

[Back to results](#) | 1 of 1[Download](#) [Print](#) [Save to PDF](#) [Add to List](#) [Create bibliography](#)**ChemBioEng Reviews** • Volume 11, Issue 2, Pages 231 - 252 • April 2024**Document type**

Review

Source type

Journal

ISSN

21969744

DOI

10.1002/cben.202300051

[View more](#)

Unlocking the Anticancer Potential of Ionic Liquids

Mohd Noor, Najihah^a; Elgharbawy, Amal A. M.^b ; Moniruzzaman, Muhammad^c; Goto, Masahiro^d[Save all to author list](#)^a International Islamic University Malaysia, Department of Chemical Engineering and Sustainability, Kulliyah of Engineering, P.O. Box 10, Kuala Lumpur, 50728, Malaysia^b International Islamic University Malaysia, International Institute for Halal Research and Training (INHART), P.O. Box 10, Kuala Lumpur, 50728, Malaysia^c Universiti Teknologi PETRONAS, Chemical Engineering Department, Perak, Seri Iskandar, 32610, Malaysia^d Kyushu University, Department of Applied Chemistry, Graduate School of Engineering, 744 Motooka, Nishi-ku, Fukuoka, 819-0395, Japan1 77th percentile
Citation in Scopus0.69
FWCI [View all metrics](#) [Full text options](#) [Export](#) [Abstract](#)[Author keywords](#)[Reaxys Chemistry database information](#)[Indexed keywords](#)[Sustainable Development Goals](#)[SciVal Topics](#)[Metrics](#)

Abstract

Despite advances in cancer treatment, many types of cancer still have high mortality rates, and the existing therapies can cause considerable side effects. Therefore, discovering new therapies, especially ones with fewer side effects, is desirable to improve the outcomes for cancer patients. Ionic liquids (ILs) have emerged as potential candidates for cancer treatment because of their particular physicochemical properties, which can be tailored for specific applications. In recent years, interest in exploring the potential of ILs in cancer treatment has been growing, and several studies have demonstrated the effectiveness of ILs in inhibiting cancer-cell growth. This review provides insight into the anticancer potential of ILs, exploring the diverse applications and the underlying mechanisms behind the cytotoxicity toward cancer cells of ILs. Understanding the mechanisms behind the cytotoxicity of ILs can aid in the design and optimization of IL-based cancer therapies. By focusing on specific pathways and targets, IL-based cancer therapies may be developed that offer new possibilities for treating this devastating disease. © 2023 Wiley-VCH GmbH.

Cited by 1 document

Tailored amino acid-derived ionic Liquids: Precision chemotherapy for tumors

Juan Andreu, J. , Falomir, E. , García-Verdugo, E.
(2024) *Journal of Molecular Liquids*[View details of this citation](#)

Inform me when this document is cited in Scopus:

[Set citation alert](#)

Related documents

Recent Developments in Ionic Liquid-Assisted Topical and Transdermal Drug Delivery

Ali, M.K. , Moshikur, R.M. , Goto, M.
(2022) *Pharmaceutical Research*

Enhanced In Vitro Antiviral Activity of Hydroxychloroquine Ionic Liquids against SARS-CoV-2

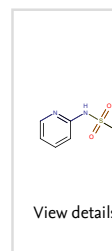
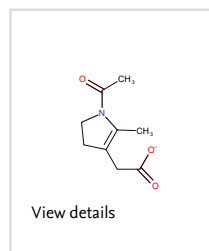
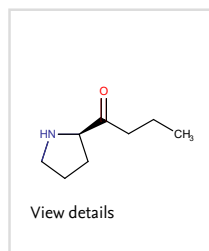
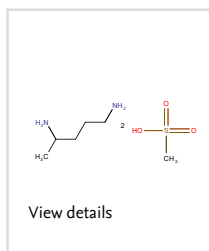
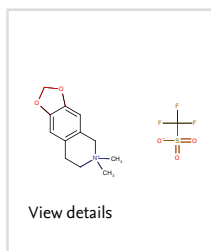

Faísca, F. , Correia, V. , Petrovski, Ž.
(2022) *Pharmaceutics*


Ionic liquids and deep eutectic solvents for application in pharmaceuticals

Santos, M.M. , Branco, L.C.
(2020) *Pharmaceutics*[View all related documents based on references](#)

Find more related documents in Scopus based on:

[Authors](#) [Keywords](#)

Powered by 




[Indexed keywords](#) 

[Sustainable Development Goals](#)  

[SciVal Topics](#)  

[Metrics](#) 

References (116)

[View in search results format >](#) All [Export](#)  [Print](#)  [E-mail](#)  [Save to PDF](#) [Create bibliography](#)

-
- 1 [Debela, D.T., Muzazu, S.G.Y., Heraro, K.D., Ndalama, M.T., Mesele, B.W., Haile, D.C., Kitui, S.K., \(...\), Manyazewal, T.](#)
New approaches and procedures for cancer treatment: Current perspectives

(2021) *SAGE Open Medicine*, 9. Cited 483 times.
<https://journals.sagepub.com/home/SMO>
doi: 10.1177/205031212111034366
[View at Publisher](#)
-
- 2 [Sun, D., Gao, W., Hu, H., Zhou, S.](#)
Why 90% of clinical drug development fails and how to improve it?

