

《食品分析》课程教学大纲

课程基本信息 (Course Information)					
课程代码 (Course Code)	FS338	*学时 (Credit Hours)	32	*学分 (Credits)	2
*课程名称 (Course Name)	食品分析 Food Analysis				
课程性质 (Course Type)	专业必修课 (Professional compulsory course)				
授课对象 (Audience)	食品科学与工程专业本科生 (Undergraduates major in Food Science and Engineer)				
授课语言 (Language of Instruction)	中英双语 (Chinese-English Bilingual Course)				
*开课院系 (School)	农业与生物学院 (School of Agricultural and Biological)				
先修课程 (Prerequisite)	有机化学、无机化学、分析化学及食品化学 (Organic Chemistry, Inorganic Chemistry, Analytical Chemistry and Food Chemistry)				
授课教师 (Instructor)	宋立华 Song Li-Hua	课程网址 (Course Webpage)			
*课程简介 (Description)	<p>食品分析是一门具有较强理论性和实践性的学科，是食品科学与工程本科专业的重要专业必修课程。本课程具有较强的实践性和应用性，教学内容主要讲授食品分析的一般过程、国标（际）方法的基本原理、特点、具体应用及如何提高分析结果的准确性和精密度。从课程内容上主要分为概论、样品的采集、制备及预处理、食品分析方法（包括物理检验法、化学及仪器分析方法）及上述方法在食品营养成分、食品化学安全分析中的应用四个模块，同时简要介绍前沿的样品前处理方法和分析技术。为更好地帮助学生理解新技术、新方法及仪器分析部分相关内容，课程部分内容采用多媒体辅助教学手段。</p> <p>通过本课程及食品分析实验课程的学习，使学生初步了解分析检测的理论体系和食品分析检验方法，培养和提高学生的实验操作能力，也为学生今后在食品生产企业、食品质量监管、进出口检验检疫及疾病预防与控制中心等领域从事分析相关工作奠定良好的理论基础。</p>				

<p>*课程简介 (Description)</p>	<p>Food Analysis is an important professional compulsory course for the undergraduates major in Food Science and Engineering. It mainly introduces the general process of food analysis, basic principle, characteristics, application of national (international) standard analysis method and how to improve the accuracy and precision of analytical results. Specifically, the course contents are divided into four parts: introduction, sampling methods, sample preparation and pretreatment, food analysis methods (including physical, chemical as well as instrumental analysis methods) and the application of these methods in the analysis of food nutrition components and food chemical safety. In addition, to help the students better understand the new food analysis technology, the multimedia -assisted means will be applied in teaching process.</p> <p>Students would grasp the basic food analysis theory and methods via learning this course. The aim of the course is to cultivate and improve the students' practical operating ability, and lay good foundation for their future working career related with analysis in the fields of food production industry, inspection and quarantine of import and export food products, the supervision and administration of food quality (FDA) and the centers for disease control and prevention agency (CDC), etc.</p>
<p>课程教学大纲 (Course Syllabus)</p>	
<p>*学习目标 (Learning Outcomes)</p>	<ol style="list-style-type: none"> 1. 掌握无机、分析及有机化学实验操作、计算机在食品科学及相关学科领域的应用等基本技能 (A5.1.2) 2. 掌握科学实验 (研究) 的基本方法论 (A5.1.3) 3. 掌握食品科学的知识体系, 包括无机化学、有机化学、生物化学、食品化学、食品微生物学、食品工程原理、食品机械与设备、食品分析、食品营养与功能、食品添加剂、食品安全学、食品工艺学、食品质量管理与法规等内容 (A5.2.1) 4. 掌握必要的食品科学实验技能以及相关的实验数据处理和分析方法 (A5.2.2) <ol style="list-style-type: none"> 1. To master the experiment skills related with Inorganic, Organic and Analytical Chemistry, as well as the computer application in the field of Food Science and related disciplines (A5.1.2). 2. To master the basic methodology of scientific research (A5.1.3). 3. To master the knowledge frameworks of Food Science, including Inorganic Chemistry,

