RUDN university

MASTER COURSE

# BIOENERGIES AND BIOREFINERIES

Head Professor

**Rafael Luque**

# JUSTIFICATION

**Necessity of search** for alternative and environmentally friendly sources of energy, in light of the limited fossil resources and climate change issues

**The program solves** the problem of energy independence and sustainable development

**Utilization of biomass** as the main fuel source

**SPECIAL COURSE**
on environmental pollution with micro- and nano-plastics

## PROGRAM ISSUE

IS THE DEVELOPMENT **OF NEW TECHNOLOGIES** AND METHODS **OF BIOMASS** PROCESSING

## PROGRAM PRIORITY

IS THE RESEARCH **IN NEW TYPES OF BIOMASS,** SUSTAINABLE COLLECTION AND RECYCLING

HEAD

UNIVERSIDAD D CORDOBA

**RAFAEL LUQUE**
(PHD SINCE 2005,
UNIVERSITY OF CORDOBA, SPAIN)

CURRENTLY:
**RUDN, RUSSIAN FEDERATION**

**2018**
**2022**
was named **highly cited researcher** (Clarivate Analytics)

## UNIQUE EXPERIENCE

in the field of methods **for processing biomass** and waste to **obtain materials, fuels and chemicals**

More than **700** publications

Hirsch index **93**

More than **40,000** citations

**7** patents

**12** edited books

Member of the advisory/editorial board of more than **10** journals
**Q1 RSC, Wiley, ACS and Elsevier**

**2** DURATION OF STUDY YEARS

**60** CREDITS ACADEMIC YEAR

## MODULAR SYSTEM

**8** MODULES

**288** LECTURES

**68** SEMINARS

**170** LABORATORY WORK


**THE FIRST YEAR** OF STUDY AT RUDN UNIVERSITY

**THE SECOND YEAR** AT A PARTNER UNIVERSITY OR RUDN UNIVERSITY

**PRACTICES BASED** IN LABORATORIES OF PARTNER UNIVERSITIES

**THE SECOND YEAR** IS COMPLETELY DEVOTED TO RESEARCH WORK ON THE PROJECT AND ITS DEFENSE

PROGRAM ADVANTAGES

# 23 PLACE IN THE QS 2024 INDUSTRY RANKING FOR CHEMISTRY

RUDN

# 1 PLACE IN RUSSIA

## UNIQUE LEVEL OF LECTURERS FOR THE RUSSIAN FEDERATION HIRSCH INDICES ≥ 30

Academician of RAS
**Valentine P. Ananikov**
RUSSIA
**Hi=66**

Prof.
**Diego Alves**
BRAZIL
**Hi=38**

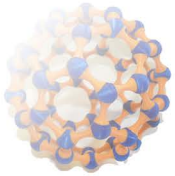
Prof.
**Eric Van Der Eyken**
BELGIUM
**Hi=54**

Prof.
**Francis Verpoort**
CHINA
**Hi=63**

Prof.
**Daniel Rivera**
CUBA
**Hi=40**

Prof.
**Rafael Luque**
SPAIN
**Hi=93**

# VALENTINE P. ANANIKOV



Prof. Dr., Academician of Russian Academy of Sciences
Sber Scientific Prize Laureate in 2023
Member of Academia Europaea

## UNIQUE EXPERIENCE IN TOPICAL AREAS OF SCIENCE:

**Green chemistry and sustainable development**
(conversion of biomass, biohybrid systems)

**Digital chemistry** (artificial intelligence and additive technologies in scientific research)

## COURSE Artificial intelligence and additive technologies in chemistry

- Adaptive digital design
- Additive technologies
- Rapid printing of chemical reactors for practical implementation
- Current state and perspectives of AI and additive technologies in chemistry
- Engineering developments in chemistry

More than **350** publications

Hirsch index **66**

More than **16 000** citations

and more than **60** Q1 over the past 2 years

Member of the advisory/editorial board of Angewandte Chemie International Edition, ACS Catalysis and JACS Au

SPECCOURSES

## BIOENERGY

**BIODIESEL:**
preparation
and types (first and
second generation)

**BIOETHANOL:**
preparation
and types (first and
second generation)

**BIOGAS:**
a promising
technology
for generating
clean energy

**HYDROGEN:**
technologies
for renewable
hydrogen
production

**SOLID FUELS:**
pellets


## BIOPRODUCTS AND BIOREFINERIES

**BIOPRODUCTS FROM BIOMASS/WASTE:**
different platforms

**OIL PLATFORM:**
types of bioproducts

**SYNGAS PLATFORM:**
chemicals from syngas

**BIOMATERIALS**
from biomass/waste

**BIOPOLYMERS:**
starch, chitosan/chitin
polylactic acid (PLA),
polyhydroxyalkanoates
(PHAs), etc.

SPECCOURSES

## ORGANIC SYNTHESIS

Modern organic **SYNTHESIS AND PHARMACOLOGY**

Alternative/ new tools **FOR ORGANIC SYNTHESIS**

Advanced **ORGANIC SYNTHESIS**

**GENERAL PRINCIPLES** of retrosynthesis, stereochemistry and thermochemistry

## CATALYSIS

**CATALYST (NANOMATERIALS)** design and applications

**CATALYSIS:** from Basic principles to applications:

- **HOMOGENEOUS**
- **HETEROGENEOUS**
- **PHOTOCATALYSIS**
- **BIOCATALYSIS**
- **ELECTROCATALYSIS**

## EXPERIMENTAL LAB 1
## FLOW + ALTERNATIVE TECHNOLOGIES

**ALKYLATION OF AROMATICS**
(batch or microwave or flow)

**CATALYST SYNTHESIS**
(supported metal nanoparticles), batch or microwave or flow

**SYNTHESIS OF BIODIESEL**
from WCO (batch or microwave or flow)

## EXPERIMENTAL LAB 2
## BIOREFINERIES AND BIOPRODUCTS

**EXTRACTION OF BIOCHEMICALS**
from biomass/ waste

**PREPARATION OF MESOPOROUS**
starch from plain starch

**PREPARATION OF MESOPOROUS**
carbonaceous materials from mesoporous starch

SPECIAL COURSE ON THE PROBLEM OF MICROPLASTICS AS A POLLUTANT

## THE PROBLEM OF MICROPLASTICS

is one of the most serious "deferred" **environmental problems of the 21st century**

The emergence of billions of tons **OF POLYMER WASTE around the world**

Annual doubling of the number of **WoS publications** on the topic **OF MICROPLASTIC POLLUTION OF THE ECOSYSTEM** over the past **3** years

A large number of interdisciplinary problems associated with the detection, **characterization and study OF THE IMPACT OF MICROPLASTICS ON HUMAN HEALTH**

## WORLD EXPERTS

and members of the Russian Academy of Sciences will be involved in delivering lectures

Prof. **Francis Verpoort**

CHINA

**Hi=63**

Prof. **Maria Branco da Silva Montenegro**

PORTUGAL

**Hi=30**

# PARTNER UNIVERSITIES

## KING SAUD UNIVERSITY (KSU)

SAUDI ARABIA

QS 203

## Xi'an Jiaotong University

CHINA

QS 302

## Universidade Federal do Pará

BRAZIL