The Determinants in Identify and Analyze of Oxaliplatin Substance: HPLC Implementation

Author(s): Kucherenko Liudmyla, Welchinska Olena, Meleshko Ruslan, Nizhenkovska Iryna, Ostanina Natalia

Email(s): podium@bigmir.net

DOI: 10.52711/0974-360X.2026.00358

Address: Kucherenko Liudmyla1, Welchinska Olena2, Meleshko Ruslan3, Nizhenkovska Iryna2, Ostanina Natalia3
1Zaporizhzhia State Medical and Pharmaceutical University, Zaporizhzhia, Ukraine.
2Bogomolets National Medical University, Kyiv, Ukraine.
3State Agency, O.M. Marzeev Institute of Public Health of the National Academy of Medical Sciences of Ukraine, Laboratory of Quality Control and Safety of Production, Kyiv, Ukraine.
*Corresponding Author

Published In: **Volume -** 19, **Issue -** 6, **Year -** 2026

ABSTRACT:
Oxaliplatin (OXPt) (trans-(R,R)-cyclohexane-1,2-diamine)oxalatoplatin) belongs to platinum-containing anticancer drugs. The lipophilic properties of OXPt contribute to differences from other anticancer agents in overall toxicity and changes in cellular uptake of the drug. The diamine ligand and its stereochemical properties affect the cytotoxic profile of OXPt. Platinum complexes with amino groups in the trans position show better cytotoxic and antitumor activity when compared with the activity of the cis-(R,S)- cyclohexane-1,2-diamine)oxalatoplatin isomer. The trans-(R,R)-isomer is a more potent antitumor agent compared to the trans-(S,S)-congener. There are a number of problematic points in the synthesis of pure racemic mixtures of this substance. It is possible to predict the formation of intramolecular bonds in the substance at the expense of free functional groups and the formation of by-products during synthesis, the degradation of molecules. The most optimal method of quality control of the OXPt substance can be the high-tech method of high-performance liquid chromatography (HPLC), since the State Pharmacopoeia of Ukraine does not regulate the analysis of the substance, while the European Pharmacopoeia (Eur.Ph.) regulates the analysis of specific impurities in the composition of the OXPt substance by the liquid chromatography method chromatography (LC). At the same time, the high quality of the OXPt substance is an important factor in protecting the health and life of cancer patients.

Keywords:

- Oxaliplatin
- Antitumor agents

- Substance
- HPLC
- Accompanying substances
- Impurities
- Retention time.

Cite this article:
Kucherenko Liudmyla, Welchinska Olena, Meleshko Ruslan, Nizhenkovska Iryna, Ostanina Natalia. The Determinants in Identify and Analyze of Oxaliplatin Substance: HPLC Implementation. Research Journal Pharmacy and Technology. 2026;19(6):2504-8. doi: 10.52711/0974-360X.2026.00358

Cite(Electronic):
Kucherenko Liudmyla, Welchinska Olena, Meleshko Ruslan, Nizhenkovska Iryna, Ostanina Natalia. The Determinants in Identify and Analyze of Oxaliplatin Substance: HPLC Implementation. Research Journal Pharmacy and Technology. 2026;19(6):2504-8. doi: 10.52711/0974-360X.2026.00358 Available on: https://www.rjptonline.org/AbstractView.aspx?PID=2026-19-6-15

REFERENCES:

