UCL Université catholique de Louvain

LBRAL2105

2015-2016

Brewing biochemistry

5.0 credits	30.0 h + 22.5 h	1q

Teacher(s) :	Liégeois Catherine ; Declerck Stephan (coordinator) ; Alvarez Costales Pablo ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	Icampus
Main themes :	The theoretical teaching is subdivided in two parts and supported by practicals: Biochemistry of malting and brewing: (1) barley an enzymatic reactions occurring during malting, (2) biochemical reactions during brewing. Biochemistry of fermentation: Focused on the utilization of Saccharomyces cerevisiae in fermentation: (1)characterization and structure of yeasts, (2)metabolism of sugars and amino acids, (3)production of organic acids, aldehyds, alcohols, esters and sulfur products, (4)propagation and conservation. The theoretical course is supported by practicals. Starting from three different beers, yeasts are (1)isolated and cultured on a suitable medium, (2)enumerated, (3)characterized (vitality, floculation, limit attenuation), (4)identified via molecular tools (5)preserved (lyophilisation and cryopreservation).
Aims :	a. Contribution of the activity to the Learning outcomes of the program (learning outcomes of the program) 1.1 ' 1.2 ' 1.3 2.1 ' 2.3 3.4 ' 3.6 ' 3.7 b. Specific formulation for this activity of the learning outcomes of the program By the end of this activity, the student is able to explain all the brewing processes in which biochemical mechanisms are involved. This means: · schematize and comment enzymatic reactions in barley during germination and brewing · describe metabolic processes in yeast, in particular those involved during the fermentation processes By the end of this activity, the student is able to manipulate yeasts and to conduct analyses which are essential to the processes of beer production. This means · isolate, purify and culture yeasts on appropriate media · Enumerate viable/total yeasts cells within a beer using vital staining and the Thoma cell counting method · Determine the physiological characteristics of yeasts in a beer (vitality, floculence, limit attenuation) · Identify yeast strains via physiological and molecular tools · Preserve the yeast diversity via cryopreservation and lyophilisation By the end of the activity, the student is able to write a synthetic, structured and rigorous report on a concrete example, involving the techniques developed/applied above. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	The methods of evaluation are based on 1. A written exam on the principal theoretical notions learned An evaluation of the reports of the practicals (structuration of the report, clarity, rigor, quality and critical analysis of the results, conclusions)

Teaching methods :	Teaching is conducted in three phases: 1. a theoretical teaching during which are teached (1) the various steps of the brewing process involving biochemical mechanisms and (2) the biochemistry of fermentation. 2. a practical teaching during which the student will learn the principal manipulations of yeast (isolation, cell enumeration, identification) and the physiological properties (vitality, floculation, limit attenuation) of importance to the brewing process. Both these teachings are complementary and allow the students to practices the theoretical notions. 3. a teaching based on the writing of reports in relation with the practicals allowing the students to report on the results of the analysis and to comment those results in the context of a brewing process.
Content :	Biochemistry of malting and brewing - study of barley and enzymatic reactions o enzymology of germination o enzymatic activity during malting o enzymatic activity during brewing Biochemistry of fermentation - Characterization and structure of yeasts o Systematics of yeasts, life cycle, cytology of yeasts characterization of the cell wall, characterization of the cell membrane - Metabolism of sugars in brewery yeasts o Assimilation of monosaccharids, assimilation of disaccharids (maltose), other carbohydrates, sugars catabolism, respiration versus fermentation, fermentation capacity - Metabolism of nitrogen in brewery yeasts o Amino acids, what for ?, Entry of amino acids : the biologist's perspective, Entry of amino acids: the brewer's perspective, Degradation of amino acids : the Ehrlich pathway, Biosynthesis of amino acids: the Genevois pathway, Case of valin, leucin and isoleucine, Case of méthionin - Products of yeast fermentation : acids, aldehyds and alcohols o Introduction, Biosynthesis of acids, Biosynthesis of aldehyds, Biosynthesis of alcohols - Products of yeast fermentation: esters and sulfur compounds o Biosynthesis of esters, Biosynthesis of sulfur compounds - Excretion by yeasts o Maturation, yeast excretion, beer yeasts - Propagation and conservation of yeasts o Plasmic membrane fluidity, Yeast propagation: aims, technical aspects of propagation, long-term storage Practicals - isolation and cultivation on appropriate media of yeasts isolated from three selected beers - enumeration via the Thomas cell method of the viable and total number of cells (using vital staining) - physiological characterization of yeasts with particular attention on vitality, floculation and limit attenuation - identification of yeasts by molecular tools - conservation of yeasts by lyophilisation and cryopreservation
Bibliography :	Teaching support comprises syllabi on the theoretical and practicals parts of the teaching.
Faculty or entity in charge:	AGRO

Programmes / formations proposant cette unité d'enseignement (UE)

Intitulé du programme	Sigle	Credits	Prerequis	Acquis d'apprentissage
Master [120] in Chemistry and Bioindustries	BIRC2M	5	-	
Advanced Master in Bio-engineering : Brewery	BRAS2MC	5	-	
Master [120] in Agricultural Bioengineering	BIRA2M	5	-	