Dr. Zili Sideratou from NCSR Demokritos on Utilizing the VITROCELL ESSENTIALS Exposure System in Nanotoxicity Research

INTRODUCTION & BACKGROUND

Can you tell us a bit about yourself and your research team? What is your primary focus or area of study?

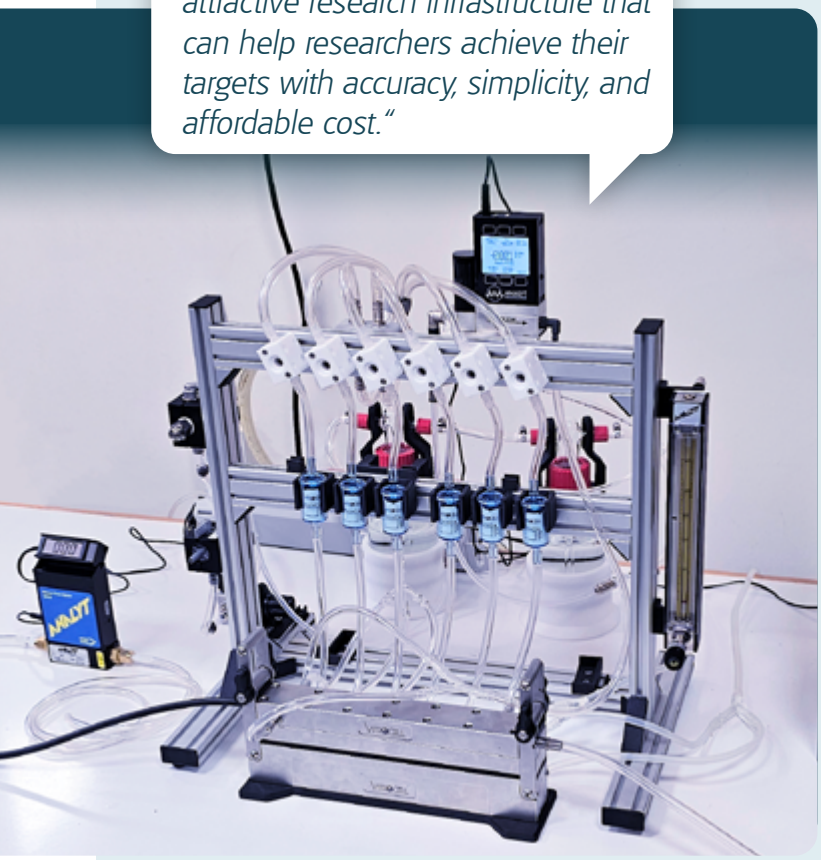
As members of the Institute of Nanoscience and Nanotechnology, our research efforts are mainly focused on the development of novel nanomaterials with advanced properties for environmental, energy and health applications. The core of our research is the synthesis of various types of nanostructured materials with special functionalities, including material with catalytic properties, nanomaterials with enhanced antimicrobial performance, materials for the abatement of hazardous pollutants, advanced multifunctional coatings as well as effective drug delivery systems for targeted cancer treatment. Recently, due to the wider concern on the health impact of the nanomaterials, our group dealt with the in vitro nanotoxicity of the developed nanomaterials, employing submerged cell cultures. This research is crucial not only for scientific purposes, but also to enhance the public acceptance of novel products based on nanotechnology and to address the social challenges.

What inspired you to choose the VC ESSENTIALS Exposure System for your research needs?

Having a significant experience on nanotoxicity assessment using traditional cell exposure systems, the group identified the limitations of these methodologies, especially for the simulation of human airway. This was more pronounced during the implementation of the European funded project AEROSOLS in which primary and secondary engine emissions would be evaluated regarding their human health impact. Thus, advanced in vitro ALI models that allow direct exposure to engine emissions are essential for this study.

One of the most cited in the literature ALI systems is the ones provided by Vitrocell company. From the various exposure systems provided by Vitrocell we have selected their new VC Essentials Exposure System, due to its high accuracy and easiness of handling.

„This exposure system is a very attractive research infrastructure that can help researchers achieve their targets with accuracy, simplicity, and affordable cost."



RESEARCH GOALS

What specific challenges in your research are you hoping to address with this system?

The air-liquid interface (ALI) exposure is challenging this exposure technique to become the method of choice as applies the aerosol directly to the cell cultures and thus enhance lung model sensitivity and improve toxicological relevance. This particularly holds for the toxicity testing of unmodified complex gas-particle mixtures, such as combustion aerosols which contain thousands of substances in both the gaseous and the solid fraction.

The ALI technique allows for a direct dynamic delivery of the aerosol to the test cells which are covered with a very thin liquid film like in the lung simulating the physiology and exposure of human lung cells. Further advantages are the facts that the dose can be determined more precisely and the gaseous phase of an aerosol can be examined separately by removing the particulate phase with filters.

DECISION-MAKING PROCESS

What made you decide to invest in this module? Were there particular features that stood out to you?

In close collaboration with VITROCELL we identified the most appropriate system not only for our current research but also for future ones. In addition, the selected module fit perfectly to our budget limitations. Another important parameter for the selection of VC ESSENTIALS exposure system was its easiness of operating, which is critical for high throughput experimentation.

How do you think the VC ESSENTIALS Exposure System will give you an advantage over other systems in your research?

In regards to other systems available in the market, which are very complicated and need highly experienced users, the VC ESSENTIALS offers an affordable but quite reliable solution that can be used by medium experienced personnel.

INSTALLATION & TRAINING EXPERIENCE

How has your experience been with the installation process so far?

The installation procedure was quite comprehensive and the technician explained thoroughly all the different parts of the system as well as their operation. In addition, maintenance guidelines were provided.

Has the training session provided insights into how to maximize the system's potential? Any key takeaways?

The VITROCELL team also helped our team on the design of our experiments based on the needs of AEROSOLS project and offered extensive information about similar sampling procedures.

„Compared to complex systems requiring expert users, the VC Essentials offers an affordable, reliable solution for moderately experienced personnel."

IMPACT ON RESEARCH

How do you think this system will advance your research outcomes?

The VC ESSENTIALS exposure system will help the team to expand its experimental capabilities for the nanotoxicity evaluation not only of the primary and secondary emissions, but also of the nanoparticles simulating the respiratory process. In addition, the new system will enable the reduction of the in vivo experiments according to national and European guidelines.

LOOKING AHEAD

What advice would you give to other researchers considering similar systems for their work?

The VC essential exposure system is a very attractive research infrastructure that can help them to achieve their research targets with accuracy, simplicity and affordable cost.

What excites you the most about using the VC ESSENTIALS Exposure System in the next months?

In the first phase the idea is to compare the results obtained by ALI with the results obtained by submerged cell cultures. Having understand the capabilities of the system, the efforts later will be focused on the evaluation of the effects of aerosols on human health.

PERSONAL TOUCH

How do you see your research contributing to the broader field or making a societal impact

By applying of the VC ESSENTIALS exposure system, the health assessment of the engine emissions will be carried out emphasizing on emissions that are currently disregarded. This will enable the team to define their unknown impact and to their classification based on their impact. Finally, the team will provide data for the LCA/social assessment of the emissions and to support the new national and European environmental policies.