(2022) *Acta Pharmaceutica Sinica B*, 12 (7), pp. 3049-3062. Cited 453 times.
http://www.elsevier.com/locate/journaldescription.cws_home/725753/description#description
doi: 10.1016/j.apsb.2022.02.002
[View at Publisher](#)
-
- 3 [Kiriiri, G.K., Njogu, P.M., Mwangi, A.N.](#)
(2020) *Future J. Pharm. Sci.*, 6 (1), pp. 1-12. Cited 462 times.
-
- 4 [Chowdhury, M.R., Moshikur, R.M., Wakabayashi, R., Tahara, Y., Kamiya, N., Moniruzzaman, M., Goto, M.](#)
Ionic-Liquid-Based Paclitaxel Preparation: A New Potential Formulation for Cancer Treatment

(2018) *Molecular Pharmaceutics*, 15 (6), pp. 2484-2488. Cited 107 times.
<http://pubs.acs.org/journal/mpohbp>
doi: 10.1021/acs.molpharmaceut.8b00305
[View at Publisher](#)

- 5 Clarke, C.J., Tu, W.-C., Levers, O., Bröhl, A., Hallett, J.P.
Green and Sustainable Solvents in Chemical Processes
(2018) *Chemical Reviews*, 118 (2), pp. 747-800. Cited 1324 times.
<http://pubs.acs.org/journal/chcreay>
doi: 10.1021/acs.chemrev.7b00571
View at Publisher
-
- 6 Qiu, Y., Chen, T., Hu, R., Zhu, R., Li, C., Ruan, Y., Xie, X., (...), Li, Y.
(2021) *Biomark. Res.*, 9 (1), pp. 1-19.
-
- 7 Truffi, M., Sorrentino, L., Corsi, F.
Fibroblasts in the Tumor Microenvironment
(2020) *Advances in Experimental Medicine and Biology*, 1234, pp. 15-29. Cited 80 times.
<http://www.springer.com/series/5584>
doi: 10.1007/978-3-030-37184-5_2
View at Publisher
-
- 8 Neophytou, C.M., Panagi, M., Stylianopoulos, T., Papageorgis, P.
The role of tumor microenvironment in cancer metastasis: Molecular mechanisms and therapeutic opportunities
(2021) *Cancers*, 13 (9), art. no. 2053. Cited 168 times.
<https://www.mdpi.com/2072-6694/13/9/2053/pdf>
doi: 10.3390/cancers13092053
View at Publisher
-
- 9 Welch, D.R., Hurst, D.R.
Defining the Hallmarks of Metastasis
(2019) *Cancer Research*, 79 (12), pp. 3011-3027. Cited 419 times.
<http://cancerres.aacrjournals.org/content/79/12/3011.full-text.pdf>
doi: 10.1158/0008-5472.CAN-19-0458
View at Publisher
-
- 10 Fares, J., Fares, M.Y., Khachfe, H.H., Salhab, H.A., Fares, Y.
Molecular principles of metastasis: a hallmark of cancer revisited
(2020) *Signal Transduction and Targeted Therapy*, 5 (1), art. no. 28. Cited 1250 times.
www.nature.com/sigtrans
doi: 10.1038/s41392-020-0134-x
View at Publisher
-
- 11 Hapach, L.A., Mosier, J.A., Wang, W., Reinhart-King, C.A.
(2019) *Npj Precis. Oncol.*, 3 (1), pp. 1-8. Cited 13 times.
-
- 12 Mollaei, M., Hassan, Z.M., Khorshidi, F., Langroudi, L.
Chemotherapeutic drugs: Cell death- and resistance-related signaling pathways. Are they really as smart as the tumor cells?
(2021) *Translational Oncology*, 14 (5), art. no. 101056. Cited 27 times.
<https://www.journals.elsevier.com/translational-oncology/>
doi: 10.1016/j.tranon.2021.101056
View at Publisher

- 13 (2022) *Cancer Research Institute, Cancer Cell Therapy Landscape*
Accessed on January 11, 2023
<https://www.cancerresearch.org/cancer-cell-therapy-landscape>
-
- 14 Tewabe, A., Abate, A., Tamrie, M., Seyfu, A., Siraj, E.A.
Targeted drug delivery — from magic bullet to nanomedicine: Principles, challenges, and future perspectives (Open Access)

(2021) *Journal of Multidisciplinary Healthcare*, 14, pp. 1711-1724. Cited 165 times.
<https://www.dovepress.com/getfile.php?fileID=71324>
doi: 10.2147/JMDH.S313968

View at Publisher
-
- 15 Baghel, P., Roy, A., Verma, S., Satapathy, T., Bahadur, S.
(2020) *Future J. Pharm. Sci.*, 6 (1), pp. 1-11. Cited 25 times.
-
- 16 Rogers, R.D., Seddon, K.R.
Ionic Liquids - Solvents of the Future?

