

Syllabus

Course description

Course title	Reaction kinetics in food processing
Course code	44740
Scientific sector	AGR/15
Degree	Food Sciences for Innovation and Authenticity
Semester	II
Year	I
Academic year	2021/2022
Credits	6
Modular	No

Total lecturing hours	36
Total exercise hours	48
Attendance	Yes
Prerequisites	Use of spreadsheet
Course page	

Specific educational objectives	<p>Aims</p> <p>The course aims to provide specific skills to analyze the chemical, physical or biological changes occurring to foods during processing or storage. The course is mainly focused on data analysis and model building. Thanks to the extensive use of spreadsheets, the students will be able to model experimental data, derive and select the most appropriate kinetic model and evaluate the overall effect of the process on food quality. A number of practical problems of great relevance for the food industry will be discussed and analyzed, including storage stability, shelf-life estimation, fermentation, lipid oxidation and browning reactions.</p> <p>Educational objectives:</p> <ol style="list-style-type: none"> 1) the student is able to describe the theory of reaction kinetic and what is behind the main reactions discussed during the course. 2) given a set of kinetic models, the student is able to comprehend the type of reaction, the rate constant, the reaction order, the rate of change and the main variables. 3) given the description of a specific storage or processing situation, the student is able to identify the most important reactions that may occur, describing the theory governing those reactions and identifying the key element to control them. 4) given a set of experimental data, the student is able to derive the best kinetic model, analyze the
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	situation, describe the appropriate procedure to report the solution to the problem, predict the changes occurring to foods.
Lecturer	Matteo Mario Scampicchio
Scientific sector of the lecturer	AGR/15
Teaching language	English
Office hours	18
Teaching assistant (if any)	
Office hours	
List of topics covered	<p>1) Introduction to reaction kinetic <i>Stability and shelf life problems in food processing, practical use of kinetic analysis, theory of reaction rates in solutions, effect of temperature, main mechanisms and rate laws.</i></p> <p>2) Application of reaction kinetics to the study of chemical, biochemical and physical changes in foods <i>Maillard reactions, vitamin loss, thermal microbial destruction, fermentation kinetics, enzyme kinetics, autoxidation and radical chain reactions, role of antioxidants.</i></p> <p>3) Modelling of kinetic data <i>Estimation of linear models, uncertainty estimation, propagation of errors, numerical methods for non-linear models</i></p>
Teaching format	Frontal lectures, exercises, labs, projects

Learning outcomes	<p>The learning outcomes are:</p> <p>Knowledge and understanding The student will gain principles and theoretical basis of chemical kinetic theory and the main reactions occurring to food during processing and storage.</p> <p>Applying knowledge and understanding The student will be able to apply the theoretical knowledge of reaction kinetics on practical problems occurring to foods. The student will learn how to fit rate laws to experimental data and validate the results by using spreadsheets and numerical methods.</p> <p>Making judgements The student will be able to derive, analyze and compare the rate of reactions and make judgments on the main factors that can affect them.</p>
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	<p>Communication skills The student will develop skills to analyze and evaluate the rate of change of relevant reactions occurring to foods during their processing and storage.</p> <p>Learning skills During classes, the student will learn how to solve kinetic problems by means of spreadsheets, graphics and numerical approaches.</p>
Assessment	The assessment is based on a final written test.
Assessment language	English
Evaluation criteria and criteria for awarding marks	<p>The evaluation consists of:</p> <ul style="list-style-type: none"> written test <p>Criteria for the written test:</p> <ul style="list-style-type: none"> The test will be based on numerical questions. The students must answer correctly, taking in consideration the accuracy of the results and the estimated uncertainty, the figure of merits and unit of measurement. The test will be based also on questions related to the theory of reaction kinetic.
Required readings	<p>During the lectures, students will receive slides for the general theories and electronic spreadsheets for the numerical applications.</p> <p>Earle, R. Earle ,M., Fundamentals of Food Reaction Technology (free version online at the following link: www.nzifst.org.nz/foodreactiontechnology/index.htm)</p>
Supplementary readings	<p>Kinetic Modeling of Reactions In Foods Martinus A.J.S. van Boekel (ISBN 9781574446142)</p>