

**ACTIVITY REPORT 2016 - 2021****FACULTY: Science DEPARTMENT/ COMMITTEE : Botany IQAC ACTIVITY No: SVC/2018-19/BOT/AKC/3****NAME OF THE ACTIVITY: Student training program on “Effect of water-soluble carbon nanotubes on germination of seeds”**

DATE	FACULTY	DEPARTMENT/COMMITTEE	COORDINATORS NAME
October-December 2018	Science	Botany	Dr. Aditi Kothari Chhajer Dr. Neeti Mehla
TIME	VENUE	NUMBER OF PARTICIPANTS	NATURE: Outdoor/Indoor
		6	Indoor
<b>SUPPORT/ASSISTANCE:</b>			

BRIEF INFORMATION ABOUT THE ACTIVITY (**CRITERION NO. - 7** ):

TOPIC/SUBJECT OF THE ACTIVITY	<b>Student training program on “Effect of water-soluble carbon nanotubes on germination of seeds”</b>
OBJECTIVES	<p>Nanoparticles are particles of the size in the order <math>10^{-9}</math> m. Nanoparticles in the form of tubes either single-walled or multi-walled are called carbon nanotubes. These materials are now being used in evolving innovative methods in various areas of science and technology. The aim of the current project is to see the impact of carbon nanotubes (functionalized and non-functionalized) on germination and growth in different plants. The project was aimed to give hands on training to students with the following objectives:</p> <ul style="list-style-type: none"><li>• To see the effect of carbon nanotubes on seed germination and seedling growth: Impact of varying concentrations of single-walled and multi-walled carbon nano-tubes will be studied on seed germination of the plant</li><li>• Studies of plant growth and development after treatment with carbon nanotubes: Various growth parameters of the plant will be evaluated</li></ul>
METHODOLOGY	Seeds of various plants were treated with varying concentrations of functionalized and non functionalized CNTs. Studies of plant growth and development after treatment with carbon nanotubes were performed, where the various growth parameters of the plant were evaluated and the impact of CNT treatment was observed. Plant growth parameters in terms of seedling growth, root, shoot and leaf length etc were recorded
OUTCOMES	The short project imparted an insight to the fast developing field of nanotechnology and its possible effects on early stages of plant growth. Students had a hands-on experience with various laboratory techniques. The studies were presented at the International conference on Integrative chemistry, biology and translational medicine .

**PROOFS & DOCUMENTS ATTACHED (Tick mark the proofs attached):**

Notice & Letters	<b>Student list of participation</b>	<b>Activity report</b> ✓	<b>Photos</b> ✓	Feedback form
<b>Feedback analysis</b>	News clip with details	Certificate ✓	Any other	

IQAC Document No:	Criterion No:	Metric No:
Departmental file no	IQAC file No;	

NAME OF TEACHER & SIGNATURE	NAME OF HEAD/ COMMITTEE INCHARGE & SIGNATURE	IQAC COORDINATOR (SEAL & SIGNATURE)

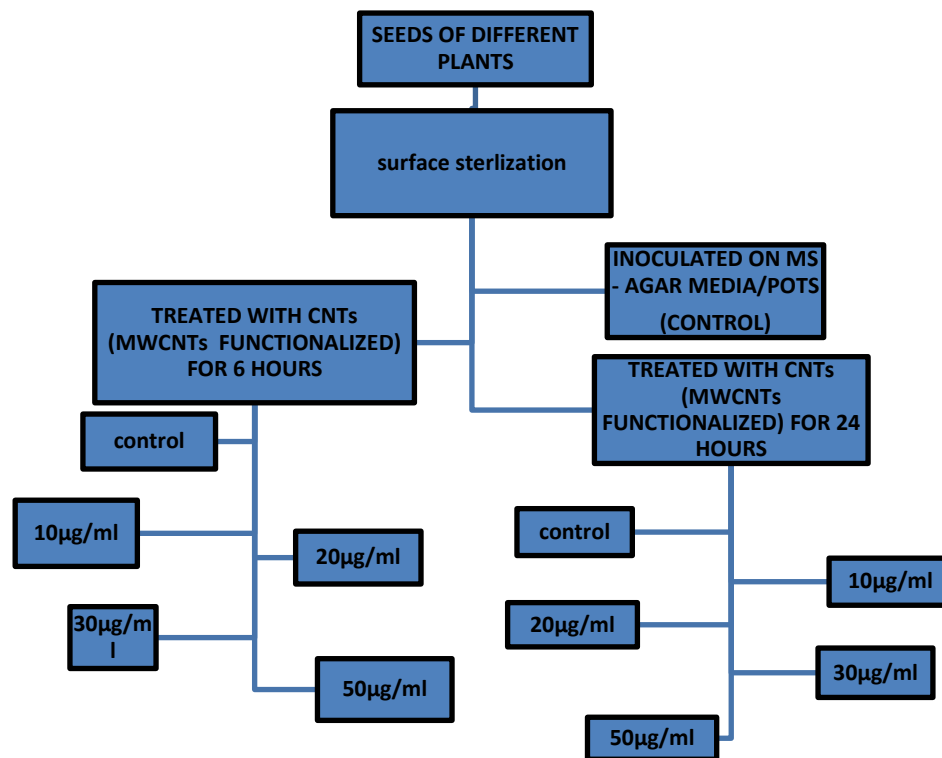
For Reference

Criterion I	Curricular Aspects (planning & Implementation)	Criterion V	Student Support & Progression
Criterion II	Teaching Learning & Evaluation	Criterion VI	Governance
Criterion III	Research, Innovations & Extension	Criterion VII	Institutional Values & Best Practices
Criterion IV	Learning Resources and Infrastructure		

