Pharmaceutical & Chemical Technology CHEM 2215

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Module Description: This module is concerned with the application of chemical sciences and technology in the pharmaceutical industry.

Module aim:
The aims of this module are

- to give the student an understanding of the basic principles of pharmachem processes
- to give the student an understanding of the different types of polymers and their physical and mechanical properties.
- to introduce the student to the various methods of polymer production and processing.
- to build on the practical knowledge gained by the student in first year with a series of laboratory sessions that are dedicated to and complement the areas covered in lectures.

Learning Outcomes:

On the completion of this module the student is expected:

- To be able to classify polymers,
- To be familiar with polymer production, manufacturing and processing technology,
- To have a thorough knowledge of polymer ingredients and degradation,
- To understand the basic principles of pharmachem production and manufacturing processes

Learning and Teaching Methods:
Lecture, tutorials, practicals, formative problem-solving exercises.

Module content:

Pharmachem production
Pharmachem processes. Flowsheets. Units. Simple mass balances. Simple energy balances.

Polymer Chemistry and Technology
Introduction to raw materials. Classification of polymers. Intermolecular forces, crystalline and amorphous region, affect on physical and mechanical properties. Types of average molecular weight. Determination of molecular weight using viscosity, light scattering, gel permeation chromatography. Bulk solution, suspension and emulsion polymerisation. Stereospecific polymerisation. Properties and application of polymers (e.g. polyethylene, polypropylene, polystyrene, polyvinyl chloride). Plastic processing including film production, injection moulding, blow moulding
Polymer processing and manufacture, medical polymer materials, medicinal polymers, biomaterial for drug delivery systems, pharmaceutical applications of polymers (e.g. packaging).

Practicals
Preparation of melamine-methanol resin
Bulk polymerisation of methyl methacrylate (methyl 2-methylpropanoate)
Bulk polymerisation of styrene (phenyl ethylene).
Preparation of expanded polystyrene
Preparation of a nylon fibre
Preparation of synthetic rubber
Preparation of polyvinyl acetate emulsion paint
Measuring the viscosity of polymer solutions and determination of the viscosity average molecular weight
Case study – pharmaceutical applications of polymers
Case study – polymer applications for drug delivery

Module Assessment:
The student will be assessed on this module by end of module written exam and laboratory practical module mark. The weighting between the written element and the practical element of the module is 60:40 respectively.

Essential Reading: C.A.Heaton, An Introduction to Industrial Chemistry, 3rd ed, Blackie, London, (1996).
J.M.G.Cowie, Polymers: Chemistry and Physics of Modern Materials, 2nd ed, Blackie, London, (1991).
Laboratory Manual and School Safety Manual

Supplemental Reading: Kirk-Othmer Encyclopedia of Chemical Technology, 4th ed, Wiley, New York, (1998).
Ullman's Encyclopedia of Industrial Chemistry, 6th ed, VCH, Germany, (2000).
R.M.Felder, R.W.Rousseau, Elementary Principles of Chemical Processes, 3rd ed, Wiley, New York, (1999).
R. J. Young, P. A. Lovell, Introduction to Polymers, 2nd ed, Chapman and Hall, London, (1991).
F. W. Billmeyer, Textbook of Polymer Science, 3rd ed, Wiley, Chichester, (1997).
E.A. Collins, J. Bares, Experiments in Polymer Science, Wiley, New York.
J.A. Brydson, K.J. Saunders, Experimental Plastics Technology, Methuen Educational Ltd. London (1970).
Pharmaceutical Applications of Polymers for Drug Delivery, D. Jones, QUB, 2004
Polymers for Controlled Drug Delivery, P.J. Tarcha, CRC Press, 1991
Polymers in Medicine: Biomedical and Pharmaceutical Applications, R. M. Ottenbrite et al, CRC Press, 1992

Web references, journals and other:

Further Details: This module may be delivered in one semester. The contact hours may be summarised as follows; 24 hours lectures, 18 hours laboratory practical, 12 hours formative assessment / problem solving sessions and 46 hours self study.