(2003) *Science*, 302 (5646), pp. 792-793. Cited 3819 times.
doi: 10.1126/science.1090313

View at Publisher
-
- 17 Navti, P.D., Pandey, A., Nikam, A.N., Padya, B.S., Kalthur, G., Koteshwara, K.B., Mutalik, S.
Ionic Liquids Assisted Topical Drug Delivery for Permeation Enhancement: Formulation Strategies, Biomedical Applications, and Toxicological Perspective (Open Access)

(2022) *AAPS PharmSciTech*, 23 (5), art. no. 161. Cited 23 times.
<http://www.springerlink.com/content/1530-9932/>
doi: 10.1208/s12249-022-02313-w

View at Publisher
-
- 18 Kunov-Kruse, A.J., Weber, C.C., Rogers, R.D., Myerson, A.S.
The A Priori Design and Selection of Ionic Liquids as Solvents for Active Pharmaceutical Ingredients (Open Access)

(2017) *Chemistry - A European Journal*, 23 (23), pp. 5498-5508. Cited 29 times.
[http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1521-3765](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1521-3765)
doi: 10.1002/chem.201605704

View at Publisher
-
- 19 Zhuang, W., Hachem, K., Bokov, D., Javed Ansari, M., Taghvaie Nakhjiri, A.
Ionic liquids in pharmaceutical industry: A systematic review on applications and future perspectives (Open Access)

(2022) *Journal of Molecular Liquids*, 349, art. no. 118145. Cited 83 times.
<https://www.journals.elsevier.com/journal-of-molecular-liquids>
doi: 10.1016/j.molliq.2021.118145

View at Publisher
-

- 20 Jovanović-Šanta, S., Kojić, V., Atagić, K., Tot, A., Vraneš, M., Gadžurić, S., Karaman, M.
Anticancer and antimicrobial properties of imidazolium based ionic liquids with salicylate anion
(2020) *Journal of the Serbian Chemical Society*, 85 (3), pp. 291-303. Cited 13 times.
<http://www.doiserbia.nb.rs/img/doi/0352-5139/2020/0352-51391900098j.pdf>
doi: 10.2298/JSC190717098J
View at Publisher
-
- 21 Ferraz, R., Silva, D., Dias, A.R., Dias, V., Santos, M.M., Pinheiro, L., Prudêncio, C., (...), Branco, L.C.
Synthesis and antibacterial activity of ionic liquids and organic salts based on penicillin g and amoxicillin hydrolysate derivatives against resistant bacteria
(2020) *Pharmaceutics*, 12 (3), art. no. 221. Cited 53 times.
<https://www.mdpi.com/1999-4923/12/3/221/pdf>
doi: 10.3390/pharmaceutics12030221
View at Publisher
-
- 22 Santos, M.M., Alves, C., Silva, J., Florindo, C., Costa, A., Petrovski, Ž., Marrucho, I.M., (...), Branco, L.C.
Antimicrobial activities of highly bioavailable organic salts and ionic liquids from fluoroquinolones
(2020) *Pharmaceutics*, 12 (8), art. no. 694, pp. 1-15. Cited 32 times.
<https://www.mdpi.com/1999-4923/12/8/694/pdf>
doi: 10.3390/pharmaceutics12080694
View at Publisher
-
- 23 Guo, J., Qian, Y., Sun, B., Sun, Z., Chen, Z., Mao, H., Wang, B., (...), Yan, F.
Antibacterial Amino Acid-Based Poly(ionic liquid) Membranes: Effects of Chirality, Chemical Bonding Type, and Application for MRSA Skin Infections
(2019) *ACS Applied Bio Materials*, 2 (10), pp. 4418-4426. Cited 33 times.
pubs.acs.org/journal/aabmcb
doi: 10.1021/acsabm.9b00619
View at Publisher
-
- 24 Klebeka, J., Krüger, O., Dubicki, M., Ossowicz-Rupniewska, P., Janus, E.
(2022) *Int. J. Mol. Sci.*, 23 (22), pp. 1-27.
-
- 25 Filipe, L., de Sousa, T., Silva, D., Santos, M.M., Ribeiro Carrott, M., Poeta, P., Branco, L.C., (...), Gago, S.
In Vitro Antimicrobial Studies of Mesoporous Silica Nanoparticles Comprising Anionic Ciprofloxacin Ionic Liquids and Organic Salts
(2023) *Pharmaceutics*, 15 (7), art. no. 1934. Cited 2 times.
<http://www.mdpi.com/journal/pharmaceutics>
doi: 10.3390/pharmaceutics15071934
View at Publisher
-

- 26 Salido-Fortuna, S., Marina, M.L., Castro-Puyana, M.
Enantiomeric determination of econazole and sulconazole by electrokinetic chromatography using hydroxypropyl- β -cyclodextrin combined with ionic liquids based on L-lysine and L-glutamic acid

(2020) *Journal of Chromatography A*, 1621, art. no. 461085. Cited 25 times.
www.elsevier.com/locate/chroma
doi: 10.1016/j.chroma.2020.461085

View at Publisher
-
- 27 Wang, C., Chen, P., Qiao, Y., Kang, Y., Guo, S., Wu, D., Wang, J., (...), Wu, H.
Bacteria-activated chlorin e6 ionic liquid based on cation and anion dual-mode antibacterial action for enhanced photodynamic efficacy (Open Access)

(2019) *Biomaterials Science*, 7 (4), pp. 1399-1410. Cited 36 times.
<http://pubs.rsc.org/en/journals/journal/bm>
doi: 10.1039/c8bm00990b

