low occupancy loads correlate with outdoor concentrations. This idea means that the magnitude of occupancy can increase bio aerosols concentration within an area.

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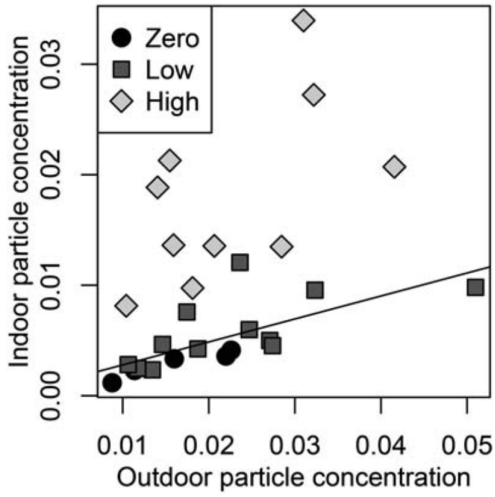
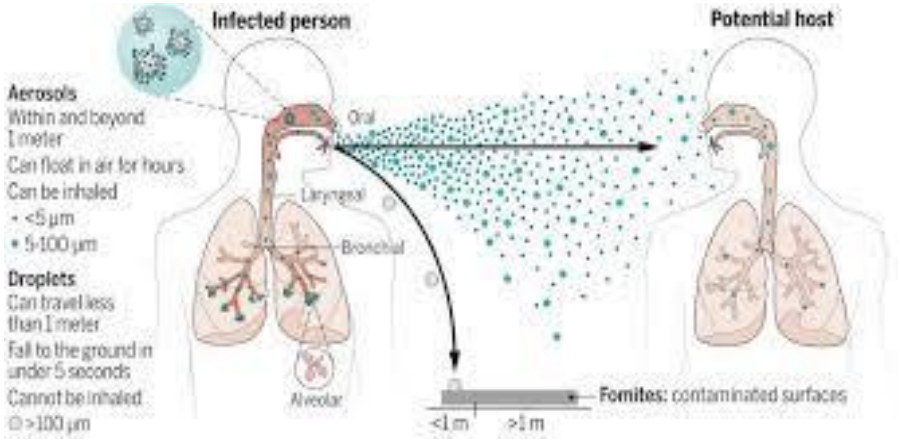


Figure 2: Mean concentrations of particles larger than 5 microns.

Tang et al. visualized the airflow of the cough of healthy white volunteers using schlieren imaging, with which the movement of the air mass could be detected as that of different thermal density from the surrounding air [19] three major differences between the human sneeze and cough have been reported and demonstrated by Hidekazu Nishimura et.al in **the** year 2013[20] they are

1. The reach of the sneeze was three times longer than that of the cough;
2. the velocity of the sneeze after 0.05 s was about three times higher than the cough
3. In contrast to the sneeze, the velocity of the cough drastically decreased at about 0.05 s after the release. All these differences can probably be attributed to a difference in the blowing energy between sneeze and cough



Even less work has been done to determine the number of sneeze virus in bio aerosols and very little is known about their potential effect on human health processes. For example, what might be the effect of secondary sneeze bio aerosol components (e.g. protein crystals) which may no longer be associated with nucleic acids? Or particles of mixed composition? From a meteorological perspective, it is important to know the actual composition of a sneeze bio aerosol in order to evaluate or model the role of individual components as ice nuclei or cloud condensation nuclei which potentially trigger precipitation We would like to point out that significant progress in characterizing the role of sneezing bio aerosols in atmospheric processes could be achieved with a reverse strategy.

New methods of sneeze bio aerosol characterization that can be integrated into methods and equipment used in cloud physics should be developed, to serve the integration of research from the various disciplines of microbiology, meteorology, molecular biology, cloud physics and cloud chemistry.

