جامعة نزوى
University of Nizwa

مركز داريس للبحث العلمي والتطوير التقني
DARIS Center for Scientific Research and Technology Development

DARIS Center for Scientific Research and Technology Development

Advanced Food Mycology, Ecophysiology and Molecular Diagnostics Course

Introduction

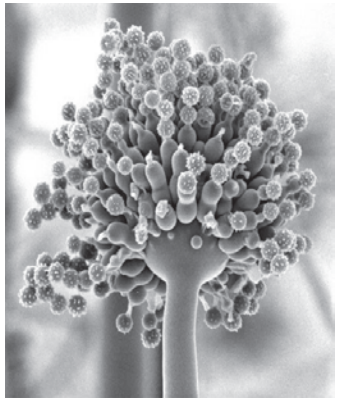
Food safety and security are very high on the agenda for food manufacturers and consumers today. This has become more important in the context of the climate change agenda and ensuring that food chains and processed products are safe for consumers. Food spoilage is one of the major challenges faced by food processors, suppliers and retailers. Clearly identification and prevention/minimisation of food spoilage by moulds and their associated contamination with mycotoxins are very important in key staple food chains from farm to fork. Quality can be compromised both aesthetically and nutritionally. Key factors which determine fungal spoilage of raw ingredients and finished food products, especially bakery products, are water activity, temperature, packaging systems and shelf-life considerations. Preservation systems, formulation of products and packaging systems are critical in ensuring that the shelf-life of products can be enhanced under both ambient and cooled storage conditions.

Thus, understanding the causes and identifying the responsible spoilage moulds can go a long way towards prevention of these potentially dangerous spoilage factors. There is thus a need for an understanding of the types of fungal species which can cause spoilage of food products, their ecology and the ability to produce mycotoxins and identify systems which can be utilised to minimise and prevent spoilage from occurring. HACCP approaches can be an important management system to address fungal spoilage and mycotoxin contamination in key relevant food/feed chains.

Techniques for the early detection of fungal contaminants in food are essential to ensure high food safety standards. Among them, techniques based on nucleic acids have been develop in the last years. Different molecular biology tools based on DNA amplification using PCR have been developed to accurately identify these species in short period of time and thus allow rapid intervention from the industry. Moreover, further developments permit the study of targeted gene expression (RT-qPCR). This has particular relevance in relation so specific food contaminants like mycotoxins. The genes involved in the biosynthetic pathway of these metabolites are known for several mycotoxins. The study of the expression of certain key genes in these metabolic pathways has proven to be a great early indication tool to assess potential risk and is currently helping to develop research with regard to how environmental, physical and chemical factors influence the toxins production at molecular level.

In this 5 days course we will provide two essential routes:
(1) Food mycology and mycotoxins
(2) Molecular Biology-food spoilage diagnostics

There will be a common part during the first 2 days of the course which aims to provide advanced training in theoretical and practical ways to identify, understand the ecology of spoilage moulds and the production of mycotoxins. Then the group will divide in two subgroups: (1) those interested on more advance and detailed information on fungal spoilage and the development of control strategies and (2) development of skills in molecular techniques to evaluate the presence of spoilage fungi in food products and use of q-PCR techniques to evaluate gene expression.
In both cases, the course will include practical and hands on experience.



Key learning objectives

To provide:

- A thorough understanding of the ecology and physiology of spoilage yeasts and filamentous moulds in key food chains responsible for quality loss.

- Methods for identifying spoilage moulds including macroscopic, microscopic and scanning EM approaches.

- Preservation systems and their assessment for controlling spoilage moulds and mycotoxin production.

- Control strategies using HACCP and hurdle technology approaches for improving shelf-life.

- Obtain practical experience in addressing these issues with hands on practical work including growth modelling and mycotoxin analyses.

- Understand and obtain practical experience on the use of molecular biology techniques for the study of fungal spoilage.

Objectives/Learning Outcomes /Competences

On successful completion of the course the participants should be able to have:

1. A detailed knowledge of key groups of spoilage moulds responsible for contamination of key food chains.

2. An understanding of the importance of spoilage mould identification, their ecology and their ability to produce mycotoxins.

3. The capability to integrate different types of knowledge and thinking on mould spoilage of food ingredients and food products in the entire supply chain.

4. A conceptual awareness of the importance of fungal ecology and mycotoxins and their risks in key food chains and the impact they have on food safety and quality.

5. Knowledge of how to develop a HACCP management plan and identify the CCPs relevant to different food production chains.