View at Publisher
-
- 28 Feder-Kubis, J., Wnętrzak, A., Chachaj-Brekiesz, A.
Terpene-Based Ionic Liquids from Natural Renewable Sources As Selective Agents in Antifungal Therapy (Open Access)

(2020) *ACS Biomaterials Science and Engineering*, 6 (7), pp. 3832-3842. Cited 14 times.
<http://pubs.acs.org/journal/abseba>
doi: 10.1021/acsbmaterials.0c00447

View at Publisher
-
- 29 Morais, E.S., Silva, N.H.C.S., Sintra, T.E., Santos, S.A.O., Neves, B.M., Almeida, I.F., Costa, P.C., (...), Freire, C.S.R.
Anti-inflammatory and antioxidant nanostructured cellulose membranes loaded with phenolic-based ionic liquids for cutaneous application (Open Access)

(2019) *Carbohydrate Polymers*, 206, pp. 187-197. Cited 66 times.
http://www.elsevier.com/wps/find/journaldescription.cws_home/405871/description#description
doi: 10.1016/j.carbpol.2018.10.051

View at Publisher
-
- 30 Czerniak, K., Pernak, J.
L-Carnitine-Based Bio-Ionic Liquids as Antioxidants (Open Access)

(2021) *ChemistrySelect*, 6 (9), pp. 1994-2001. Cited 6 times.
[http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)2365-6549](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)2365-6549)
doi: 10.1002/slct.202100420

View at Publisher
-
- 31 Chantereau, G., Sharma, M., Abednejad, A., Vilela, C., Costa, E.M., Veiga, M., Antunes, F., (...), Silvestre, A.J.D.
Bacterial nanocellulose membranes loaded with vitamin B-based ionic liquids for dermal care applications

(2020) *Journal of Molecular Liquids*, 302, art. no. 112547. Cited 47 times.
<https://www.journals.elsevier.com/journal-of-molecular-liquids>
doi: 10.1016/j.molliq.2020.112547

View at Publisher

- 32 Mehta, M.J., Kumar, A.
Ionic Liquid Assisted Gelatin Films: Green, UV Shielding, Antioxidant, and Antibacterial Food Packaging Materials ([Open Access](#))

(2019) *ACS Sustainable Chemistry and Engineering*, 7 (9), pp. 8631-8636. Cited 68 times.
<http://pubs.acs.org/journal/ascecg>
doi: 10.1021/acssuschemeng.9b00423

View at Publisher
-
- 33 Rama, R., Meenakshi, S., Manjunathan, J., Abirami, G., Karthikeyan, S.
Furoate Based Functionalised Ionic Liquid: Antimicrobial and Antioxidant Studies

(2021) *Australian Journal of Chemistry*, 74 (3), pp. 186-191. Cited 3 times.
<http://www.publish.csiro.au/nid/52/aid/49.htm>
doi: 10.1071/CH20178

View at Publisher
-
- 34 Bastos, J.C., Vieira, N.S.M., Gaspar, M.M., Pereiro, A.B., Araújo, J.M.M.
(2022) *Sustainable Chem.*, 3 (3), pp. 358-375. Cited 7 times.
-
- 35 Rapaić, M., Panić, J., Teofilović, B., Grujić-Letić, N., Gadžurić, S., Vraneš, M.
Synthesis and evolution of physicochemical properties of new pharmaceutically active ionic liquids - tetracainium salicylate and tetracainium ibuprofenate

(2022) *RSC Advances*, 12 (41), pp. 26800-26807. Cited 4 times.
<http://pubs.rsc.org/en/journals/journal/ra>
doi: 10.1039/d2ra04711j

View at Publisher
-
- 36 Chantereau, G., Sharma, M., Abednejad, A., Neves, B.M., Sèbe, G., Coma, V., Freire, M.G., (...), Silvestre, A.J.D.
Design of Nonsteroidal Anti-Inflammatory Drug-Based Ionic Liquids with Improved Water Solubility and Drug Delivery

(2019) *ACS Sustainable Chemistry and Engineering*, 7 (16), pp. 14126-14134. Cited 52 times.
<http://pubs.acs.org/journal/ascecg>
doi: 10.1021/acssuschemeng.9b02797

View at Publisher
-
- 37 Panić, J., Tot, A., Janković, N., Drid, P., Gadžurić, S., Vraneš, M.
Physicochemical and structural properties of lidocaine-based ionic liquids with anti-inflammatory anions

(2020) *RSC Advances*, 10 (24), pp. 14089-14098. Cited 34 times.
<http://pubs.rsc.org/en/journals/journal/ra>
doi: 10.1039/c9ra08815f

