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Review Article

Synthesis and Activity Studies of Active Pharmaceutical Substances That Can Be Used in Cancer Treatment by Yozgat Bozok University Department of Chemistry

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Abstract

Cancer treatment involves a range of treatments aimed at stopping or slowing the uncontrolled growth of abnormal cells in the body. These methods include surgical intervention, radiotherapy, chemotherapy, targeted drugs, and immunotherapy. Cancer treatment can be applied depending on the patient's type, stage, and general health condition. A multidisciplinary approach is taken during cancer treatment, which requires oncologists, surgeons, radiation specialists, and other healthcare professionals to work together. Treatment aims to destroy or control cancer cells, minimize side effects, and improve the patient's quality of life. In this article, Yozgat Bozok University's Department of Chemistry will provide information about the synthesis and activity studies of active pharmaceutical substances that can be used in cancer treatment.

Keywords: Cancer treatment, Activity studies, Pharmaceutical substances, Antiproliferative

1. INTRODUCTION

The historical development of chemistry in cancer treatment dates to ancient times. Ancient Egyptians used substances obtained from plants in the treatment of cancer. Essentially, the discovery and use of chemical substances of plant origin were the starting point in the historical development of cancer treatment. In the late 19th century and early 20th century, with the development of chemistry, various chemical methods such as synthetic drugs and radiation therapy began to be used in cancer treatment. Research and discoveries made during this period emphasized the importance of chemistry in cancer treatment.

Chemical drugs are one of the basic elements in cancer treatment. Future developments aim to increase the effectiveness of fighting cancer at the cellular and molecular levels. Innovative chemical drugs will have the potential to target cancer cells, causing minimal damage to healthy cells. Additionally, customized drugs are being developed to address treatment-resistant types of cancer more effectively. This means that future chemical drugs in cancer treatment will be more targeted, effective, and have fewer side effects.

Additionally, advances in fields such as nanotechnology and genetic engineering will shape future chemical drug development. Thanks to these advances, drugs that target specific gene mutations will be able to be developed, focusing on individual treatment. This will pave the way for more effective and personalized approaches to cancer treatment.

Additionally, data science and AI-supported drug development processes will enable faster and more efficient discovery of chemical drugs. In the future, chemical drugs used in cancer treatment will be an important part of more specific and personalized treatments, thus increasing patients' quality of life and survival rates.

This article will provide information about the syntheses and activity studies of active pharmaceutical substances that can be used in cancer treatment by Yozgat Bozok University Department of Chemistry from 2013 to the present.

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2. RESULTS AND DISCUSSION

One of the most important health problems in the world and our country is cancer. Therefore, there is an increased demand for drugs used in cancer treatment. As a result, the development of these drugs increases costs in the pharmaceutical industry. For these reasons, interest in domestic cancer drug development studies ranks first among the health policies of countries. For all these reasons, since 2013, Yozgat Bozok University's Department of Chemistry has synthesized active pharmaceutical substances that can be used in cancer treatment and obtained structure activity results with multidisciplinary studies. The study conducted by Koca et al. in 2013 included the synthesis of pyrazolyl acyl thiourea compounds and their anticancer activity studies (Figure 1) [1]. According to the results obtained, it was stated in the study that the new compounds synthesized could be strong candidates for leukemia, liver, and colon cancer drugs.

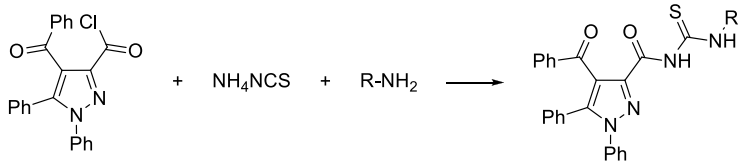

Figure 1. Synthesis of pyrazolyl acyl thiourea compounds

In the study conducted by Koca and his colleagues in 2015, they synthesized coumarin compounds containing the thiazole skeleton and examined their anticancer activity studies (Figure 2) [2]. The results obtained suggest that the synthesized new compounds are important and useful in the treatment of human colon and liver cancer, as proven by in vitro and silico results.

