History of implementation of Nanotechnology in the novel air purifiers with a special reference in reduction of Pollen, Mold Spore and PM2.5 Indices

NABARUN GHOSH PhD[1*] SHAILY GOYAL PhD[1], AUBREY HOWARD MS[1], PRABIR BANERJEE MD MS[1] MARYTRINH NGUYEN BS[1]

AND JAY VITALE[2]

[1]Department of Life, Earth and Environmental Sciences, West Texas A&M University, Canyon, Texas; [2]Air For Life, Milton Keynes - MK12 5TS, Buckinghamshire, UK.

Abstract

In a collaborative project we have developed various novel filter-less air purifiers to improve the Indoor Air Quality (IAQ). Presently our Laboratory has been focusing on the issues of PM2.5 pollution (Ref. Ghosh on NIH). Particulate matter of 2.5 micron is a major issue in Global Air Pollution. WHO reports that a very high number of people die every year due to this particulate pollution. With is current scenario of air pollution we have targeted in developing an advanced level of air purifier implementing the AFLPCO Nanotechnology to solve the problem of Indoor Air Quality or IAQ.

We used a Burkard Spore Trap for aeroallergen sampling that provided the data for the onset, duration, and severity of the pollen season that clinicians use to guide allergen selection for skin testing and treatment.

We examined the pollen samples with an SEM (TM-1000) that revealed the micro-morphology with the size of colpi, sulci and the detailed microstructures. We also used the Fluorescein-based dyes to stain the samples on the slides. The slides were observed under with BX-40 Olympus microscope with *Cellsens* software. The daily weather was recorded including temperature, wind speed, precipitation, humidity, average soil temperatures. This allowed the estimation of the clinical significance of the various pollen types by combining data concerning in vivo allergenicity and terminal velocity as a means to judge the clinical significance. We applied the AFLPCO Nanotechnology to develop unique filter-less air purifiers, AFL masks to combat the respiratory ailments.

Objectives

- Analyzing and characterizing the Aeroallergen of the Texas Panhandle.
- Correlating the meteorological data with the cases of allergic rhinitis.
- Applying the novel AFLPCO Nanotechnology to develop filter-less air purifiers and masks in reducing the allergy, asthma and COVID cases by improving the indoor air quality.

Methodology-1 Collection of Aeroallergen

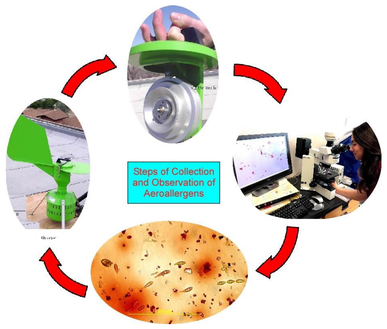
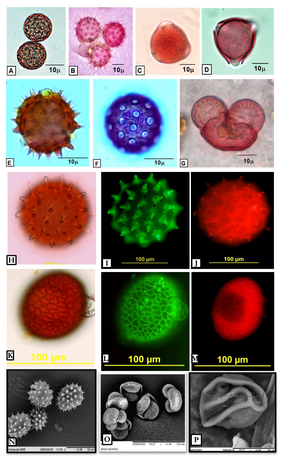


Fig. 1.1 A-D. Aeroallergen trapping



Figures 1.2 A-G: Digital Micrographs showing most frequent allergenic pollen of the Texas Panhandle. **Figs. H-M:** Micrographs of pollen with Bright Field and Fluorescence, FITC and TRITC. **Figs. N-P:** Scanning Electron Micrographs of pollen.

Methodology-2 Assessing AFLPCO Nanotechnology

Fig. 2 A-F. Evaluating the efficiency of AFL Mini and AFL Mask.
A,B. Assessing the air quality using the *LIGHTHOUSE* Particulate Monitor. C. AFL Mini, D. Petri plate exposed without any AFL Mini air purifier. E. AFL-Masks. F. Petri plates with AFL Mini running after 48h, 72h.

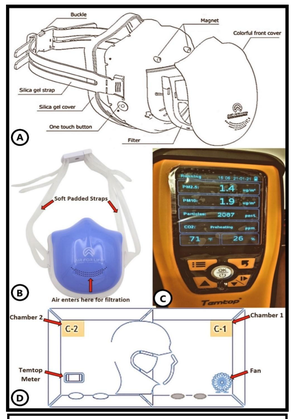


Fig. 3. A. Design of the face mask, B. Air inlet and soft padded straps, C. Temtop Air Quality Meter, D. Exp. Using the fiberglass chamber. Fig. 5D shows the diagram of the fiberglass chamber and the experimental set up.