View at Publisher
-

- 38 Silva, A.T., Cerqueira, M.J., Prudêncio, C., Fernandes, M.H., Costa-Rodrigues, J., Teixeira, C., Gomes, P., (...), Ferraz, R.
Antiproliferative Organic Salts Derived from Betulinic Acid: Disclosure of an Ionic Liquid Selective Against Lung and Liver Cancer Cells
- (2019) *ACS Omega*, 4 (3), pp. 5682-5689. Cited 18 times.
pubs.acs.org/journal/acsodf
doi: 10.1021/acsomega.8b03691
- [View at Publisher](#)
-
- 39 Lu, B., Yi, M., Hu, S., Wu, D., Zhu, Z., Wu, C., Wang, Z., (...), Zhang, J.
Taurine-Based Ionic Liquids for Transdermal Protein Delivery and Enhanced Anticancer Activity ([Open Access](#))
- (2021) *ACS Sustainable Chemistry and Engineering*, 9 (17), pp. 5991-6000. Cited 23 times.
<http://pubs.acs.org/journal/ascecg>
doi: 10.1021/acssuschemeng.1c01064
- [View at Publisher](#)
-
- 40 Al-Sodies, S., Rezki, N., Albelwi, F.F., Messali, M., Aouad, M.R., Bardaweel, S.K., Hagar, M.
Novel dipyrindinium lipophile-based ionic liquids tethering hydrazone linkage: Design, synthesis and antitumorigenic study ([Open Access](#))
- (2021) *International Journal of Molecular Sciences*, 22 (19), art. no. 487. Cited 6 times.
<https://www.mdpi.com/1422-0067/22/19/10487/pdf>
doi: 10.3390/ijms221910487
- [View at Publisher](#)
-
- 41 Peyvand, P., Vaezi, Z., Sedghi, M., Dalir, N., Ma'mani, L., Naderi-Manesh, H.
Imidazolium-based ionic liquid functionalized mesoporous silica nanoparticles as a promising nano-carrier: response surface strategy to investigate and optimize loading and release process for Lapatinib delivery
- (2020) *Pharmaceutical Development and Technology*, 25 (9), pp. 1150-1161. Cited 14 times.
<http://www.tandfonline.com/loi/ijphd20>
doi: 10.1080/10837450.2020.1803909
- [View at Publisher](#)
-
- 42 Moshikur, R.M., Ali, M.K., Wakabayashi, R., Moniruzzaman, M., Goto, M.
Methotrexate-based ionic liquid as a potent anticancer drug for oral delivery: In vivo pharmacokinetics, biodistribution, and antitumor efficacy
- (2021) *International Journal of Pharmaceutics*, 608, art. no. 121129. Cited 17 times.
www.elsevier.com/locate/ijpharm
doi: 10.1016/j.ijpharm.2021.121129
- [View at Publisher](#)
-
- 43 Vieira, F.Q., Marques-Magalhães, Â., Miranda-Gonçalves, V., Ferraz, R., Vieira, M., Prudêncio, C., Jerónimo, C., (...), Silva, R.A.
The impact of [c16pyr][amp] on the aggressiveness in breast and prostate cancer cell lines
- (2020) *International Journal of Molecular Sciences*, 21 (24), art. no. 9584, pp. 1-20. Cited 4 times.
<https://www.mdpi.com/1422-0067/21/24/9584/pdf>
doi: 10.3390/ijms21249584
- [View at Publisher](#)

- 44 Teixeira, S., Santos, M.M., Fernandes, M.H., Costa-Rodrigues, J., Branco, L.C.
Alendronic acid as ionic liquid: New perspective on osteosarcoma
(2020) *Pharmaceutics*, 12 (3), art. no. 293. Cited 18 times.
<https://www.mdpi.com/1999-4923/12/3/293/pdf>
doi: 10.3390/pharmaceutics12030293
View at Publisher
-
- 45 Kumar, A., Kumari, K., Singh, S., Bahdur, I., Singh, P.
Noscapine anticancer drug designed with ionic liquids to enhance solubility: DFT and ADME approach (Open Access)
(2021) *Journal of Molecular Liquids*, 325, art. no. 115159. Cited 37 times.
<https://www.journals.elsevier.com/journal-of-molecular-liquids>
doi: 10.1016/j.molliq.2020.115159
View at Publisher
-
- 46 Khansakina, A.S., Nasrullah, A., Ullah, S., Ullah, Z., Khan, Z., Khan, N.A., Khan, S.Z.I.U.D.
(2023) *Chembioeng Rev*, pp. 1-22.
-
- 47 Ohno, H., Fujita, K., Kohno, Y.
Is seven the minimum number of water molecules per ion pair for assured biological activity in ionic liquid-water mixtures?
(2015) *Physical Chemistry Chemical Physics*, 17 (22), pp. 14454-14460. Cited 55 times.
<http://www.rsc.org/Publishing/Journals/CP/index.asp>
doi: 10.1039/c5cp00768b
View at Publisher
-
- 48 Turguła, A., Stęsik, K., Materna, K., Klejdysz, T., Praczyk, T., Pernak, J.
Third-generation ionic liquids with: N -alkylated 1,4-diazabicyclo[2.2.2]octane cations and pelargonate anions (Open Access)
(2020) *RSC Advances*, 10 (15), pp. 8653-8663. Cited 14 times.
<http://pubs.rsc.org/en/journals/journal/ra>
doi: 10.1039/d0ra00766h
View at Publisher
-
- 49 Zhang, W.-X., Gao, Y.-R., Xue, R., Nguyen, W., Chen, W., Wang, J.-H., Shu, Y.
Liquid formulations based on ionic liquids in biomedicine (Open Access)
(2023) *Materials Today Physics*, 30, art. no. 100925. Cited 20 times.
<www.journals.elsevier.com/materials-today-physics>
doi: 10.1016/j.mtphys.2022.100925
View at Publisher
-
- 50 Banerjee, A., Ibsen, K., Brown, T., Chen, R., Agatemor, C., Mitragotri, S.
Ionic liquids for oral insulin delivery
(2018) *Proceedings of the National Academy of Sciences of the United States of America*, 115 (28), pp. 7296-7301. Cited 286 times.
<http://www.pnas.org/content/pnas/115/28/7296.full.pdf>
doi: 10.1073/pnas.1722338115
View at Publisher