	<p>Organic Chemistry, Biochemistry, Food Chemistry, Food Microbiology, Principle of Food Engineering, Food Machinery, Food Analysis, Food Nutrition and Functional Food, Food Additives, Food Security, Food Technology, Food Quality Management and Regulations, etc. (A5.2.1)</p> <p>4. To master the necessary experiment skills related Food Science and application of data statistical analysis method (A5.2.2)</p>					
<p>*教学内容 进度安排及要求 (Class Schedule & Requirements)</p>	<p>教学内容 Main contents</p>	<p>学时 Class hour</p>	<p>教学方式 Teaching method</p>	<p>作业及要求 Home work and requirements</p>	<p>基本要求 Basic requirements for the course</p>	<p>考查方式 Assessme nt</p>
	<p>第一部分 绪论和基本知识 食品分析的研究内容、研究进展和发展趋势； 简要介绍新食品分析技术 The research content, progress and the future trends of food analysis technology; brief introduction of the new food analysis technology</p>	<p>2</p>	<p>讲授为主 结合讨论 Lecture and discussion</p>	<p>查阅文献, 要求学生了解食品快速分析方法研究进展 Students are required to know some fast food analysis method through looking up references</p>	<p>学生应熟悉食品分析的研究内容, 从整体上理解本课程在实际工作中的重要作用 Students should be familiar with the research area of food analysis, and its important role in the food quality management, control and</p>	

					the study of food science	
	<p>第二部分 采样、样品制备和预处理</p> <p>采样；采样原则；采样方法；采样数量；食品样品的保存；常用经典的样品前处理方法，包括无机化法、溶剂提取法、色谱分离法、磺化法、皂化法及蒸馏法等，介绍较新的快速样品前处理方法，如微波辅助萃取、超声波萃取、CO₂超临界萃取及固相微萃取等</p> <p>Conception of the sampling; the principle, method and amount of the sampling; the</p>	2	<p>讲授为主，辅以视频多媒体教学，使学生了解采样操作及样品前处理技术</p> <p>Lecture and multimedia assisted teaching</p>	<p>查阅英文文献，写阅读报告，要求学生了解新的样品前处理方法在食品功能性成分分析中的应用</p> <p>Students are required to understand the application of some new preparation method in the analysis of functional components in food</p>	<p>学生应掌握正确采样的重要性、正确采样的一般方法、样品前处理的方法及其应用，熟悉样品前处理的最新方法及其应用</p> <p>Students should master the importance of correct sampling and sampling method; sample preparation method and the application, familiar with some new sample preparation</p>	<p>阅读报告</p> <p>Paper reading report</p>

	<p>preservation of food sample; classical sample preparation methods including digestion, extraction, chromatography, chemistry and distillation method etc.</p> <p>Some new sample preparation methods including microwave assisted extraction, supersonic extraction, supercritical CO2 extraction and solid-phase micro-extraction</p>				<p>methods and application</p>	
	<p>第三部分 食品的物理检验</p>	<p>2</p>	<p>讲授为主 Lecture</p>	<p>查阅文献,了解实际生产</p>	<p>学生应掌握食品分析密</p>	

	<p>法</p> <p>相对密度法、折光法、旋光法的原理和实际应用;简要介绍食品热分析技术</p> <p>The principle of relative density , refraction and optical analysis method and the application in food quality analysis; briefly introduce thermal analysis application</p>			<p>和品质控制中物理检验法的基本应用情况</p> <p>Students are required to know the practical applications of physical analysis method via reading paper</p>	<p>度法、折光法、旋光法的实际应用</p> <p>Students should master the practical applications of physical method including densimetry, refractometry and polarimetry</p>	
	<p>第四部分 仪器分析方法</p> <p>(一) 原子吸收分光光度法的基本原理、原子吸收分光光度计的主要组成部件、原子吸收分光光度法存在的干扰,原子吸收</p>	4	<p>讲授为主,以小组为单位完成大作业的基础上以小组展示ppt形式讨论食品中铅、汞、砷、镉等重金属的分析检测</p> <p>Lecture and</p>	<p>小组查阅文献,总结并汇报食品中铅、汞、砷、镉等重金属的分析检测方法</p> <p>及特点</p> <p>Group work: Summarize the analysis methods of</p>	<p>学生应掌握原子吸收分光光度法的基本原理、分析条件的确定及具体应用,熟悉AAS及ICP-AES仪器的基本构成</p> <p>The basic</p>	<p>小组ppt汇报</p> <p>Group presentation and discussion</p>

