

POLITECHNIKA KRAKOWSKA IM. TADEUSZA KOŚCIUSZKI

KARTA PRZEDMIOTU

obowiązuje studentów rozpoczynających studia w roku akademickim 2018/2019

Wydział Inżynierii i Technologii Chemicznej

Kierunek studiów: Technologia Chemiczna

Profil: Ogólnoakademicki

Forma studiów: stacjonarne

Kod kierunku: T

Stopień studiów: II

Specjalności: Innovative Chemical Technologies

1 INFORMACJE O PRZEDMIOCIE

NAZWA PRZEDMIOTU	Biofuels and bioresources
NAZWA PRZEDMIOTU W JĘZYKU ANGIELSKIM	Biofuels and bioresources
KOD PRZEDMIOTU	WITCh TCH oIIS D1 18/19
KATEGORIA PRZEDMIOTU	Przedmioty specjalnościowe
LICZBA PUNKTÓW ECTS	4.00
SEMESTRY	1

2 RODZAJ ZAJĘĆ, LICZBA GODZIN W PLANIE STUDIÓW

SEMESTR	WYKŁADY	ĆWICZENIA	LABORATORIUM	LABORATORIUM KOMPUTERO- WE	PROJEKT	SEMINARIUM
1	15	0	30	0	0	0

3 CELE PRZEDMIOTU

Cel 1 The course reviews the liquid biofuels diversity on a background of other renewable energy sources, highlighting their role in the global energy balance. The basics of Polish, European and worldwide legislation regulating the production, properties and distribution of biofuels will be given together with the most typical classification based on the physical state (biogas, biomass and liquid biofuels) and the generation; the analysis

and comparison of potential raw-materials and production technologies, as well as the perspectives for further development will be discussed

Cel 2 The aim of the course is to learn modern transport biofuels obtained from renewable raw materials. The laboratory exercises will include: synthesis of biodiesel fuel from pure or waste vegetable oils, as well as yeast fermentation of hydrolysed starch combined with efficient distillation. The physicochemical properties, composition and functional quality of prepared biocomponents will be tested and compared with traditional mineral fuels. The analysis will include: chemical composition by chromatography, analysis of density, viscosity, flash point in open crucible, freezing and cloud points, selected characteristic values - acidic, neutralization, saponification, and iodine numbers, and other specified in European standards.

4 WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I INNYCH KOMPETENCJI

1 Basis knowledge in the field of organic chemistry and technology

5 EFEKTY KSZTAŁCENIA

EK1 Wiedza Student have basis knowledge on the energy policy in the world, know the main, obligatory law regulations and understand the meaning of the carbon cycle and the sustainable energy balance

EK2 Wiedza Student have knowledge about the available alternative biofuels, recognize the fuels of various generations and know the methods of obtaining biofuels from various raw materials

EK3 Umiejętności Student is able to determine the advantages and disadvantages of biofuels in comparison to conventional energy sources

EK4 Kompetencje społeczne Student is able to select the optimal technologies for the production of biocomponents, taking into account available resources and scale of production

EK5 Umiejętności Student recognize the basic properties of biofuels and biocomponents, and is able to characterize them according to standards

6 TREŚCI PROGRAMOWE

WYKŁADY		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
W1	Organization of course, conditions of assessment and dates of final exam. Definitions, introduction to actual polish, european and worldwide bioenergy policy development and perspectives	1
W2	Alternative energy - Biomass as a raw material for solid, liquid and gaseous biofuels on the background of other renewable energy mainstreams geothermal power, wind and solar energy, and hydropower.	1
W3	Biomass and bioenergy policy - Using of energy and oilseeds crops for the production of heat and biofuels. Forecasts and barriers for the development in the Poland and other countries. Biofuels policy and legislation. Classification of biofuels (I, II, III and IV generation biofuels).	1

WYKŁADY		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
W4	Ist generation solid biofuels - The economic, social and agricultural conditions in the production and using of solid biofuels (wood, straw, hay, etc.), Biogas from municipal wastes, landfills and manures - resources and opportunities.	1
W5	Ist generation biodiesel - Production of biodiesel from edible and waste oils resources and technologies. The conflict fuel versus food. Valorization of waste glycerol fraction.	2
W6	Ist generation bioethanol - Bioethanol and other related biocomponents (bioETBE) fermentation of edible plans and other processes. The production efficiency from various raw materials, environmental and political considerations in world production of bioethanol	1
W7	IIInd generation biofuels conversion of lignocelluloic biomass to alcohols - Bioethanol from lignocellulosic biomass - advanced hydrolysis and fermentation processes. Obtaining of biomethanol, biobutanol and bioDME	2
W8	IIInd generation biofuels biomass pyrolysis - Biohydrogen and biogas derived from biomass gasification. Liquefaction of biomass to liquid biofuels (F-T synthesis).	1
W9	IIInd generation biofuels biodiesel and biooil - Biooil and biodiesel from hydrodeoxygenation and decarbonation of animal and vegetable fats.	1
W10	IIIrd generation biohydrogen and fuel cells - Biohydrogen as an example of IIIrd generation biofuels and the principles of fuel cells.	1
W11	IIIrd generation biofuels from algae - Algae as a modern natural source with high carbon dioxide assimilation. Their harvest and processing gasification, transesterification and enzymatic processes.	1
W12	IVth generation biofuels summary and perspectives- Prospects for the production of the next generation biofuels - the genetic modification of plants in order to increase the production efficiency and closing CO ₂ cycle. Basic information about the necessity and possibilities of the uptake and storage of carbon dioxide.	1
W13	Final test	1