1. Kopper O, de Witte CJ, Lohmussaar K, Valle-Inclan JE, Hami N, Kester L, et al. An organoid platform for ovarian cancer captures intra- and interpatient heterogeneity. Nat Med. 2019; 25(5): 838–49. doi:10.1038/s41591-019-0422-6. Available from: https://pubmed.ncbi.nlm.nih.gov/31011202/
2. Tuveson D, Clevers H. Cancer modeling meets human organoid technology. Science. 2019; 364(6444): 952–5. doi:10.1126/science.aaw6985
3. Takagi Y, Sakai N, Yoshitomi H, Kagawa S, Shimizu H, Furukawa K, et al. High expression of Kruppel-like factor 5 is associated with poor prognosis in patients with colorectal cancer. Cancer Sci. 2020; 111(6): 2078–92. doi:10.1111/cas.14411. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7293098/
4. Atkinson CJ, Kawamata F, Liu C, Gellert P, Koay YC, Jankova L, et al. EGFR and Prion protein promote signaling via FOXO3a-KLF5 resulting in clinical resistance to platinum agents in colorectal cancer. Mol Oncol. 2019; 13(4): 725–37. doi:10.1002/1878-0261.12411. Available from: https://pubmed.ncbi.nlm.nih.gov/30478887/
5. Stadnichenko AV, Krasnopolsky YM, Yarnykh TG. Standardization of extrusion parameters during liposomal oxaliplatin creation. Res J Pharm Technol. 2017; 10(3): 785–8. DOI: 10.5958/0974-360X.2017.00147.0
6. Zuo Q, Xu Q, Li Z, Zhang M, Xu W, Gao Y, et al. Kruppel-like factor 5 enhances proliferation, lipid droplet formation and oxaliplatin resistance in colorectal cancer by promoting fatty acid binding protein 6 transcription. Anticancer Drugs. 2023; 34(10): 1171–82. doi:10.1097/CAD.0000000000001515. Available from: https://pubmed.ncbi.nlm.nih.gov/37067981/
7. Yao J, Yang J, Yang Z, Cheng Y, Guo L, Zhu Y, et al. FBXW11 contributes to stem-cell-like features and liver metastasis through regulating HIC1-mediated SIRT1 transcription in colorectal cancer. Cell Death Dis. 2021; 12(10): 930. doi:10.1038/s41419-021-04185-7. Available from: https://pubmed.ncbi.nlm.nih.gov/34642302/
8. Hua F, Shang S, Yang YW, Zhang H, Yu JJ, Zhao M, et al. TRIB3 interacts with β-Catenin and TCF4 to increase stem cell features of colorectal cancer stem cells and tumorigenesis. Gastroenterology. 2019; 156(3): 798–821. doi:10.1053/j.gastro.2018.10.031. Available from: https://pubmed.ncbi.nlm.nih.gov/30365932/
9. Patel K, Patel D. Simultaneous method development and validation by HPLC for capecitabine and oxaliplatin in mucoadhesive microspheres containing capsules. Res J Pharm Technol. 2021; 14(6): 3365–70. DOI: 10.52711/0974-360X.2021.00585