	<p>定量方法及仪器分析条件的确定; 扩展介绍原子发射光谱法</p> <p>The basic principle of atomic absorption spectrophotometry;</p> <p>the main components of atomic absorption spectrophotometer;</p> <p>Interference in atomic absorption spectroscopy analysis;</p> <p>quantitative analysis methods;</p> <p>optimization of the AAS operating conditions;</p>		<p>group presentation about the summary of analysis methods on heavy metals including Pb, Hg, As, Cd, etc</p>	<p>Pb, Hg, As and Cd in food</p>	<p>principle of AAS; the application and the establishment of analysis condition of the instrument;</p> <p>familiar with the basic components of AAS and ICP-AES instruments</p>	
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	introduction of ICP-AES					
	<p>第四部分 仪器分析方法 (二) 气相色谱法的基本原理、气相色谱仪的主要构成、定性定量方法及仪器分析条件的确定； 气相色谱法在脂肪酸及农药残留分析中的应用</p> <p>The basic principle of gas chromatography (GC); the main components of gas chromatography ; the qualitative and quantitative method of GC; the establishment of the optimal analysis</p>	4	讲授为主 Lecture	<p>查阅文献和教材,总结气相色谱分析方法在食品营养及食品化学安全分析中的应用</p> <p>Summarize the application of GC in the food nutrition components and food chemical safety analysis via reading the paper and the related chapter in textbook</p>	<p>学生应掌握气相色谱分析方法的基本原理、仪器分析条件的确定,熟悉各种仪器的基本构成,熟悉仪器分析技术在食品营养及食品化学安全分析中的应用</p> <p>Students should master the basic principle of GC analysis method, its application and the establishment of analysis condition of the instrument;</p>	<p>阅读报告 Paper reading report</p>

	<p>conditions of instrument; the application of GC on the analysis of fatty acids and the pesticide residues</p>				<p>familiar with the basic components of the instruments, familiar with the application of GC in the analysis of food nutrition and food chemical safety control</p>	
	<p>第四部分 仪器分析方法 (三) 高效液相色谱法的基本原理、 高效液相色谱仪的主要构成、 定性定量方法及仪器分析条件的确定; 高效液相色谱法在食品防腐剂、色素等添加剂中的应用 The basic</p>	4	<p>讲授为主 Lecture</p>	<p>查阅文献和教材, 总结高效液相色谱分析方法在食品营养及食品化学安全分析中的应用 Summarize the application of HPLC in the food nutrition components and food</p>	<p>学生应掌握高效液相色谱分析方法的基本原理及仪器分析条件的确定, 熟悉各种仪器的基本构成, 熟悉仪器分析技术在食品营养及食品化学安全分析中的实际应用 Students</p>	<p>阅读报告 Paper reading report</p>

	<p>principle of high performance liquid chromatography (HPLC); the main components of HPLC instrument; the establishment of the optimal analysis conditions of instrument; the application of HPLC in the analysis of preservatives and food colorants</p>			<p>chemical safety analysis through reading the paper and the related chapter in textbook</p>	<p>should master the basic principle of HPLC analysis method, its application and the establishment of analysis condition of the instrument; familiar with the basic components of the instruments and the application of HPLC in the analysis of food nutrition components and food chemical safety control</p>	
	<p>第四部分 仪器分析方法</p>	<p>2</p>	<p>讲授为主，辅以视频多</p>		<p>学生应掌握荧光分光光</p>	

	<p>(四) 荧光分光光度法的基本原理, 定性、定量方法和应用; 薄层色谱法</p> <p>The basic principle of fluorescence spectrophotometry; the qualitative and quantitative methods and applications in food analysis.</p> <p>Brief introduction of thin layer chromatography (TLC)</p>		<p>媒体教学</p> <p>Lecture and multimedia assisted teaching</p>		<p>度法和薄层层析的基本原理、定性、定量方法及其在食品分析中的应用</p> <p>Students should master the basic principle and the qualitative and quantitative methods of fluorescence spectrophotometry and TLC, as well as their applications in food analysis</p>	
	<p>第五部分 食品</p> <p>水分的测定: 水分分析的实际意义和应用。介绍水分常规测定方法, 包括:</p>	1.5	<p>讲授为主 结合讨论</p> <p>Lecture and discussion</p>		<p>学生应掌握水分测定各种方法的适用范围、误差来源及消除方法; 了解水分快速测定</p>	

