

Course title: Raw materials and processes of organic chemical technology

Institute/Division: FACULTY OF CHEMICAL ENGINEERING AND TECHNOLOGY

Number of contact hours: 75 hours Exam. (30h lectures, 30h exercises, 15h project)

Course duration: 1 semester (6th semester of regular I cycle studies - spring)

ETCS credits: 6

Course description: Technological principles. Basic quantities determining the technological process (efficiency, degree of conversion, selectivity). General features of organic technology (ecological aspect, use of catalysts, flexibility in implementation - different products from one raw material, the same product from different raw materials). General characteristics of natural resources (coal, oil, natural gas). Basic characteristics of coal preparation methods (coking, gasification, liquefaction). Reactions occurring in coal processing. Different variants of the coal gasification process. Crude oil processing - general characteristics. Tubular tower distillation. Reactions taking place in crude oil processing (hydrotreating, catalytic cracking, catalytic reforming). Reforming and catalytic cracking - industrial installations. Kerosene processing. Processing of oil fractions. Processing of lubricating oils (extraction of oils with low viscosity index, extraction of slack wax). Separation of paraffins from hydrocarbon fractions. Asphalt oxidation. Directions of crude oil distillates. Gasification of residues from crude oil processing. Olefin pyrolysis (general characteristics, effect of temperature, pressure, residence time of reagents in the reaction zone, freezing of the system). Preparation of alkylation gasoline - process chemistry. Obtaining oxygen additives for motor fuels (for gasolines and diesel fuels). Thermodynamics of the dehydrogenation reaction. Preparation of dienes (on the example of butadiene and isoprene). General characteristics of the processes for obtaining aromatic hydrocarbons. Methods for the separation and separation of aromatic hydrocarbons (extraction distillation, extraction, adsorption processes). Separation of fraction C8. Transformation of alkylaromatic hydrocarbons (trans-alkylation, disproportionation, dealkylation, isomerization). General characteristics of the oxidative dehydrogenation reaction. General characteristics of the gas and liquid phase oxidation process (reaction mechanisms involving a catalyst). Preparation of olefin oxides (ethylene and propylene) and ethylene glycol. Obtaining phenol (cumene process, Rashig, from toluene, direct oxidation of benzene with nitrous oxide). Preparation of maleic and phthalic anhydride. Preparation of aromatic acids and polyethylene terephthalate (PET). General characteristics of raw materials for the production of polyamides. Preparation of caprolactam (benzene - cyclohexane - cyclohexanone - oxime - Beckman rearrangement). Other methods of obtaining caprolactam. Methods for obtaining high-molecular compounds. Industrial processes (bulk polymerization, emulsion, pearl, solvent) - general characteristics. Preparation of resins. Cellulose derivatives.

Education effects :

- knowledge: student knows the most important types of raw materials; knows the methods of organic molecules synthesis and recognize their critical properties; is familiar with existing raw processes of organic chemical technology
- skills: student can synthesize various types of raw materials and characterize them in respect of current EU standards; can use the specific apparatus dedicated for raw materials production; knows how to prepare high-quality research report from performed exercises and project calculations
- social: student is able to work independently and in the group both at the project group and during preparation of the report; understand the reason of fulfilling the biofuels standards

Literature: [1] J.A. Moulijn, M. Makkee and A. van Diepen -Chemical process technology. John Wiley and Sons Ltd, Chichester, 2001.

[2] Klaus Weissermel, Hans-Jürgen Arpe - Industrial Organic Chemistry, WILEY-VCH Verlag, 2003.

Assessment method: Final test, completing the exercises and project (presence and delivering of reports from each performed exercise and project), exam

Prerequisites: Basic knowledge in organic chemistry and technology.

Primary target group: Students from all specialties

Lecturer: dr hab. inż. I. Czekaj, prof. PK, dr Adam Węgrzynowicz

Contact person: dr hab. inż. I. Czekaj, prof. PK, izabela.czekaj@pk.edu.pl

Remarks: The course is selectable