

ISSN 1996-4196

# Chemistry & Chemical Technology

*Editor-in-Chief*  
*Michael Bratychak*

Volume 17 • Number 3

2023



LITTERIS ET ARTIBVS

Lviv Polytechnic  
National University

**Chemistry  
&  
Chemical Technology**

Volume 17 • Number 3  
2023

Quarterly journal  
published from 2007

**Founder and Publisher**

*Lviv Polytechnic National University*

**Address for contacts:**

*Lviv Polytechnic National University*

12, Bandery str., Lviv, 79013, Ukraine

Tel.: + 38 032 258 2166

e-mail: mbratychak@gmail.com

http://science2016.lp.edu.ua/chcht

**Publishing House of**

*Lviv Polytechnic National University*

4, F. Kolessy str., Lviv, 79013, Ukraine

Tel.: +38 032 258 4100

vlp@vlp.com.ua; http://vlp.com.ua

**Printing Center of Publishing House  
of Lviv Polytechnic National University**

4, F. Kollessy str., Lviv, 79013, Ukraine

Tel.: +38 032 258 4100

© Lviv Polytechnic National  
University, 2023

Науково-технічний журнал  
"Хімія та хімічна технологія"  
№ 3 (67) • 2023

Виходить щоквартально  
з вересня 2007 року.

**Засновник і видавець**

*Національний університет  
"Львівська політехніка"*

**Контактна адреса:**

*Національний університет  
"Львівська політехніка"*

вул. Бандери, 12, Львів, 70013, Україна

Тел.: + 38 032 258 2166

e-mail: mbratychak@gmail.com

http://science2016.lp.edu.ua/chcht

Мова видання англійська.

Свідоцтво про державну реєстрацію  
№ 13066-1950P від 25.07.2007 р.

Рекомендувала Вчена рада  
Національного університету  
"Львівська політехніка"  
(протокол № 91 від 28.02.2023 р.)

ISSN 1996-4196

© Національний університет  
"Львівська політехніка", 2023

**Editorial Board**

Prof. **Michael Bratychak**, Lviv Polytechnic National University,  
Ukraine – Editor-in-Chief

Prof. **Volodymyr Starchevskyy**, Lviv Polytechnic National University,  
Ukraine – Deputy Editor-in-Chief

Prof. **Ananiy Kohut**, Lviv Polytechnic National University,  
Ukraine – Executive Secretary