	<p>常压干燥法、真空干燥法、卡尔·费休法、蒸馏法的基本原理、方法适用范围;如何提高分析的精确度;简要介绍水分快速测定方法</p> <p>The significance of the moisture analysis and its application; moisture analysis methods, including oven drying, Karl Fischer and distillation method; the principles and application range of these methods; how to improve the accuracy of the moisture</p>				<p>方法</p> <p>Students should master the moisture determination methods and the application range of each methods, error sources and the eliminate methods; know the rapid moisture determination method</p>	
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	analysis; Brief introduction of rapid moisture determination methods					
	<p>酸度的测定: 酸度分析的实际意义和应用。有效酸度、总酸度及牛乳的真实酸度的概念及其测定方法</p> <p>Concept of acidity, total acidity (TA), active acidity (pH), volatile acidity;</p> <p>practical application of acidity assay</p>	1.5	讲授为主 Lecture		<p>要求学生掌握酸度的概念和实际应用, pH 计的正确使用和维护</p> <p>The students are required to master the concept of acidity and the its application in food quality control;</p> <p>familiar with the usage and maintenance of pH meter</p>	
	<p>灰分的测定: 灰分分析的实际意义和应用; 粗灰分、水溶性灰分和酸不溶性</p>	1.5	讲授为主 Lecture		<p>学生应掌握粗灰分、水溶性灰分和酸不溶性灰分的相关概念、</p>	

	<p>灰分的概念及意义；粗灰分、水溶性灰分和酸不溶性灰分的测定方法,如何提高实验数据的准确度和精密度</p> <p>Importance of ash analysis; definition of crude ash, water-soluble ash and acid-insoluble ash and their determination process; how to improve the accuracy and precision of ash analysis result</p>				<p>其分析意义及分析方法</p> <p>The students are required to master the concepts of crude ash, water-soluble ash and acid-insoluble ash, the determination methods and the application of ash assay in some of the food quality control</p>	
	<p>脂肪的测定及油脂质量分析：结合食品中脂肪的形态及测定方法介绍粗脂肪和总脂肪的概念；针对不</p>	2	<p>讲授为主 结合讨论</p> <p>Lecture and discussion</p>		<p>理解并掌握粗脂肪和总脂肪的概念及相应的测定方法；掌握索氏法、酸性乙醚法、碱性</p>	

	<p>同食品类型,介绍索氏抽提法、罗兹-哥特里法、巴布科克法和盖勃法等脂肪测定方法及各方法适用范围;介绍脂肪的快速测定方法:油脂酸价、过氧化值、碘价、皂化价及羰基价的概念及其在油脂质量评价中的应用</p> <p>Concepts of crude fat and total fat; the principle of lipid analysis methods, including Soxhlet Method; acid hydrolysis method; alkaline hydrolysis method,</p>				<p>乙醚法(罗兹-哥特里法)、氯仿-甲醇法及巴布科克法和盖勃法的适用范围,并能针对不同的食品选用合适的分析方法;熟悉油脂酸价、碘价、皂化价、过氧化值及羰基价的概念和应用</p> <p>The students are required to master the principle, characteristics and application of each method, and know how to select the suitable method for the analysis of the lipids</p>	
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	<p>chloroform-methanol method, Babcock and Gerber method, as well as the characteristics of above methods; the evaluation of oil quality including the analysis of acid value, saponification value, iodine value, peroxide value, and TBA (Thiobarbituric Acid) test</p>				<p>content in different types of food; familiar with the concepts of acid value, saponification value, iodine value, peroxide value and TBA value, and the analysis methods of oil quality control</p>	
	<p>碳水化合物的测定; 碳水化合物的分类; 还原糖的提取; 还原糖的测定方法 (包括: 滴定法、比色法和酶比色法), 此为这部分重点讲述内容之一; 简</p>	2.5	<p>讲授为主 Lecture</p>		<p>熟悉还原糖、淀粉和膳食纤维分析检测的前处理方法; 掌握碱式铜盐滴定法的基本原理及该方法特点, 重点掌握国标方法</p>	