- 51 Jadhav, N.R., Bhosale, S.P., Bhosale, S.S., Mali, S.D., Toraskar, P.B., Kadam, T.S.
Ionic liquids: Formulation avenues, drug delivery and therapeutic updates ([Open Access](#))

(2021) *Journal of Drug Delivery Science and Technology*, 65, art. no. 102694. Cited 34 times.
http://www.editionsdesante.fr/category.php?id_category=48
doi: 10.1016/j.jddst.2021.102694

View at Publisher
-

- 52 Egorova, K.S., Gordeev, E.G., Ananikov, V.P.
Biological Activity of Ionic Liquids and Their Application in Pharmaceutics and Medicine ([Open Access](#))

(2017) *Chemical Reviews*, 117 (10), pp. 7132-7189. Cited 1259 times.
<http://pubs.acs.org/journal/chreay>
doi: 10.1021/acs.chemrev.6b00562

View at Publisher
-

- 53 Berton, P., Shamshina, J.L.
Ionic Liquids as Tools to Incorporate Pharmaceutical Ingredients into Biopolymer-Based Drug Delivery Systems ([Open Access](#))

(2023) *Pharmaceuticals*, 16 (2), art. no. 272. Cited 6 times.
<https://www.mdpi.com/journal/pharmaceuticals>
doi: 10.3390/ph16020272

View at Publisher
-

- 54 Adawiyah, N., Moniruzzaman, M., Hawatulaila, S., Goto, M.
Ionic liquids as a potential tool for drug delivery systems ([Open Access](#))

(2016) *MedChemComm*, 7 (10), pp. 1881-1897. Cited 220 times.
<http://www.rsc.org/Publishing/Journals/MD/About.asp>
doi: 10.1039/c6md00358c

View at Publisher
-

- 55 Hough, W.L., Smiglak, M., Rodríguez, H., Swatloski, R.P., Spear, S.K., Daly, D.T., Pernak, J., (...), Rogers, R.D.
The third evolution of ionic liquids: Active pharmaceutical ingredients ([Open Access](#))

(2007) *New Journal of Chemistry*, 31 (8), pp. 1429-1436. Cited 751 times.
<http://pubs.rsc.org/en/journals/journal/nj>
doi: 10.1039/b706677p

View at Publisher
-

- 56 Moshikur, R.M., Ali, M.K., Wakabayashi, R., Moniruzzaman, M., Goto, M.
Favipiravir-Based Ionic Liquids as Potent Antiviral Drugs for Oral Delivery: Synthesis, Solubility, and Pharmacokinetic Evaluation

(2021) *Molecular Pharmaceutics*, 18 (8), pp. 3108-3115. Cited 25 times.
<http://pubs.acs.org/journal/mpohbp>
doi: 10.1021/acs.molpharmaceut.1c00324

View at Publisher
-

- 57 Faísca, F., Correia, V., Petrovski, Ž., Branco, L.C., Rebelo-De-andrade, H., Santos, M.M.

Enhanced In Vitro Antiviral Activity of Hydroxychloroquine Ionic Liquids against SARS-CoV-2 ([Open Access](#))

(2022) *Pharmaceutics*, 14 (4), art. no. 877. Cited 5 times.

<https://www.mdpi.com/1999-4923/14/4/877/pdf>

doi: 10.3390/pharmaceutics14040877

[View at Publisher](#)

- 58 Yuan, Y., Zhang, B., Wang, L., Wang, L.

Low-Carbon Strategies Considering Corporate Environmental Responsibility: Based on Carbon Trading and Carbon Reduction Technology Investment ([Open Access](#))

(2022) *Sustainability (Switzerland)*, 14 (11), art. no. 6683. Cited 10 times.

<https://www.mdpi.com/2071-1050/14/11/6683/pdf?version=1653997034>

doi: 10.3390/su14116683

[View at Publisher](#)

- 59 Shu, Y., Xue, R., Gao, Y., Zhang, W., Wang, J.

A thermo-responsive hydrogel loaded with an ionic liquid microemulsion for transdermal delivery of methotrexate

(2022) *Journal of Materials Chemistry B*, 11 (24), pp. 5494-5502. Cited 8 times.

<http://pubs.rsc.org/en/journals/journal/tb>

doi: 10.1039/d2tb02189g

[View at Publisher](#)

- 60 Grassiri, B., Mezzetta, A., Maisetta, G., Migone, C., Fabiano, A., Esin, S., Guazzelli, L., (...), Piras, A.M.

Betaine- and L-Carnitine-Based Ionic Liquids as Solubilising and Stabilising Agents for the Formulation of Antimicrobial Eye Drops Containing Diacerein ([Open Access](#))

(2023) *International Journal of Molecular Sciences*, 24 (3), art. no. 2714. Cited 7 times.

<http://www.mdpi.com/journal/ijms>

doi: 10.3390/ijms24032714

[View at Publisher](#)

- 61 Kulshrestha, A., Gehlot, P.S., Kumar, A.