Methodology-3 Assessing AFLPCO on bedbugs!

Fig. 4 A. Evaluating the efficiency of AFL Mini and AFL Mask using the Analytics with the Fiberglass Chamber Simulation. Petri plates with AFL Mini running after 24h., 48h, 72h. Inset B. *Drosophila melanogaster*, (fruit fly).

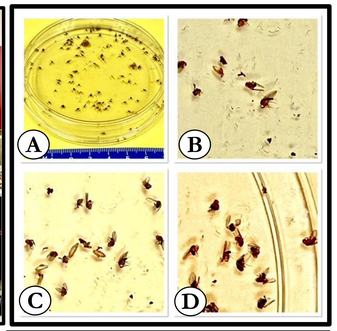


Fig. 5A-D. Testing the lethality induced by the air purifier in the Petri dishes placed inside the fiberglass chamber in the Aerobiology Lab at NSB 215, West Texas A&M University. Figures 5A-D Showing the death of the fruit flies at different intervals of exposure with the AFL- Mini Sanifier II®.

- We set up equipment for testing the effect of using the AFL Mini Sanifier II® in a simulated environment of a fiberglass chamber in the Aerobiology Lab, NSB 215.
- We used *Drosophila* sp. (fruit fly)an insect test system to test the efficacy of this negative ion air purifier in reducing and eradicating the bed bugs.

Findings

- The data from the different types of aeroallergens show an overall increase in aeroallergens. Some trends display an unusual spikes in their counts.
- The Anomalous Aeroallergen indices increased the patients' visits.
- From the experiments on assessment, AFLPCO technology proved to be a safe and effective means of eradicating aeroallergens such as mold, microbes and pests like bedbugs from indoor air. VOC concentrations has reduced on running the Air For Life air purification units.

Conclusions

The aeroallergen index in Texas Panhandle exhibited an increasing trend in the last 21 years. However this may be a result of the constantly fluctuating meteorological conditions evidenced globally. This anomaly is showed in a large spike in aeroallergen counts for both allergen types and the spikes are nearly identical to each other. The weeds graph showed an increasing trend of 2.465x. Meaning that, on average, every month increased in pollen by 2.465. The grasses graph had a value of 2.4272x, or 2.4272 increasing monthly trend. The tree graph had a quite small increasing trend; however it still was an increasing trend. It had value of .0373x or .0373 increasing monthly average. The molds chart had steep increasing trend of 7.132 monthly averages. However, it also displays the steep spike anomaly occurring the same years as the spikes in the grasses and weeds charts. We found that most of our pollen population are wind-borne from the vegetation of Oklahoma, New Mexico and Colorado. The spikes for each chart could be attributed to the drought that occurred during 2017-2022. The spike in mold spores could possibly be attributed to West Texas A&M campus being roughly thirty miles northeast of the Hereford feedlots. The pollen counts for trees seem to be the only ones not affected by the drought years in the Texas Panhandle. They also illustrate an increasing trend. Evaluations on safety of the air purifier showed no side effect on human cell cultures. Indoor aeroallergens such as, mold spores, airborne bacteria, PM2.5 and insect count reduced significantly on using the Air For Life (AFL, UK) air purifiers and thereby improved the indoor air quality leading to the alleviation of the breathing ailments. AFLPCO Nanotechnology proved to be an efficient way to reduce molds and bacteria and prevent respiratory ailments. The AFL mask is capable of providing germ free air ensuring the health and safety of the users. (Figs. 2-5).

Significance

- Climate change has effect on aeroallergens and allergies. The increasing trends of total pollen amounts, changing pollen seasons, and increasing carbon dioxide indicate there should be an increase in allergies and severity.
- Use of AFLPCO implemented air purifiers can proved to be an efficient way to reduce molds and bacteria and prevent respiratory ailments.

References

- Amarillo Globe-News: An Increasing Trend. (2011) Web link: http://amarillo.com/news/local-news/2011-08-28/increasing-trend
- Ghosh N., Goyal S., Howard A., Banerjee P. & Vitale J. (2023). Application of Nanotechnology in a Novel Air Purifier for Remediation of Airborne Pathogen and to Prevent the Spread of COVID-19. *European Scientific Journal, ESJ, 19 (12), 1.* https://doi.org/10.19044/esj.2023.v19n12p1