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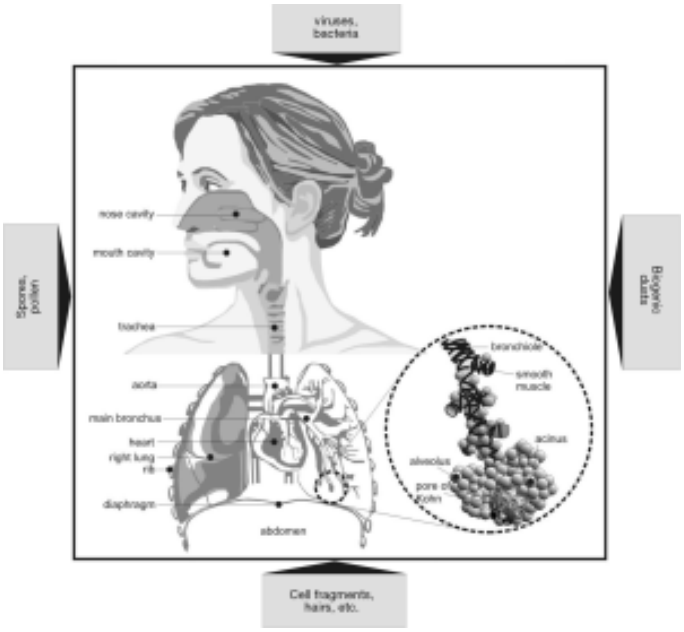

Figure 3 Scheme illustrating the human respiratory tract as well as particles of biological origin which have the potential to be taken up into the lungs. As per Robert sturn conclusions adult lungs may increasingly suffer from biogenic particles burden when they are subject to a long term exposure to certain bio aerosols [2]

IV. RESULT

Some atmospheric disease caused by airborne harmful bio-aerosols in climate as shown in following example [22]

Sr. No	Species	Causes	Spreading Area	Spread Through
1	legionella pneumophila	legionnaires	2 µm in length 0.3 to 0.9 cm in wide	inhalation of water aerosols
2	Mycobacterium tuberculosis	tuberculosis	2 to 4 µm in length 0.2 to 0.5 cm in wide	through air /person to person
3	Bordet Ella pertussis	whooping cough	2 to 4 µm in length and 0.2 to 0.5 cm in wide	direct contact or inhalation of airborne particles
4	bacillus anthraces spore	anthrax	3 to 5 µm in length 1.0 to 1.2 µm in wide	inhalation of airborne

Similarly sneeze bio aerosols paly important role in dangerous disease which is harmful to human body as well as climate Sneeze droplets merge in air quick than sneeze bio aerosols image analysis is done during a person sneeze who is 175 to 180 cm in height, healthy male volunteer early 20s was recorded by using HDTV high speed video system in a studio when temp is 27º,RH-15%under this case with maximum air velocity of less than 20 cm/s ,screenshot where taken after each 0.05 s and arranged respectively from fig Top image unprocessed Images while lower rows image are processing .the sneeze mist diffuse within 0.3s then it looks to fade after 0.4s however images shows each particles possess granular signals fall in size but were after 0.40s From this analysis we know that large droplets are face with high speed and fade from image within 0.20s a part of mist is swish in around sneeze person after 0.05simage analysis of sneeze bio mist except fast falling bigger droplets who's size is calculated 300mm in diameter initial velocity of mist particles of sneeze is about 6 m/s which is slow down as they go ahead sneeze particles lost their momentum at0.12 s to 0.15s after that they disappear or diffuse in air the dispersal of total velocities of the vectors was displayed in below which observe momentum each separately .by getting data of position and velocity of each vector, where it plotted in 2d distance with time on the axes .it is easily to know that after 0.08s velocity of particles placed at 75-80 cm from mouth which is highest in mist cloud and after that it slow down at the inner part of mist mass and finally total lost velocity by 0.15about 85cm from the sneeze mouth