Magnetic proline-based ionic liquid surfactant as a nano-carrier for hydrophobic drug delivery ([Open Access](#))

(2020) *Journal of Materials Chemistry B*, 8 (15), pp. 3050-3057. Cited 35 times.

<http://pubs.rsc.org/en/journals/journal/tb>

doi: 10.1039/d0tb00176g

[View at Publisher](#)

- 62 Kulshrestha, A., Sharma, S., Singh, K., Kumar, A.

Magneto-responsive biocomposite hydrogels comprising gelatin and valine based magnetic ionic liquid surfactant as controlled release nanocarrier for drug delivery ([Open Access](#))

(2022) *Materials Advances*, 3 (1), pp. 484-492. Cited 26 times.

www.rsc.org/journals-books-databases/about-journals/materials-advances/

doi: 10.1039/d1ma00758k

[View at Publisher](#)

- 63 Kuddushi, M., Pandey, D.K., Singh, D.K., Mata, J., Malek, N.
An ionic hydrogel with stimuli-responsive, self-healable and injectable characteristics for the targeted and sustained delivery of doxorubicin in the treatment of breast cancer

(2022) *Materials Advances*, 3 (1), pp. 632-646. Cited 23 times.
www.rsc.org/journals-books-databases/about-journals/materials-advances/
doi: 10.1039/d1ma00835h

View at Publisher
-
- 64 Saquib, M., Ahamad, S., Khan, M.F., Khan, M.I., Hussain, M.K.
An ultrasound assisted, ionic liquid-molecular iodine synergy driven efficient green synthesis of pyrrolbenzodiazepine-triazole hybrids as potential anticancer agents

(2023) *Frontiers in Pharmacology*, 14, art. no. 1168566. Cited 7 times.
<http://www.frontiersin.org/Pharmacology>
doi: 10.3389/fphar.2023.1168566

View at Publisher
-
- 65 Egorova, K.S., Posvyatenko, A.V., Fakhruddinov, A.N., Galushko, A.S., Seitkalieva, M.M., Ananikov, V.P.
Synergistic/antagonistic cytotoxic effects in mixtures of ionic liquids with doxorubicin or mitoxantrone (Open Access)

(2021) *Journal of Molecular Liquids*, 323, art. no. 114870. Cited 8 times.
<https://www.journals.elsevier.com/journal-of-molecular-liquids>
doi: 10.1016/j.molliq.2020.114870

View at Publisher
-
- 66 Sharma, H., Kumar Sahu, G., Kaur, C.D.
Development of ionic liquid microemulsion for transdermal delivery of a chemotherapeutic agent (Open Access)

(2021) *SN Applied Sciences*, 3 (2), art. no. 215. Cited 9 times.
springer.com/snasc
doi: 10.1007/s42452-021-04235-x

View at Publisher
-
- 67 Li, X., Fan, D.
Smart Collagen Hydrogels Based on 1-Ethyl-3-methylimidazolium Acetate and Microbial Transglutaminase for Potential Applications in Tissue Engineering and Cancer Therapy (Open Access)

(2019) *ACS Biomaterials Science and Engineering*, 5 (7), pp. 3523-3536. Cited 20 times.
<http://pubs.acs.org/journal/abseba>
doi: 10.1021/acsbiomaterials.9b00393

View at Publisher
-
- 68 Santos, M.M., Raposo, L.R., Carrera, G.V.S.M., Costa, A., Dionísio, M., Baptista, P.V., Fernandes, A.R., (...), Branco, L.C.
Ionic Liquids and Salts from Ibuprofen as Promising Innovative Formulations of an Old Drug

(2019) *ChemMedChem*, 14 (9), pp. 907-911. Cited 45 times.
[http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1860-7187](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1860-7187)
doi: 10.1002/cmdc.201900040

View at Publisher

- 69 Al-Blewi, F.F., Rezki, N., Naqvi, A., Uddin, H.Q., Al-sodies, S., Messali, M., Aouad, M.R., (...), Bardaweel, S.
(2019) *Int. J. Mol. Sci.*, 20 (12), p. 2865. Cited 2 times.
-
- 70 Daddiouaissa, D., Amid, A., Kabbashi, N.A., Fuad, F.A.A., Elnour, A.M., Epandy, M.A.K.M.S.
Antiproliferative activity of ionic liquid-graviola fruit extract against human breast cancer (MCF-7) cell lines using flow cytometry techniques ([Open Access](#))

(2019) *Journal of Ethnopharmacology*, 236, pp. 466-473. Cited 32 times.
www.elsevier.com/locate/jethpharm
doi: 10.1016/j.jep.2019.03.003

View at Publisher
-
- 71 Su, L., Wu, Q., Tan, L., Huang, Z., Fu, C., Ren, X., Xia, N., (...), Meng, X.
High Biocompatible ZIF-8 Coated by ZrO₂ for Chemo-microwave Thermal Tumor Synergistic Therapy

(2019) *ACS Applied Materials and Interfaces*, 11 (11), pp. 10520-10531. Cited 89 times.
<http://pubs.acs.org/journal/aamick>
doi: 10.1021/acsami.8b22177

View at Publisher
-
- 72 Caparica, R., Júlio, A., Araújo, M.E.M., Baby, A.R., Fonte, P., Costa, J.G., de Almeida, T.S.
Anticancer activity of rutin and its combination with ionic liquids on renal cells