6. Apply the approaches to industrial food production processes.

7. Practical approaches to examining preservation effects on spoilage moulds and the quantification of mycotoxins.

8. Understanding and practical approaches to the use molecular techniques including PCR and q-PCR.

9. Study the gene expression of important key genes involved in the biosynthetic pathway of mycotoxins.

The handbook on Food Mycology as well as all necessary stationary will be provided to all course participants as a pack at Registration.
At the end of the course a Certificate of Attendance will be given to all registered attendees. The Certificate will be signed by the Department Director and countersigned by the lecturers.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Syllabus/Range of Topics

This short course is tailored to include both interactive lectures and practical hands on training. Lectures on Fungal ecology, environmental conditions and microbial growth concepts, fungal contamination in different food chains (beverages, cereals, coffee, nuts); heat resistant moulds, ecology of mycotoxigenic moulds in food chains; legislative drivers for mycotoxin control; aerobiology in factory environments; HACCP management tools and group case studies; Practical and demonstration work; Case studies; Group work; use of different tools including scanning EM for identification; fluorescence methods for control of spoilage; mycotoxin analyses; ecology and growth modelling of key spoilage moulds.
In the molecular biology subgroup, you will have interactive sessions covering extraction of nucleic acids, checking of nucleic acid quality, quantity, and integrity and DNA/RNA amplification and results analysis.

Questions like:
Which fungal population do I have? Do they have the capacity to produce mycotoxin? If so, how can I monitor their production? will be answered in this route.

We will start with a reminder of the basics of molecular biology before going into a deeper understanding of how we can apply them to Food spoilage diagnostics.


Aspergillus flavus


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Set Up Run
Sign In
New Method
Open Method
Incubate
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Topics to be covered

1. Introduction – food mycology do we know enough??

2. Beverage/yeast spoilage/heat resistant fungal spores and problems in beverages.

3. Mycotoxins: their importance in different food chains.

4. Mycotoxins: regulations and sampling issues.

5. HACCP: Principles and Critical Control Point determination; Group case studies.

6. Prevention strategies for mycotoxigenic fungi.

7. Modelling fungal growth.

8. Climate change impacts on moulds/mycotoxins: do we know enough?

9. Analysis and rapid diagnostics – traditional vs. modern approaches.

10. Factory environment – mould problems – aerobiology measurements.

11. Hands on practical work with spoilage moulds including identification using Scanning EM and other microscopic techniques.

12. Examination of food products to understand the relationship between ingredients and relative shelf life of different products (e.g. 1 week to 23- months).

13. Practical experience of the importance of environmental factors/preservatives on spoilage /mycotoxigenic moulds and relative mould counts in different products.

14. Demonstration sessions for food spoilage moulds: including mycotoxin analyses.

15. Basic understanding on DNA and RNA structures in fungi. Concept of gene clusters for secondary metabolites production. Identification of main genes related with mycotoxin production.

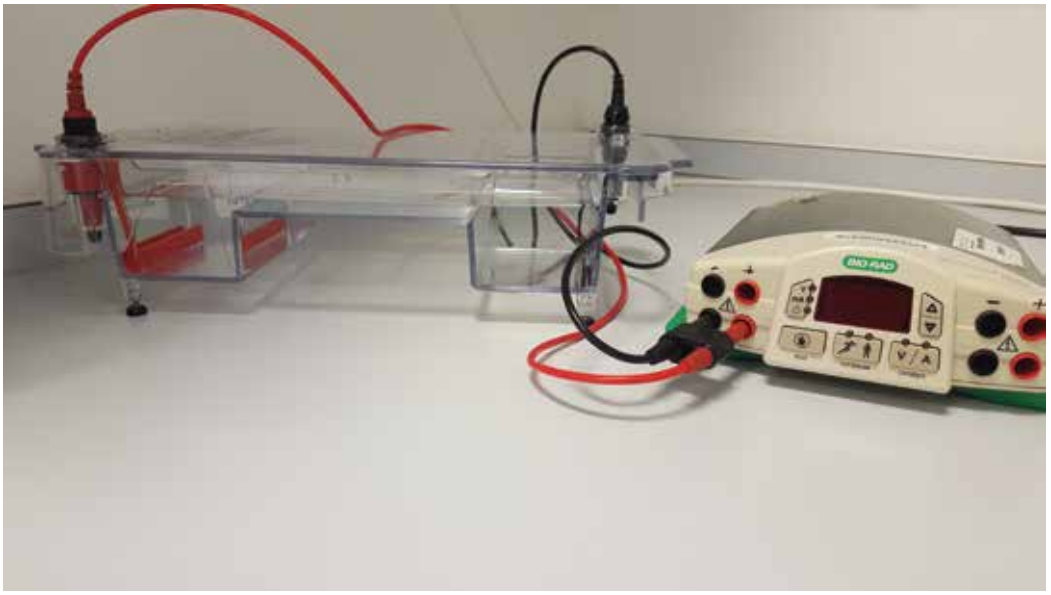
16. Use and analysis using PCR techniques to identify important food spoilage fungal species.

17. Analyse the gene expression of genes involved in the biosynthetic pathway of mycotoxins and integrate knowledge to understand the potential use in control strategies.