Prof. **Marc J.M. Abadie**, France

Prof. **Rameshwar Adhikari**, Nepal

Prof. **Volodymyr Atamanyuk**, Ukraine

Prof. **Dariusz M. Bieliński**, Poland

Prof. **Witold Brostow**, USA

Prof. **Victor Castano**, Mexico

Prof. **Volodymyr Donchak**, Ukraine

Prof. **Oleg Figovsky**, Israel – Canada

Prof. **Ulf Gedde**, Sweden

Prof. **Roman Gladyshevskii**, Ukraine

Prof. **Juozas Vidas Gražulevičius**, Lithuania

Prof. **Oleg Grynshyn**, Ukraine

Dr. **Shaghayegh Hamzehlou**, Spain

Prof. **Roald Hoffmann**, USA

Prof. **Cemil Ibiş**, Turkey

Prof. **Radomir Jasiński**, Poland

Prof. **Stepan Kuchmiy**, Ukraine

Prof. **Roman Lesyk**, Ukraine

Dr. **Rimantas Levinskas**, Lithuania

Prof. **Volodymyr Levytskyi**, Ukraine

Prof. **Vira Lubenets**, Ukraine

Prof. **Elizabete Lucas**, Brazil

Prof. **Myroslav Malyovanyy**, Ukraine

Prof. **Krzysztof Matyjaszewski**, USA

Prof. **Alice Mija**, France

Prof. **Denis Miroshnichenko**, Ukraine

Prof. **Roman Nebesnyi**, Ukraine

Prof. **Larysa Paniwnyk**, United Kingdom

Prof. **Andrij Pich**, Netherlands

Prof. **Serhiy Pyshyev**, Ukraine

Prof. **Iryna Savchenko**, Ukraine

Prof. **Pavlo Shapoval**, Ukraine

Prof. **Volodymyr Skorokhoda**, Ukraine

Prof. **Anatoliy Starovoit**, Ukraine

Prof. **Maryna Stasevych**, Ukraine

Prof. **Yurij Stetsyshyn**, Ukraine

Prof. **Miriam Strumia**, Argentina

Prof. **Kostyantyn Sukhyy**, Ukraine

Prof. **Poonam Tandon**, India

Prof. **Domagoj Vrsaljko**, Croatia

Prof. **Maria Ząbkowska–Waclawek**, Poland

Prof. **Eldar Zeynalov**, Azerbaijan

Prof. **Borys Zimenkovsky**, Ukraine

Prof. **Zenoviy Znak**, Ukraine

**Acknowledgements**

*Dr. Olena Shyshchak and Olha Yarema.*

*Chemistry & Chemical Technology*, a quarterly journal, published by Lviv Polytechnic National University, Lviv, Ukraine is publishing pre-reviewed scientific and technical research papers covering chemical science and technology in the field of analytical chemistry, general and inorganic chemistry, organic chemistry, physical chemistry, chemistry of high molecular compounds, chemical kinetics and catalysis, biotechnology, materials science and engineering, technology of inorganic substances, technology of organic synthesis products, chemical technology of fossil fuels processing, ecology of chemical processes.

The papers are abstracted and indexed by: Scopus, Chemical Abstracts (CAS), Web of Science Core Collection (ESCI), Google Scholar, ICI Journals Master List, Worldcat, EuroPub, Vernadsky National Library, Electronic Journals Library GIGA, Social Science Research Center Berlin, DESY Publication Database, ZHdK Medien- und Informationszentrum, Elektronische Zeitschriftenbibliothek, Bielefeld Academic Search Engine (BASE), Vse Nauki.

## AUTHOR GUIDELINES

### GENERAL

Chemistry & Chemical Technology journal publishes innovative research papers in such fields as: analytical chemistry; general and inorganic chemistry; organic chemistry; physical chemistry; chemistry of high molecular compounds; chemical kinetics and catalysis; materials science and engineering; technology of inorganic substances; technology of organic synthesis products; chemical technology of processing of combustible minerals; processes and apparatus of chemical productions; biotechnology; ecology.

All manuscripts are peer reviewed, and final acceptance is contingent upon satisfactory response by the author to the reviewers' comments.

### SUBMISSION OF MANUSCRIPT

Manuscripts of the articles should be addressed to the Editor-in-Chief, Prof. Michael Bratychak by e-mail: mbratychak@gmail.com

The content of the manuscripts must correspond to the scope of the journal and be written in English in a clear and concise manner. Manuscripts which are not written in fluent English will be rejected automatically without review. Authors are fully responsible for the content of their published materials.

A cover letter must accompany every manuscript submission. In this letter authors must state that the manuscript has not been previously published and is not under consideration for publication elsewhere.

After a preliminary assessment by the Editorial Board and acceptance of the subject of the paper as compliant with the profile of the journal, the paper is registered and the register number is handed over to the authors.

### PREPARATION OF MANUSCRIPT

Manuscripts have to be submitted in MS Word format, font – Times New Roman, size 10.5, 1.1 space interval. All pages must be numbered, starting from the title page. The manuscript length should not be less than 8 pages. Figures, schemes, equations and tables must be inserted into the main body. The following margins should be used: 18 mm on the left, 22 mm on the right, 20 mm on top, 29 mm below.

