

Course Feedstock evaluation and composition

Basic Information

This is a course, which contributes to MSc award in Chemistry

Title of the Academic Program	Master's Degree Programs in English "Feedstock Evaluation and Composition"
Type of the course	core course
Course period	From October 1st till February 28 th, 1 semester
Study credits	5 ECTS credits
Duration	180 hours
Language of instruction	English
Academic requirements	<ul style="list-style-type: none">– BSc degree in Chemistry, Physics, Mathematics, Engineering, Environmental Sciences or equivalent (transcript of records),– good command of English (certificate or other official document)

Course Description

It is very difficult to imagine our life without petroleum and petroleum products. Petroleum is used mostly for producing fuel oil and gasoline (petrol). Petroleum is also the raw material for many chemical products, including solvents, fertilizers, pesticides and plastics; the 16 % not used for energy production is converted into these other materials. Due to its high energy density, easy transportability and relative abundance, it has become the world's most important source of energy.

Petroleum products are any petroleum-based products that can be obtained by refining. These products are highly complex chemicals, and considerable effort is required to characterize their chemical and physical properties with a high degree of precision and accuracy. Indeed, the analysis of petroleum products is necessary to determine the properties that can assist in resolving a process problem as well as the properties that indicate the function and performance of the product in service.

The course acquaints students with the group composition of natural hydrocarbons, their classification, properties, various methods for determination of these properties.

The most important part of this course is laboratory activity. Students will perform different laboratory experiments for given tasks to achieve a proper result.

Special Features of the Course

1. The course is split into 3 major sections: Chemical composition and methods of determining properties of oil, Chromatographic methods in the analysis of oil and petroleum products, Spectral methods in the analysis of oil and petroleum products.

Apart from lectures, the course offers a range of other learning opportunities in which students actively make presentations, reports and do MCQs.

2. Provides different technical information about natural hydrocarbons, their differences. Students can get information about modern methods of petroleum and petroleum products assay.

Detailed course material with a glossary of the main technical terms of equipment, instruments, chemical reagents used in petroleum product analysis.

3. Petroleum chemistry laboratory activities

Range of experiments will be undertaken and its main objectives will be analyzed in the conclusion to determine whether the experiments succeeded. All the experiments are intended to get lecture information down, deepen knowledge and give an opportunity for independent research.

Course Aim

The aim of teaching the discipline is to give students knowledge of the chemical composition, physical and chemical properties and technical quality levels indicators of petroleum, its fractions, commercial products and other natural hydrocarbon raw materials.

Course Objectives

- to analyze main determinable indicators for hydrocarbon raw materials (oil, its fractions, commercial petroleum products) and examine their relationship with the chemical composition;
- to review theoretical principles and principles of chromatographic, spectral methods of hydrocarbon raw material analysis;
- to obtain practical skills in the analysis of hydrocarbon raw materials.

Learning Outcomes of the Course

By the end of the course, students will be able to:

- to describe and illustrate:
 - types of hydrocarbon raw materials, the principles of its classification;
 - chemical composition of the main types of hydrocarbon raw materials, its effect on the physicochemical properties and technical indicators of the quality of commercial products;
 - theoretical bases of chromatographic, spectral methods of hydrocarbon raw material analysis.
- to classify hydrocarbon raw materials depending on its usage and physical and chemical properties;
- to select and apply necessary methods for the analysis of hydrocarbon feedstocks, depending on the scientific or engineering tasks.

Course Structure

Learning Activities	Hours
Lectures	14
Seminars	28
Self-study Assignments	138
Final Exam (including preparation)	2
Total study hours	180

Course Outline

Week	Lectures	Practice session / Assignments	Hours ¹
1-4	Chemical composition and methods of determining properties of oil		
	- The composition of the oil and oil products. Systems of hydrocarbons classification;		2
	- Physical properties of oil and petroleum products;		1
	- Thermal properties of oil and petroleum products.		1
		- Introduction to techniques of laboratory work, safety, instructions to laboratory equipment	2
		- Determination of density and petroleum oil fractions	4
		- Determination of fractional composition of oil	4

¹Hours designed for Classroom sessions, Web-sessions, Home Assignments etc.

4-10	Chromatographic methods in the analysis of oil and petroleum products		
	- The basic concepts. Classification of chromatographic methods of analysis		2
	-Gas chromatography		1
	-Liquid chromatography		1
		- Determination of fractional composition of gasoline by FIA-method. - Determination of the hydrocarbon composition of gasoline by means of gas chromatography, identification chromatograms	4 4
10-14	Spectral methods in the analysis of oil and petroleum products		
	- Atomic emission and atomic absorption spectroscopy		2
	- UVspectroscopy. IR and Raman spectroscopy		2
	- NMR Spectroscopy		1
	- Methods of analysis based on the interaction of matter with X-rays		1
		- IR spectroscopy petroleum fractions - X-Ray Fluorescent spectroscopy	6 4
15	Final exam		2

Lecturer and Contact Information



Alexander Tretyakov

Senior lecturer at School of Petroleum and Natural Gas Engineering,
Siberian Federal University

(room 323) 82/6, Svobodny prospect, Krasnoyarsk, Russia

Tel: +7 965 896-01-50, aetretyakov@sfu-kras.ru

Assessment

Grade policy for both home assignments and the final exam is:

- A (excellent work) 91–100 points
- B (above average work) 81–90 points
- C (average work) 71–80 points
- D (below average work) 50–70 points
- F (failed work) < 50 points

To pass the exam students have to do all course's assignments. The final exam consists of two parts: laboratory reports and writing exam.

Students should be able to:

- defend the laboratory reports (50 points maximum),
- write an answer on 2 questions, demonstrate covered material (50 points maximum).

Attendance Policy

Students are expected to attend and participate in classes and should notify trainers of excused absences in advance, where possible. Students who have an excused absence are expected to make arrangements with instructors for alternative assignment.

Every topic has a home assignment work that should be done. The final mark will be made by the same grade policy as for a final exam.

Web page of the course

The webpage of the course [Feedstock evaluation and composition](#) is available through E-learning SibFU web site: www.e.sfu-kras.ru. You must be logged in to access this course. Course Guide and all accompanying materials are also available at the course webpage.

Core reading

The main book for this course is [Handbook of Petroleum Products Analysis](#) K. F. Arndt and M. D. Lechner. It contains all information that is required for study in a more extensive manner. It will help students to reach a deeper understanding of feedstock evaluation and composition.

The book [Structure and Modeling of Complex Petroleum Mixtures](#) by Chunming Xu and Quan Shi (Springer International Publishing, ISBN: 978-3-319-32320-6, Vol. 182, 2016) is also recommended for studying the basic petroleum chemistry that will be used during the course.

Books, [Problems and Solutions in Oil Refining and Petrochemical Industry](#) by Alec Groysman and [Handbook of Petroleum Processing](#) will be extremely helpful in order to understand the intent of all feedstock evaluation processes.

Web sites

<http://www.sciencedirect.com/>

<http://link.springer.com/>

<https://www.scopus.com/>