LABORATORIUM		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
L1	Organization of course, introduction to experiments, description of hazards and safety training, explaining the requirements for the laboratory reports, assessment conditions and dates of planned laboratory exercises with dividing of students for groups.	1
L2	Enzymatic and acid catalysed hydrolysis of starch, followed by yeast fermentation and distillation. Quantitative analysis of bioalcohol by chromatography and density measurements.	10

LABORATORIUM		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
L3	Biodiesel synthesis from vegetable or waste oils and analysis of its physicochemical properties (density, viscosity, flash point in open crucible, freezing and cloud points, and optionally a fractional distillation of fuel, and identification of acidic, saponification, and iodine numbers).	10
L7	Biogas production from biomass with chromatographic analysis of the gases composition.	8
L9	Final test evaluating the knowledge of the biofuels preparation and analysis	1

7 NARZĘDZIA DYDAKTYCZNE

N1 Laboratory experiments

N2 Lectures

8 OBCIĄŻENIE PRACĄ STUDENTA

FORMA AKTYWNOŚCI	ŚREDNIA LICZBA GODZIN NA ZREALIZOWANIE AKTYWNOŚCI
Godziny kontaktowe z nauczycielem akademickim, w tym:	
Godziny wynikające z planu studiów	45
Konsultacje przedmiotowe	5
Egzaminy i zaliczenia w sesji	2
Godziny bez udziału nauczyciela akademickiego wynikające z nakładu pracy studenta, w tym:	
Przygotowanie się do zajęć, w tym studiowanie zalecanej literatury	25
Opracowanie wyników	20
Przygotowanie raportu, projektu, prezentacji, dyskusji	10
SUMARYCZNA LICZBA GODZIN DLA PRZEDMIOTU WYNIKAJĄCA Z CAŁEGO NAKŁADU PRACY STUDENTA	107
SUMARYCZNA LICZBA PUNKTÓW ECTS DLA PRZEDMIOTU	4.00

9 SPOSOBY OCENY

OCENA FORMUJĄCA

F1 Final test grade

F2 Laboratory reports

F3 Practical work

F4 Preparation to laboratories

OCENA PODSUMOWUJĄCA

P1 Average from grades

WARUNKI ZALICZENIA PRZEDMIOTU

W1 Presence on lectures and laboratories

W2 Positive grade from tests and reports

OCENA AKTYWNOŚCI BEZ UDZIAŁU NAUCZYCIELA

B1 Test

B2 Laboratory reports

B3 Preparation to practical work

KRYTERIA OCENY

EFEKT KSZTAŁCENIA 1	
NA OCENĘ 2.0	Lack of knowledge on the energy policy in the world, the main obligatory law-regulations, the carbon cycle and the sustainable energy balance
NA OCENĘ 3.0	51-60% points from average grades
NA OCENĘ 3.5	61-70% points from average grades
NA OCENĘ 4.0	71-80% points from average grades
NA OCENĘ 4.5	81-90% points from average grades
NA OCENĘ 5.0	student ma dobrze ugruntowaną wiedzę z zakresu otrzymywania z surowców odnawialnych i badania właściwości biopaliw, w szczególności ciekłych biopaliw transportowych
EFEKT KSZTAŁCENIA 2	
NA OCENĘ 2.0	Lack of knowledge about the available alternative biofuels, the fuels of various generations and the methods of obtaining biofuels from various raw materials
NA OCENĘ 3.0	51-60% points from average grades
NA OCENĘ 3.5	61-70% points from average grades
NA OCENĘ 4.0	71-80% points from average grades
NA OCENĘ 4.5	81-90% points from average grades