10. Armstrong A, Haque MR, Mirbagheri S, Jalilian I, Liang H, Habibollah S, et al. Multiplex patient-based drug response assay in pancreatic ductal adenocarcinoma. Biomedicines. 2021; 9(7): 705. doi:10.3390/biomedicines9070705
11. Ou B, Sun H, Zhao J, Yang J, Xu M, Yu W, та ін. Polo-like kinase 3 inhibits glucose metabolism in colorectal cancer by targeting HSP90/STAT3/HK2 signaling. J Exp Clin Cancer Res. 2019; 38: 426. doi:10.1186/s13046-019-1418-2
12. Ganesh K, Basnet H, Kaygusuz Y, Laughney AM, He L, Sharma R, та ін. L1CAM defines the regenerative origin of metastasis-initiating cells in colorectal cancer. Nat Cancer. 2020; 1(1): 28–45. doi:10.1038/s43018-019-0006-x
13. Cañellas-Socias A, Sancho E, Batlle E. Mechanisms of metastatic colorectal cancer. Nat Rev Gastroenterol Hepatol. 2024. doi:10.1038/s41575-024-00934-z
14. Sreelakshmi KP, Shrikumar S. GC-MS analysis of ethyl acetate extract of Mansoa alliacea (Lam.) A.H. Gentry leaves. Asian J Pharm Anal. 2022; 12(1): 1–5. DOI: 10.52711/2231-5675.2022.00001
15. O'Dowd PD, Sutcliffe DF, Griffith DM. Oxaliplatin and its derivatives – An overview. Coord Chem Rev. 2023; 497: 215439. doi:10.1016/j.ccr.2023.215439
16. Liu Z, Cai J, Jiang G, Chen Y, Chen T, Zhang J, та ін. Novel Platinum(IV) complexes intervene oxaliplatin resistance in colon cancer via inducing ferroptosis and apoptosis. Eur J Med Chem. 2024; 263: 115968. doi:10.1016/j.ejmech.2023
17. Kitteringham E, Andriollo E, Gandin V, Morrison LC, Griffith DM. Synthesis, characterisation and in vitro antitumour potential of novel Pt(II) estrogen linked complexes. Inorg Chim Acta. 2019; 495: 118944. doi:10.1016/j.ica.2019.05.043
18. Pradhan M, Alexander A, Ajazuddin. Development and validation of a robust RP-HPLC method for analysis of calcipotriol in pharmaceutical dosage form. Res J Pharm Technol. 2019; 12(2): 579–83. DOI: 10.5958/0974-360X.2019.00103.3
19. Vyas AJ, Godhaniya JP, Patel AI, Patel AB, Patel NK, Chudasama A, та ін. A review on carcinogenic impurities found in marketed drugs and strategies for its determination by analytical methods. Asian J Pharm Anal. 2021; 11(2): 159–69. DOI: 10.52711/2231-5675.2021.00028
20. Patel AB, Asnani AH, Vyas AJ, Patel NK, Patel AI, Lumbhani AN. A brief review on genotoxic impurities in pharmaceuticals. Asian J Pharm Res. 2021; 11(3): 187–93. DOI: 10.52711/2231-5691.2021.00034
21. Kitteringham E, McKeon AM, O'Dowd P, Gandin V, Griffith DM. Synthesis and characterisation of a novel mono functionalisable Pt(IV) oxaliplatin-type complex and its peptide conjugate. Inorg Chim Acta. 2020; 505: 119492. doi:10.1016/j.ica.2020.119492
22. McGhie BS, Sakoff J, Gilbert J, Al-Sayah M, Stokes K, McKeon AM, та ін. Synthesis and characterisation of fluorescent novel Pt(II) cyclometallated complexes with anticancer activity. Int J Mol Sci. 2023; 24: 8049. doi:10.3390/ijms24098049
23. Manasa M, Aanandhi MV. Stability indicating method development and validation of semaglutide by RP-HPLC in pharmaceutical substance and pharmaceutical product. Res J Pharm Technol. 2021; 14(3): 1385–9. doi:10.5958/0974-360X.2021.00247.X. Available from: https://rjptonline.org/AbstractView.aspx?PID=2021-14-3-35
24. Prathyusha P, Sundararajan R, Bhanu P, Mukthinuthalapati MA. A new stability indicating RP-HPLC method for determination of bilastine in bulk and pharmaceutical formulation. Res J Pharm Technol. 2020; 13(6): 2849–53. doi:10.5958/0974-360X.2020.00507.7. Available from: https://rjptonline.org/ AbstractView.aspx?PID=2020-13-6-57
25. Konidala SK, Penumala A, Mugada VK, Kamala GR. Development and validation of RP-HPLC method for simultaneous estimation of paracetamol and flupirtine maleate. Asian J Pharm Anal. 2015; 5(2): 105–11. doi:10.5958/2231-5675.2015.00017.4
26. Parida AK, Rao KS, Patnaik AK. A novel validated RP-HPLC method for the estimation of ticagrelor in bulk and pharmaceutical dosage forms. Res J Pharm Technol. 2018; 11(3): 867–72. doi:10.5958/0974-360X.2018.00161.0. Available from: https://rjptonline.org/AbstractView.aspx?PID=2018-11-3-8
27. Gandla K, Lalitha R, Bommakanti S, Suthakaran R, Pallavi K. Development and validation of RP-HPLC method for simultaneous estimation of albendazole and praziquantel in tablet dosage form. Asian J Pharm Anal. 2015; 5(3): 115–8. doi:10.5958/2231-5675.2015.00018.6
28. Kaur S, Jiwan T. Comparison of adjustment among adolescent boys and girls of substance using parents. Int J Adv Nur Manag. 2016; 4(3): 264–70. doi:10.5958/2454-2652.2016.00058.5
29. Vanaja N, Preethi Ch, Manjunath SY, Pal K. Method development and validation for simultaneous estimation of telmisartan and chlorthalidone by RP-HPLC in pharmaceutical dosage

form. Asian J Pharm Anal. 2015; 5(4): 171–7. doi:10.5958/2231-5675.2015.00027.7
30. European Pharmacopoeia. 10th ed. Vol. 1. Strasbourg: Council of Europe; 2019. p.3442–5.