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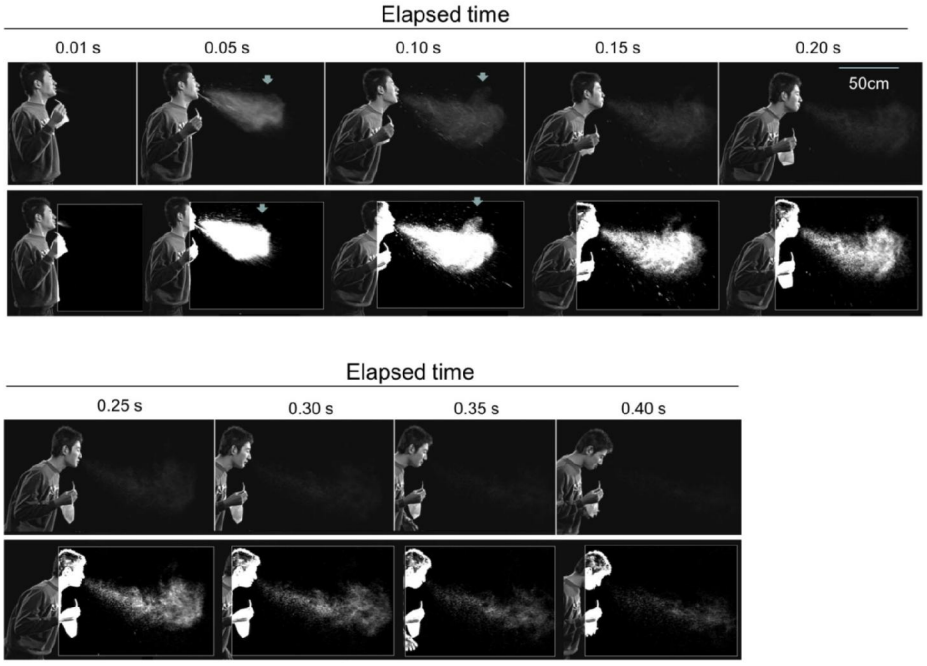

Figure 1. Serial photographs of a sneeze extracted from the video image. Original (upper rows) and enhanced (lower rows) images of the Sneeze of a healthy adult male volunteer. The photographs were extracted from the video image recorded by a digital high-vision, high-speed video System at 0.01 s and every 0.05 sec. The mist of the sneeze advanced forward as a mass, associated with gradual diffusion and fading followed by Disappearance. A part of the mist cloud looked swirled in the peripheral area (arrows). doi:10.1371/journal.pone.0080244.g001

V. Discussion and Conclusion

This study provides an overview of studies associated with sneeze bio aerosols based on previous literature .Biological and physical properties of sneeze bio aerosols are complex. Its diffusion, deposition, control, and measurement have to carry out for various applications. Its volatility divides across climate changes, indoor encasements, outdoors sources and atmospheric conditions. Hence disease carrying sneeze bio aerosols requires an in depth research as mention above .sneeze bio aerosol study is being developed due to pandemic health hazards .and the revolutions are being put in use by various branch of sciences. The role of sneeze bio aerosols in medical field offers numerous research and development applications and advancement of health hazards.

In summery this study adds new idea about the releasing of sneezing bio aerosols while sneezing and breathing in healthy human.it also makes a direct difference between cough and sneeze. For the past three years bioterrorism events like Covid-19 SARS airborne transmission is an important pathway of spreading these pandemic diseases.

As per literature survive the USA the leading country based on the number of publications however in bio aerosols research china ranked the top in 2019 .Recently it is noted that the most preferred journal in this field is the journal of aerosol science while popular research areas and web of sciences categories pointed out that bio aerosols is hot topic among environmental scientists. Indoor air quality, particulate matter relation to bio aerosols, bio aerosol sampling and health effects of bio aerosols especially occupational exposure are the main hot topic in bio aerosols research however sneeze bio aerosols are also very important in health aspect research.

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