NA OCENĘ 5.0	above 91% points from test. Good knowledge of the available alternative biofuels, the fuels of various generations and the methods of obtaining biofuels from various raw materials
EFEKT KSZTAŁCENIA 3	
NA OCENĘ 2.0	Lack of ability to determine the advantages and disadvantages of biofuels in comparison to conventional energy sources
NA OCENĘ 3.0	51-60% points from average grades
NA OCENĘ 3.5	61-70% points from average grades
NA OCENĘ 4.0	71-80% points from average grades
NA OCENĘ 4.5	81-90% points from average grades
NA OCENĘ 5.0	above 91% of points from test. Good knowledge of the advantages and disadvantages of biofuels in comparison to conventional energy sources
EFEKT KSZTAŁCENIA 4	
NA OCENĘ 2.0	Lack of knowledge about the possible technologies for the production of bio-components, taking into account available resources and scale of production
NA OCENĘ 3.0	51-60% points from average grades
NA OCENĘ 3.5	61-70% points from average grades
NA OCENĘ 4.0	71-80% points from average grades
NA OCENĘ 4.5	81-90% points from average grades
NA OCENĘ 5.0	above 91% of points from test. Good knowledge on the available technologies for the production of bio-components, taking into account the type of resources and scale of production
EFEKT KSZTAŁCENIA 5	
NA OCENĘ 2.0	Student don't recognize the basic properties of biofuels and biocomponents, and is not able to characterize them according to standards
NA OCENĘ 3.0	51-60% points from average grades
NA OCENĘ 3.5	61-70% points from average grades
NA OCENĘ 4.0	71-80% points from average grades
NA OCENĘ 4.5	81-90% points from average grades
NA OCENĘ 5.0	Above 91% from average grades. Student recognize the basic properties of biofuels and biocomponents, and is able to characterize them according to standards

10 MACIERZ REALIZACJI PRZEDMIOTU

EFEKT KSZTAŁCENIA	ODNIESIENIE DANEGO EFEKTU DO SZCZEGÓŁOWYCH EFEKTÓW ZDEFINIOWANYCH DLA PROGRAMU	CELE PRZEDMIOTU	TREŚCI PROGRAMOWE	NARZĘDZIA DYDAKTYCZNE	SPOSOBY OCENY
EK1	K2_W05 K2_W08 b K2_W10 b K2_W11 b K2_W12 b	Cel 1	W1 W2 W3 W4 W5 W6 W7 W8 W9 W10 W11 W12 L2 L3 L7	N1 N2	F1 F2 F3 F4 P1
EK2	K2_W05 K2_W08 b K2_W10 b K2_W11 b K2_W12 b	Cel 1 Cel 2	W3 W4 W5 W6 W7 W8 W9 W10 W11 W12 L2 L3 L7	N1 N2	F1 F2 F3 F4 P1
EK3	K2_U01 K2_U02 K2_U11 b K2_U16 K2_U18 b	Cel 1 Cel 2	W3 W4 W5 W6 L2 L3 L7	N1 N2	F1 F2 F3 F4 P1
EK4	K2_W10 b K2_W12 b K2_W13 b K2_U02 K2_U13 b K2_U16	Cel 1	W1 W2 W3 W4 W5 L2 L3 L7	N1 N2	F1 F2 F3 F4 P1
EK5	K2_U11 b K2_U12 b K2_U14 b K2_U16 K2_U18 b K2_K02	Cel 2	W3 W4 W5 L2 L3 L7	N1 N2	F1 F2 F3 F4 P1

11 WYKAZ LITERATURY

LITERATURA PODSTAWOWA

- [1] | Knothe G., Van Gerpen J., Krahl J. — *The Biodiesel Handbook*, Illinois, 2005, AOCS Press
- [2] | Olsson L. — *Biofuels*, Berlin Heidelberg, 2007, Springer-Verlag
- [3] | Mielenz J.R. — *Biofuels - Methods and Protocols*, NY, 2009, Humana Press
- [4] | Sitnik L.J. — *Ekopaliwa silnikowe*, Wrocław, 2004, Oficyna Wyd. Politechniki Wrocławskiej

[5] | Lewandowski W.M., Ryms M. — *Biopaliwa*, Warszawa, 2013, WNT

LITERATURA UZUPEŁNIAJĄCA

[1] | — *The state of food and agriculture. Biofuels: prospects, risks and opportunities*, Rome, 2008, Food and Agriculture Organization of the United Nations

[2] | — *Biofuels for transport, An International Perspective*, , 2004, International Energy Agency

LITERATURA DODATKOWA

[1] | notes from lectures

[2] | technical requirements and methods of characterization of biofuels in EU standards

12 INFORMACJE O NAUCZYCIELACH AKADEMICKICH

OSOBA ODPOWIEDZIALNA ZA KARTĘ

dr hab. inż. prof. PK Elżbieta Skrzyńska-Ćwiakalska (kontakt: eskrzynska@pk.edu.pl)

OSOBY PROWADZĄCE PRZEDMIOT

1 dr hab. inż. Elżbieta Skrzyńska (kontakt: eskrzynska@pk.edu.pl)

13 ZATWIERDZENIE KARTY PRZEDMIOTU DO REALIZACJI

(miejscowość, data)

(odpowiedzialny za przedmiot)

(dziekan)

PRZYJMUJĘ DO REALIZACJI (data i podpisy osób prowadzących przedmiot)

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