## ACTIVITY REPORT

Nano-biotechnology came as a hybrid discipline, a combination of biotechnology and nano-science. Nano size (1-100nm) results in to nanomaterial exhibiting significantly improved / different physical, chemical and biological properties that were hitherto unknown in the bulk material. Carbon Nanotubes (CNTs) have wide range of applications because of their unique structural, optical, mechanical and electronic properties. Their high specific surface area and facile functionalisation, conductivity, magnetic susceptibility and catalytic activity have resulted into CNT applications into widest range of activities, including plant growth and development. An exponential growth on nanotube research is happening that aids the emergence of new technologies. Nanotechnology is rapidly entering all the primary industrial sectors which is due to increased investment by the various government agencies in this sector. As such some novel and exquisite applications of nanotechnology have been seen in the agricultural sector. There are ample examples of the same in improvement of nutritional value of food, assessment of nanoscale nutrient delivery systems, harvesting energy and conversion, livestock reproduction enhancement, sensing technology and enhancement of plant growth that primarily includes the increase in the root and shoot lengths of various agriculturally important crops. In the current project the impact of CNTs on seed germination and early stages of seedling growth was evaluated. The project aimed to give an insight into the fast developing

field of nanobiology and helped students understand how nano materials may impact plant growth.



**Flowchart representing the methodology used**

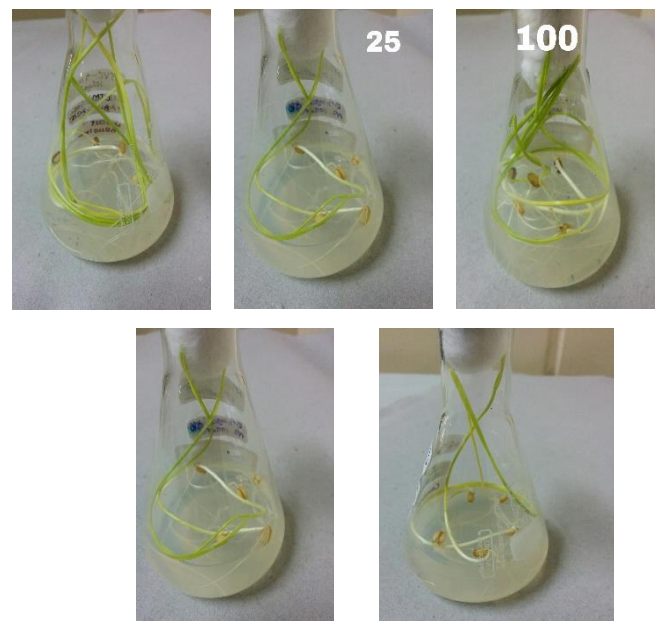
#### GROWTH STIMULATION IN PLANTS BY THE IMPACT OF WATER-SOLUBLE CARBON NANOTUBES

Aditi Kothari-Chajer<sup>1\*</sup>, Neeti Mehla<sup>1</sup>, Deepa Bisht<sup>1</sup>, Ishani Mukherjee<sup>1</sup>, Tanya Rattanpal<sup>1</sup>

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Nano-biotechnology came as a hybrid discipline, a combination of biotechnology and nanoscience. Different nano-materials have been tried on plant systems to evaluate their impact on plant growth and Carbon Nanotubes are allotropes of carbon which have a cylindrical nanostructure. In the current study carbon nanotubes (CNTs) have been used because of their unique properties and hence wide range of applications. Seeds of Wheat, Tobacco and Tomato were exposed to different concentrations of functionalized and non-functionalized multi-walled carbon nanotubes (MWCNTs) and non-functionalized single walled CNTs (SWCNTs). MS medium was supplemented with 0 µg/ml, 50 µg/ml, 100 µg/ml, 250 µg/ml, and 500 µg/ml SWCNTs for wheat. Different concentrations of non-functionalized MWCNTs and SWCNTs were used (0 µg/ml, 5 µg/ml, 25 µg/ml, 50 µg/ml, 100 and 125 µg/ml) for Tomato and Tobacco. Factors such as seed germination, root elongation, plant biomass (fresh and dry), root length, shoot length, number of leaves, etc. were evaluated. The observations were taken at least thrice a week and the day of germination was also observed. It was seen that a treatment with MWCNTs led to an early germination in the treated samples vis-à-vis control. The treated seedlings showed improved growth parameters in terms of their root length, shoot length, fresh weight and dry weight. An improvement in the percent seed germination was also observed. However, concentrations higher than 100 µg/ml proved toxic in Tomato and Tobacco. Wheat had better tolerance to higher concentrations of the nanomaterial. Our findings suggest a possibility of the use of Carbon nanotubes as Growth stimulating additive when used in low doses. A detailed understanding of the molecular mechanisms would pave the way for the use of these materials in agriculture, where they could soon emerge as a novel technology.







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This is to certify that the Activity report (Teacher/Department /Society/Association) has been submitted for documentation to IQAC, Sri Venkateswara College, University of Delhi.

*N. Latha*

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