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Metabolic and cellular changes triggered by atmospheric cold plasma treatment at sub-lethal conditions in *Alternaria alternata*

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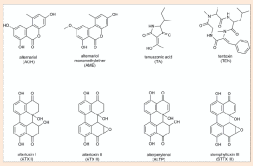
A. alternata alone infects already more than 100 plant species, and therefore, is an economically important food and feed contaminating fungus. In addition to crop loss through plant infections, *A. alternata* causes huge damage in agriculture due to postharvest decay and contamination of food and feed with mycotoxins (Wenderoth, et al., 2019). Among novel technologies the atmospheric cold plasma (CAP) treatment has shown potential effectiveness in reducing fungi and mycotoxin concentration. In the recent years high-throughput technologies have revolutionized the research. The omics technologies, such as transcriptomics, metagenomics, proteomics and metabolomics, are a powerful tools to characterize the state of the cell and aim to expand the scope of biological investigation from studying single genes, individual compounds or proteins to studying all genes, metabolites and proteins at once in a systematic fashion.

Plant diseases

Mycotoxin production



Objective

This research PhD proposal is intended to contribute to a better understanding about the biological, biochemical and biophysical molecular processes regulating the production of mycotoxins, and the adaptation of *A. alternata* to cold plasma treatment trough high throughput–omic techniques including transcriptomics, proteomics and metabolomics.

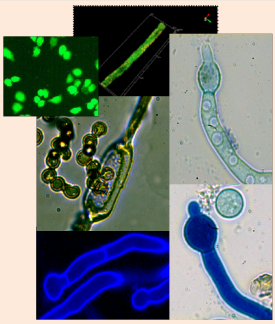
Omic approach

RNA-Transcriptome-Transcriptomics

Protein-Proteome-Proteomics

Metabolite-Metabolome-Metabolomics

Morphological evaluations



Atmospheric cold plasma

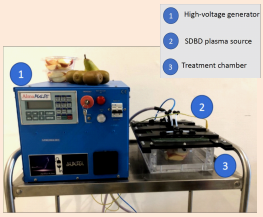


Table 1.Gantt diagram for this PhD thesis project

	Activity/Months	1-6	7-12	13-18	19-24	25-30	31-36
A1)	**Bibliographic research**						
A2)	**Atmospheric cold plasma treatment conditions**						
	Optimization of cold plasma treatment conditions.						
	Evaluation of the minimum inhibitory concentration (MIC) for mycelium of *A. alternata* and determination of sub-lethal conditions treatment.						
	Evaluation of the minimum inhibitory concentration (MIC) for spores germination of *A. alternata* and determination of sub-lethal conditions treatment.						
A3)	**Effect of sub-lethal atmospheric cold plasma (CAP) treatment on *A. alternata* morphological characteristics**						
	Determination of cellular viability, nuclear condensation, membrane integrity, membrane depolarization, intracellular ROS accumulation.						
A4)	**Metabolic changes induced by atmospheric cold plasma (CAP) treatment at sub-lethal condition in *A. alternata***						
	Study of extracellular enzymatic production changes.						
	Evaluation of VOCs profile changes .						
	Evaluation of proteomic profile changes.						
	Effect on mycotoxins production.						
	Evaluation of expression profiling of genes involved in mycotoxins production, stress responses and pathogenicity.						
A5)	**Bibliographic research, writing and editing.**						

References

Bennett, J.W. and Klich, M. (2003) Mycotoxins. Clinical Microbiology Reviews, 16, 497-516.
Feizollahi, E., Misra, N. N., & Roopesh, M. S. (2021). Factors influencing the antimicrobial efficacy of Dielectric Barrier Discharge (DBD) Atmospheric Cold Plasma (ACP) in food processing applications. Critical reviews in food science and nutrition, 61(4), 666-689.
Misra, N. N., Yadav, B., Roopesh, M. S., & Jo, C. (2019). Cold plasma for effective fungal and mycotoxin control in foods: mechanisms, inactivation effects, and applications. Comprehensive reviews in food science and food safety, 18(1), 106-120.
Wenderoth, M., Garganese, F., Schmidt-Heydt, M., Soukup, S. T., Ippolito, A., Sanzani, S. M., & Fischer, R. (2019). Alternariol as virulence and colonization factor of Alternaria alternata during plant infection. Molecular microbiology, 112(1), 131-146.