(2020) *Biomolecules*, 10 (2), art. no. 233. Cited 95 times.
<https://www.mdpi.com/2218-273X/10/2/233/pdf>
doi: 10.3390/biom10020233

View at Publisher
-
- 73 Celik, S., Albayrak, A.T., Akyuz, S., E. Ozel, A.
Molecular modelling and vibrational investigations of ammonium-based ionic liquid (CLTOAB) ([Open Access](#))

(2019) *Journal of Biomolecular Structure and Dynamics*, 37 (10), pp. 2515-2526. Cited 12 times.
<http://www.tandfonline.com/loi/tbsd20>
doi: 10.1080/07391102.2018.1495578

View at Publisher
-
- 74 Tampucci, S., Guazzelli, L., Burgalassi, S., Carpi, S., Chetoni, P., Mezzetta, A., Nieri, P., (...), Monti, D.
Ph-responsive nanostructures based on surface active fatty acid-protic ionic liquids for imiquimod delivery in skin cancer topical therapy ([Open Access](#))

(2020) *Pharmaceutics*, 12 (11), art. no. 1078, pp. 1-22. Cited 53 times.
<https://www.mdpi.com/1999-4923/12/11/1078/pdf>
doi: 10.3390/pharmaceutics12111078

View at Publisher
-

- 75 Zaharudin, N.S., Mohamed Isa, E.D., Ahmad, H., Abdul Rahman, M.B., Jumbri, K.
Functionalized mesoporous silica nanoparticles templated by pyridinium ionic liquid for hydrophilic and hydrophobic drug release application (Open Access)
(2020) *Journal of Saudi Chemical Society*, 24 (3), pp. 289-302. Cited 88 times.
<http://www.sciencedirect.com/science/journal/13196103>
doi: 10.1016/j.jscs.2020.01.003
View at Publisher
-
- 76 Fan, J.-P., Lai, X.-H., Zhang, X.-H., Yang, L., Yuan, T.-T., Chen, H.-P., Liang, X.
Synthesis and evaluation of the cancer cell growth inhibitory activity of the ionic derivatives of oleanolic acid and ursolic acid with improved solubility (Open Access)
(2021) *Journal of Molecular Liquids*, 332, art. no. 115837. Cited 16 times.
<https://www.journals.elsevier.com/journal-of-molecular-liquids>
doi: 10.1016/j.molliq.2021.115837
View at Publisher
-
- 77 Han, S., Yao, A., Wang, Y.
An ionic liquid-molecularly imprinted composite based on graphene oxide for the specific recognition and extraction of cancer antigen 153
(2021) *RSC Advances*, 11 (22), pp. 13085-13090. Cited 11 times.
<http://pubs.rsc.org/en/journals/journal/ra>
doi: 10.1039/d1ra00134e
View at Publisher
-
- 78 Zhang, Y., Lv, Q., Chi, K., Li, Q., Fan, H., Cai, B., Xiao, F., (...), Wang, L.
Hierarchical porous carbon heterojunction flake arrays derived from metal organic frameworks and ionic liquid for H₂O₂ electrochemical detection in cancer tissue (Open Access)
(2021) *Nano Research*, 14 (5), pp. 1335-1343. Cited 18 times.
<http://www.springer.com/materials/nanotechnology/journal/12274>
doi: 10.1007/s12274-020-3176-z
View at Publisher
-
- 79 Işın, D., Eksin, E., Erdem, A.
Graphene-Oxide and Ionic Liquid Modified Electrodes for Electrochemical Sensing of Breast Cancer 1 Gene (Open Access)
(2022) *Biosensors*, 12 (2), art. no. 95. Cited 15 times.
<https://www.mdpi.com/2079-6374/12/2/95/pdf>
doi: 10.3390/bios12020095
View at Publisher
-
- 80 Dias, A.R., Ferraz, R., Costa-Rodrigues, J., Santos, A.F.M., Jacinto, M.L., Prudêncio, C., Noronha, J.P., (...), Petrovski, Ž.
(2022) *Future Pharmacol.*, 2 (3), pp. 320-329.

🔍 Elgharbawy, A.A.M.; International Islamic University Malaysia, International Institute for Halal Research and Training (INHART), P.O. Box 10, Kuala Lumpur, Malaysia;
email:amal.elgharbawy@gmail.com

© Copyright 2024 Elsevier B.V., All rights reserved.

About Scopus

[What is Scopus](#)

[Content coverage](#)

[Scopus blog](#)

[Scopus API](#)

[Privacy matters](#)

Language

[日本語版を表示する](#)

[查看简体中文版本](#)

[查看繁體中文版本](#)

[Просмотр версии на русском языке](#)

Customer Service

[Help](#)

[Tutorials](#)

[Contact us](#)

ELSEVIER

[Terms and conditions](#) ↗ [Privacy policy](#) ↗

All content on this site: Copyright © 2024 Elsevier B.V. ↗, its licensors, and contributors. All rights are reserved, including those for text and data mining, AI training, and similar technologies. For all open access content, the Creative Commons licensing terms apply.

We use cookies to help provide and enhance our service and tailor content. By continuing, you agree to the use of cookies ↗.