	<p>要介绍双糖、总糖和可消化多糖淀粉的测定；可溶性和不溶性膳食纤维的分析为本部分的重点内容之二；简要介绍果胶物质的分析测定</p> <p>The categories and characteristics of different carbohydrates; the brief introduction of methods used in different carbohydrate analysis; general sample preparation process and the analysis methods of reducing sugar; briefly introduce the</p>				<p>---直接滴定法；熟悉碳水化合物测定的苯酚-硫酸法的原理及具体应用；理解还原糖测定在双糖、总糖及淀粉测定中的应用；掌握可溶性和不溶性膳食纤维的测定方法；了解果胶物质的提取及测定方法</p> <p>The students are required to master the analysis methods of reducing sugar , especially direct titration method; familiar with other methods</p>	
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	<p>analysis of sucrose and starch; the analysis of dietary fiber; briefly introduce the analysis of pectin</p>				<p>used in reducing sugar determination ; understand the application of reducing sugar analysis method in sucrose, oligosaccharide and starch determination ; master the analysis of dietary fiber; familiar with the sample preparation method for different types of carbohydrate</p>	
	<p>蛋白质的测定：凯氏定氮法、凯氏定氮法测定蛋白质的误差来源及消除方</p>	1.5	<p>讲授为主 结合多媒体 视频了解奶粉中三聚氰胺的 HPLC</p>		<p>掌握凯氏定氮法测定蛋白质；掌握氨基酸总量和分离测定方</p>	

	<p>法; 比色法快速测定蛋白质; 杜马斯燃烧法测定蛋白质; 滴定法和比色法测定总量氨基酸; 简要介绍氨基酸分析仪</p> <p>Kjeldahl method and the source of errors of this method; fast detection methods of protein assay; Dumas combustion method; the analysis methods of total amount as well as isolation and quantification of amino acids</p>		<p>分析方法</p> <p>Lecture and multimedia assisted teaching</p>		<p>法; 熟悉杜马斯燃烧法测定蛋白质; 了解氨基酸分析仪的工作原理</p> <p>The students are required to master Kjeldahl method; familiar with Dumas combustion method; master total amino acids analysis method and the application of GC and HPLC methods in amino acids analysis; understand the principle of amino</p>	
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					acids analyzer	
	<p>维生素的测定： 维生素分类及其性质。脂溶性维生素和水溶性维生素的样品前处理方法；仪器分析方法，尤其是 HPLC 法在维生素分析中的具体应用</p> <p>Classification and properties of vitamins; sample preparation methods of fat-soluble and water-soluble vitamins; the application of HPLC in the analysis of vitamins</p>	1.5	<p>讲授为主 Lecture</p>		<p>了解维生素水溶性维生素和脂溶性维生素的性质；熟悉脂溶性维生素和水溶性维生素的前处理方法；掌握维生素各种测定方法及特点；重点掌握 HPLC 方法在维生素分析中的应用</p> <p>The students are required to master the general sample preparation procedure for the analysis of fat-soluble and water-soluble vitamins; familiar with</p>	

					the methods used for fat-soluble and water-soluble vitamins, especially the application and significance of HPLC method in the analysis of vitamin	
	<p>期末考试：70%；平时：30%</p> <p>（平时包括：上课出勤：5%；上课提问和小组汇报及讨论：10%；作业：15%）</p> <p>Final exam: 70%； Usual performance: 30%</p> <p>（Usual performance including: attendance: 5%； group presentation and discussion: 10%； homework: 15%）</p>					
	<p>*考核方式 (Grading)</p>					
	<p>*教材或参考资料(Textbooks & Other Materials)</p> <p>教材：食品分析，谢笔钧，何慧主编，第一主编非我校教师，科学出版社，2015年6月第二版，ISBN 978-7-03-045008-1，使用4届，不是外文教材，普通高等教育“十一五”国家级规划教材，国家级精品资源共享课配套教材</p> <p>参考书：Food analysis (第四版), S. Suzanne Nielsen主编，Purdue University West Lafayette, IN, USA, ISBN 978-1-4419-1477-4</p> <p>Text book: Food analysis, Edited by Xie Bi-Jun, He Hui, Science press., 2015 (the 2nd edition), ISBN 978-7-03-045008-1, not a textbook in foreign language, is National planning textbook</p> <p>Reference book: Food analysis (the Fourth edition) edited by S. Suzanne Nielsen, Purdue University West Lafayette, IN, USA, ISBN 978-1-4419-1477-4</p>					

其它 (More)	
备注 (Notes)	