Manuscript Text Components should be assembled in the following sequence: Title, Authors, Abstract, Keywords, Introduction, Experimental, Results and Discussion, Conclusions, Acknowledgements (if necessary), References. Abbreviations and uncommon symbols should be explained at the first mention. List of abbreviations is possible.

#### Title and authors:

- Title of the article should be typed in capital letters (size 14) and be concise and informative; avoid abbreviations and formulae where possible.
- Full first and family names of all coauthors; where the name may be ambiguous (e.g. a double name), please indicate this clearly.
- Authors' affiliation addresses; provide the full postal address of each affiliation, including the country name
- e-mail of the coauthor to whom the correspondence is to be sent

**Abstract** should be concise and factual, of not more than 50 words. It should briefly reflect all aspects of the study, as most databases list mainly abstracts.

**Keywords (not more than 5-6)** should represent content of the whole article and be characteristic of the terminology used within the particular field of study. Avoid general and plural terms and multiple concepts (avoid, for example, "and", "of"). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible.

**Introduction** should be brief and clear and needs to include relevant references followed by an objective of the research.

All materials and methods by which the results were obtained should be described in the **Experimental** or basic theory part. Subsections should be numbered 2.1. (then 2.1.1., 2.1.2...), 2.2. may be used.

**Results and Discussion.** Results should be presented with clarity and precision. The Discussion should interpret the findings in view of

the results. Also here subheadings may be used. Avoid extensive citations and discussion of published literature. Please move any detailed description of equations or methods to the experimental section (theoretical part).

**Conclusions** should emphasize the main achievements of this work, underline their significance and give examples of their possible application.

**Acknowledgements** of people, grants, funds, etc. should be brief and placed in a separate paragraph after the text.

**A list of abbreviations** should be included if applicable.

#### References

The accuracy of the references is critical and is the responsibility of the authors. Authors should refrain from using Wikipedia as a source.

Reference numbers should be typed as unparenthesized superscripts in the text but should be enclosed in parentheses in the reference list. References and notes should be typed in numerical order at the end of the text. References should be individually numbered with only one reference per citation.

Authors should follow the ACS style for reference format. The titles should be included in title case, and ending page numbers should be included. References with more than 10 authors should list the first 10 authors followed by "et al." ISO4 abbreviated titles for journals names should be used.

No references to unpublished results are allowed, but citation of manuscripts that have been submitted or accepted for publication and have not yet appeared is acceptable. References to materials that are "in press" should include the DOI when available.

Journals' and books' titles in the original languages must be typed in Latin letters without translation into English.

For examples see <http://science2016.lp.edu.ua/jcct/>

**Illustrations** (figures, graphics, and pictures). Figures are numbered consecutively with Arabic numerals. Captions for figures should follow on the same line as the figure number and should be placed under the figure (not on the figure itself), in the center (size 9.5). Figures should appear within the manuscript when mentioned and should not be grouped at the end. They must be suitable for corrections or changes, and their sizes must correspond to the parameters of the page.

The quality of illustrations in Chem.Chem.Technol. journal depends on the quality of the original files provided by the authors. Color figures will be black-and-white, remember this when explain the legend of the figure.

**Structural formulas** should be carefully drawn and numbered consecutively in the order of appearance in the text (with Arabic numerals).

Chemical and mathematical **equations** are denoted by Arabic numerals in parentheses at the right side and should be numbered consecutively.

**Tables** are numbered consecutively with Arabic numerals. Basic size of the tables is 9.5; size of the table titles is 10.5. The title should immediately follow the table number at the head of the table. Tables should appear within the manuscript when mentioned and should not be grouped at the end.

Mathematical equations must be typed and should be presented in the proper type style (i.e., italics, boldface, subscript, superscript, etc.).

**Units.** Follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI.

#### Supporting Information

This information is provided only to the reviewers during the peer-review process Supporting Information (if necessary) must be submitted at the same time as the manuscript.

When including supporting information for review, include copies of references that are unpublished or in-press. These files are available only to editors and reviewers.