Code: **QG464**

Name: **Laboratório Integrado**

Name in English: **Integrated Laboratory**

Name in Spanish: **Laboratorio Integrado**

Subject type: **Weekly**

Approval Type: **Grade and frequency**

Characteristic: **Regular**

Frequency: **75%**

Period Type / Offering period: **Semestral/all the periods**

Requires Final Exam: **yes**

Vectors

T	L	P	O	PE	OE	SL	SEMANAS	CRÉDITO
-	**4**	**-**	**-**	**-**	**-**	**4**	**15**	**4**

Occurrence on curriculum: **05, 50**

Pre requirement: **QG108 + QG109**

Summary: **Interdisciplinary experiments covering different methods of preparation, characterization and analysis of phenomena involved in the preparation of products such as preparation of biodiesel and industrial solvent, synthesis and formulation of pharmaceuticals, etc... using techniques and procedures such as IR spectroscopy, NMR, X-ray fluorescence, mass spectrometry, rheology, thermogravimetric analysis, surface area determination, among others.**

Program:

Development of experiments that integrate the different areas of Chemistry and that illustrate the theoretical training acquired in previous semesters. Use of chemical synthesis techniques, understanding of the phenomena involved and analysis and determination of the structure and properties of chemical compounds, including classical purification methods (recrystallization, distillation, and preparative chromatography) and modern instrumental techniques (NMR and IR spectroscopy, mass spectrometry, microscopy, etc.).

Cement: three-week project involving the preparation of cement from raw materials, involving formulation steps (different additives) and calcination. Characterization of the specimen by mechanical tests, factorial planning, x-ray fluorescence, TGA, electron microscopy, etc.

Cream for personal use: Three-week project involving cream formulation steps and incorporation of a fragrance extracted by a soxhlet-type process, fragrance composition by GC-MS. Study on the stability of the colloidal system, determination of particle size and zeta potential.

Activated charcoal preparation: Three-week project involving the preparation and activation of activated charcoal for water purification purposes. Characterizations through adsorption isotherms, BET, performance evaluation in terms of adsorption of model effluents. Nanocomposites.

Preparation, characterization and use of heterogeneous catalyst: preparation of palladium adsorbed on charcoal, characterization and dosage of adsorbed palladium content, use in catalytic hydrogenation reaction. Techniques to be used: electron microscopy, surface area, atomic absorption, GC-MS.

Synthesis, formulation and characterization of a drug: preparation, characterization and formulation of paracetamol. Use of NMR, IR, EM, NIR techniques.

Use of raw materials from renewable sources: production of biodiesel and green solvents. Transesterification reaction of vegetable oils with methanol, physicochemical characterization of biodiesel and industrial solvent obtained from glycerol and acetone. Techniques used: GC-MS, NMR, NIR.

Use of raw materials from renewable sources: production of hydroxymethylfurfural from fructose. Fructose dehydration reaction using batch and flow processes to produce hydroxymethylfurfural. Use of separation (GC-MS, HPLC) and identification (EM, NMR, IR) methods.

Natural Product Synthesis: this experiment proposes the synthesis of the natural product goniothalamine, isolated from several plant species, including Brazilian biodiversity, the discussion of the principles of organometallic chemistry (Grignard reaction), homogeneous catalysis (metathesis reaction for ring closure), biosynthesis of this family of secondary metabolites and the biological action of this compound regarding cell apoptosis and neoplasms.

Basic Bibliography

1) ATKINS, P.; JONES, L.; LAVERMAN, L; **Princípios de Química: Questionando a Vida Moderna e o Meio Ambiente**, 7ª edição, Bookman, Bookman Editora LTDA, Porto Alegre, RS, 2018.
2) PAVIA, D. L.; LAMPMAN, G. M.; KRIZ, G. S.; ENGEL, R. G.; **Introduction to Organic Laboratory Techniques: A Microscale Approach**, 5ª edição, Brooks/Cole, Belmont, CA, 2013.
3) J. SHAW, D. J.; **Introdução à Química dos Colóides e de Superfícies**, Edgard Blucher, São Paulo, 1975.

Supplementary Bibliography

1) GERMSCHEIDT, R. L.; MOREIRA, D.E. B.; YOSHIMURA, R. G.; GASBARRO, N. P.; DATTI, E.; DOS SANTOS, P. L.; BONACIN, J. A.; **Hydrogen Environmental Benefits Depend on the Way of Production**: **An Overview of the Main Processes Production and Challenges by 2050. Advanced Energy & Sustainability Research, vol. 2**, n.10, p. 2100093, 2021
2) ZUBEN, T. W. V.; MOREIRA, D.E. B.; GERMSCHEIDT, R. L.; YOSHIMURA, R. G.; DORRETTO, D. S.; ANA DE ARAUJO, A. B. S.; SALLES JR, A. G.; BONACIN, J. A.; **Is Hydrogen Indispensable for a Sustainable World? A Review of H_2 Applications and Perspectives for the Next Years. Journal of the Brazilian Chemical Society**, vol. 33, n.8, p. 824-843, 2022
3) RINALDI, R.; GARCIA, C.; MARCINIUK, L. L.; ROSSI, A. V.; SCHUCHARDT, U.; **Síntese de biodiesel: uma proposta contextualizada de experimento para laboratório de química geral.** Química Nova, vol. 30, n.5, p.1374-1380, 2007.
4) CUNNINGHAM, A. D.; HAM, E. Y.; VOSBURG, D. A.; **Chemoselective Reactions of Citral: Green Syntheses of Natural Perfumes for the Undergraduate Organic Laboratory.** Journal of Chemical Education, vol. 88, n.3, p. 322-324, 2011.
5) https://en.wikipedia.org/wiki/Colloid