



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2020/2021
MASTER'S DEGREE (MSC)	CHEMICAL ENGINEERING
SUBJECT	PACKAGING FOR THE FOOD INDUSTRY
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50352-Ingegneria chimica
CODE	20918
SCIENTIFIC SECTOR(S)	ING-IND/22
HEAD PROFESSOR(S)	BOTTA LUIGI Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	108
COURSE ACTIVITY (Hrs)	42
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	FOOD PRODUCTS PACKAGING - Corso: IMPRENDITORIALITA' E QUALITA' PER IL SISTEMA AGROALIMENTARE FOOD PRODUCTS PACKAGING - Corso: FIRM AND QUALITY FOR THE AGRICULTURAL AND FOOD SYSTEM
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	BOTTA LUIGI Monday 15:00 17:00 Ufficio (Ed. 6, terzo piano) Thursday 15:00 17:00 Ufficio (Ed. 6, terzo piano)

DOCENTE: Prof. LUIGI BOTTA

PREREQUISITES	General knowledge of chemical structure and chemical properties of materials.
LEARNING OUTCOMES	Knowledge and understanding: Knowledge of processing methods and technological properties of the materials used for food packaging applications. Knowledge of the main food packaging technologies. Applying knowledge and understanding: Ability to choose the most suitable materials and appropriate packaging systems for each type of food product, depending on the specific characteristics of the product and of its shelf life. Making judgements: After completing the teaching course, the student will be able to critically evaluate the suitability of a material for food packaging applications. Moreover, the student will be able to choose sustainable packaging, taking into account the environmental impact and the cost-benefit analysis. Communication: The student will acquire the capability to communicate and express problems inherent the course topics. The student will be able to highlight questions related to the preparation and processing of different materials, exposing the information in an adequate technical language. The student will also be able to expose the results of a scientific research, to propose suitable materials and packaging systems and to explain eventual project plans connected with them. Lifelong learning skills: At the end of the course, the student will have learnt how to choose the most suitable material for the packaging of a specific food product, by evaluating properties and functions. The learned skills in this course will allow to have the awareness to be able to make supported choices when realizing potential projects.
ASSESSMENT METHODS	The evaluation will be based on a written test consisting containing 4 questions to be answered openly on topics described during the teaching classes. It aims to assess the competences and the knowledge learnt during the course. The test duration is two hours. The questions will verify: acquired knowledge; elaboration capability; talking capability; ability to build autonomous connections not bound to the referring textbooks; capability to produce autonomous evaluations inherent the course topics; capability to understand the applications connected with the discipline areas; capability to connect the discipline topics with the referring professional and technological context. The final assessment is on a 30 basis according to the criteria reported below: 30-30+: excellent knowledge of the topics, excellent language and vocabulary, good analytical capability, the student is able to apply knowledge to solve the proposed problems; 26-29: Good management of the topics, nice language and vocabulary, the student is able to apply knowledge to solve the proposed problems; 24-25: basic knowledge of the topics, fair language and vocabulary, limited capability to apply autonomously knowledge to solve the proposed problems; 21-23: the student does not show full management of the main topics while possessing the knowledge, satisfactorily language and vocabulary, poor capability to apply autonomously the acquired knowledge; 18-20: minimal basic knowledge of the main topics and of the technical language and vocabulary, poor or no capability to apply autonomously the acquired knowledge. The exam will be not passed if the student will show a not acceptable knowledge of the topics.
EDUCATIONAL OBJECTIVES	The aim of the course is to provide a multidisciplinary approach to the knowledge of materials and of packaging systems for food products, in order to fully understand all the problems regarding the food packaging and design the best solutions in accordance with current standards, benefit–cost ratio and a sustainable development. In the first part of the course, it will be provided the rudiments of material science and technology, which are required to describe physical and chemical properties of materials and the related packaging systems. Thereafter, it will be studied the issues and the technologies related to processing methods of materials used for food packaging applications and the manufacturing of food packages. Finally, it will be studied the food packaging technologies aimed for extending the shelf life of packaged food products. For this purpose, some theoretical aspects of shelf life are described in order to provide the knowledge useful to improve the preservation of packaged food.
TEACHING METHODS	Lectures.
SUGGESTED BIBLIOGRAPHY	L. Piergiovanni, S. Limbo. "Food packaging. Materiali, tecnologie e qualita' degli alimenti", Springer-Verlag Italia (2010). R. Coles, D. McDowell. M. Kirwan, editors. "Food Packaging Technology", Blackwell Publishing, Oxford, UK (2003). D. Sun Lee, K. L. Yam, L. Piergiovanni. "Food Packaging Science and Technology", CRC Press, Taylor & Francis Group, New York.

SYLLABUS

Hrs	Frontal teaching
2	Introduction. Terminology. Goals and characteristics of food packaging. Food packaging statistics.
2	Physical properties of food packaging materials. Surface properties. Thermal properties. Mechanical properties. Electromagnetic properties.

SYLLABUS

Hrs	Frontal teaching
5	Barrier properties of food packaging materials. Gas and water vapour permeation. Migration from packaging to foods. Legislation on materials and articles intended to come into contact with food.
3	Glass and glass packaging. Glass composition. Glass manufacture. Chemical and physical properties of glass. Glass container manufacture. Surface treatments of glass containers.
4	Metals and metal packages. Aluminium. Tinplate and other coated steels. Stainless steels. Properties of metals. Metal cans and can-making processes.
3	Paper and paperboard packaging. Cellulosic fibres. Corrugated cardboard. Coated cardboard. Pulp molded. Cellophane. Package types.
7	Plastics food packaging. Introduction to polymeric materials. Properties of polymers. Modification of polymers. Types of plastics used for food packaging applications. Processing methods of thermoplastic polymers and manufacture of plastics packaging.
3	Biopolymers and biopolymeric food packaging. Introduction to biopolymeric materials. Properties of biopolymers. Processing methods of biopolymers and manufacture of biopolymeric packaging.
3	Flexible multilayer food packaging. Manufacture of multilayer packaging. Liquid packaging cartons. Barrier properties of multilayer packaging.
3	Packaged product quality and shelf life. Factors affecting product quality and shelf life. Role of packaging.
3	Modified atmosphere packaging (MAP). Vacuum Packaging. Main gases used in MAP.
4	Active and intelligent packaging.