Pre-requisite

For the Fungal Ecophysiology route no prerequisites are needed. An interest in the field of food spoilage and minimization / prevention strategies in food/feed production chains. Those involved in food safety management will benefit from this .course

The Molecular Biology would require attendees to have some basic previous knowledge about molecular biology and a clear understanding of fungal ecology and physiology. Those who have attended the Fungal Ecophysiology course in previous .years would be a great starting point for the molecular diagnostics components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Lecturers

Prof. Naresh Magan DSc. (Cranfield University, Bedfordshire, UK) 30+ years of experience working on spoilage moulds, mycotoxins and prevention strategies. Prof. Magan has published 275+ research papers and is an international authority on this subject. He is a member of the International Commission for Food Mycology.

Dr. Angel Medina (Cranfield University, Bedfordshire, UK). He is Lecturer in Food Mycology with 13+ years' experience in working on mycotoxins, analysis and prevention strategies. Dr Medina has published 60+ research papers on food spoilage, mycotoxins and analyses of toxic secondary metabolites.

Dr. Carol Verheecke (Cranfield University, Bedfordshire, UK). Dr Verheecke has a background in microbiology and molecular biology. She has 6 years' experience in the study of the impact of environmental parameters on mycotoxins biosynthesis and their associated gene expression. She has a wealth of experience in molecular ecology, PCR, q-PCR and their application for diagnostics in the food safety context.

Mr. Ghanim Aalthani (DARIS Centre at the University of Nizwa), Nizwa, Sultanate of Oman, 8 years' experience in analytical chemistry (chromatography & spectroscopy

Work Load

Lectures:	12
Practical hands on training:	19


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RESEARCH &TECHNOLOGY DEVELOPMENT

Date:
Sunday 15 th of April to Thursday 19 th of April 2018

Venue:
Lecture theatre: DARIS Centre/ Building 26, Univrsity Of Nizwa

Microbiology Laboratory: DARIS Centre/ Building 26, University of Nizwa.

Fee:
R.O 1000 per participant.

FOOD MYCOLOGY: TIMETABLE FOR THE COURSE

Day	Sunday	Monday	Tuesday	Wednesday	Thursday
Date	15th April	16th April	17th April	18th April	19th April
9:15-10:00	Moduleispoilage ntroduction to fungi in food (NM) introduction	CCPs: How to identify them and implement HACCP approaches (NM)	Mycotoxins (NM)	Molecular Biology Applied to Fungi & Mycotoxins assessment. I (CV)	Food Mycology Groups: Food products: ingredients, shelf life and preservation techniques – + Measurements in groups (NM, AM) Molecular biology groups: PCR and qPCR practical session (CV)
	Coffee/refreshments	Coffee/ refreshments	Coffee/refreshments	Coffee/refreshments	Coffee/refreshments
10:15-11:00	Beverages : yeast spoilage+ heat resistance spores (NM)	Group work: HACCP: Flow diagrams and identifying CCPs (NM/AM)	Hurdle technology and prevention strategies (NM)	Molecular Biology Applied for Fungi & Mycotoxins assessment. II (CV)	Practical sessions continued (NM, AM, CV)
11:00-12:00	Introduction to HACCP (NM)	General introduction to molecular Biology. (1) CV	Mycotoxins: Regulations and sampling issues (AM)	Molecular Biology Applied for Fungi & Mycotoxins assessment. III (CV)	Practical sessions continued (NM, AM, CV)
1:00-2:00	Lunch	Lunch	Lunch	Lunch	Lunch
2:00-3:00	All Groups: Ecological studies – inoculation of environmental -preservative media	Divided Groups: Food Mycology Groups: p work: Measurement of ecological experiments fungi in the lab + scanning EM of fungi	Food Mycology Groups: measurements of colonies and examination of mycotoxigenic fungi Molecular biology Groups: Extraction of DNA and RNA	Food Mycology Groups: Measure ecology experiments and check enumeration results (NM, AM) Molecular biology Groups: CR and qPCR practical session (CV)	All Groups Analyses of ecological data; shelf-life of products and molecular data (NM, AM,CV)
	Coffee/tea	Coffee/tea	Coffee/tea	Coffee/Tea	Coffee/Tea
3:00-5:00	Enumeration of fungal populations using serial/direct plating of food commodities. Air sampling (NM, AM, CV)	Molecular Biology Groups: Extraction of DNA and RNA (CV, AM)	Food Mycology Groups: measurements of colonies and examination of mycotoxigenic fungi Molecular biology Groups: Extraction of DNA / RNA (CV, AM)	Food Mycology Groups: Complete measurements and examples of how to plot data (NM, AM) Molecular Biology Groups: PCR and qPCR practical session (CV)	Wrap up session and final conclusions of the course: theoretical and practical considerations (NM/AM/CV)

Lecture

Practical session

NM: Prof. Naresh Magan; AM: Dr. Angel Medina; CV: Dr. Carol Verheecke

For More Details

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For Registration

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