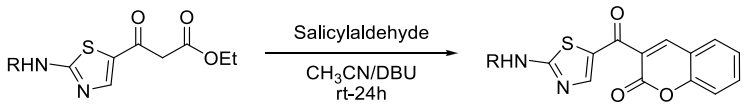

Figure 2. Synthesis of thiazolyl coumarin compounds

In the study conducted by Koca and his colleagues in 2016, they synthesized pyrimidine acyl thiourea compounds and examined their cancer activity studies (Figure 3) [3]. The obtained results explained that the synthesized new pyrimidinyl acyl thiourea derivatives could provide a drug template for the effective treatment of invasive ductal breast carcinoma and its bone metastases, as well as a new therapeutic perspective for drug design.

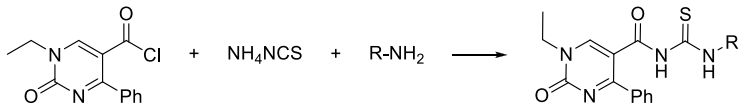

Figure 3. Synthesis of pyrimidinyl thiourea compounds

In the study conducted by Gümüş and his colleagues in 2016, they synthesized benzodiazepine compounds and examined their cancer activity studies (Figure 4) [4]. The results obtained explained the effect of the synthesized new benzodiazepine derivatives on both breast cancer and endothelial cell lines and their potential to inhibit breast cancer and metastasis as drug templates.

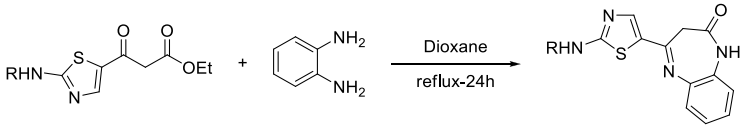

Figure 4. Synthesis of benzodiazepine compounds

In the study conducted by Sağlam and his colleagues in 2021, they synthesized nickel(II) organodithio-phosphorus complexes and examined their cancer activity studies (Figure 5) [5]. The results obtained explained the cytotoxic activities of the newly synthesized nickel(II) organodithio-phosphorus complexes against breast cancer.

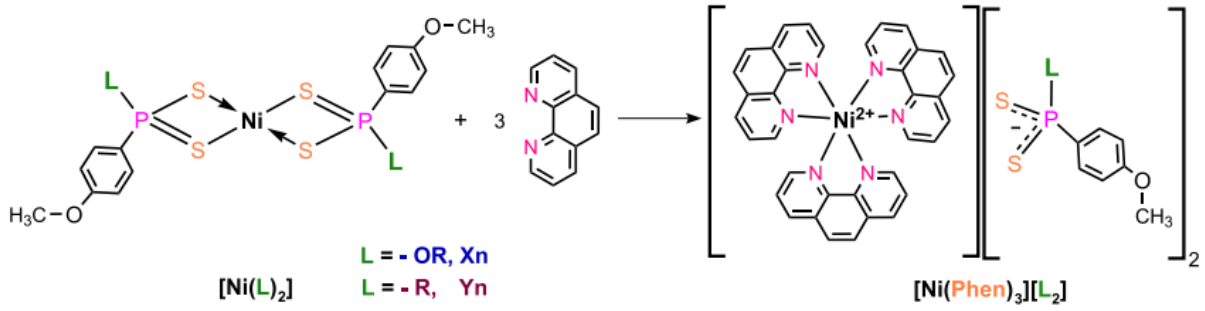

Figure 5. Synthesis of nickel(II) organodithio-phosphorus complexes

In the study conducted by Sağlam and his colleagues in 2021, they synthesized nickel(II) ferrocenyldithiophosphonato complexes and examined their cancer activity studies (Figure 6) [6]. The results obtained explained the antiproliferative activities of the newly synthesized nickel(II) ferrocenyldithiophosphonato complexes against liver, colon, and breast cancer.

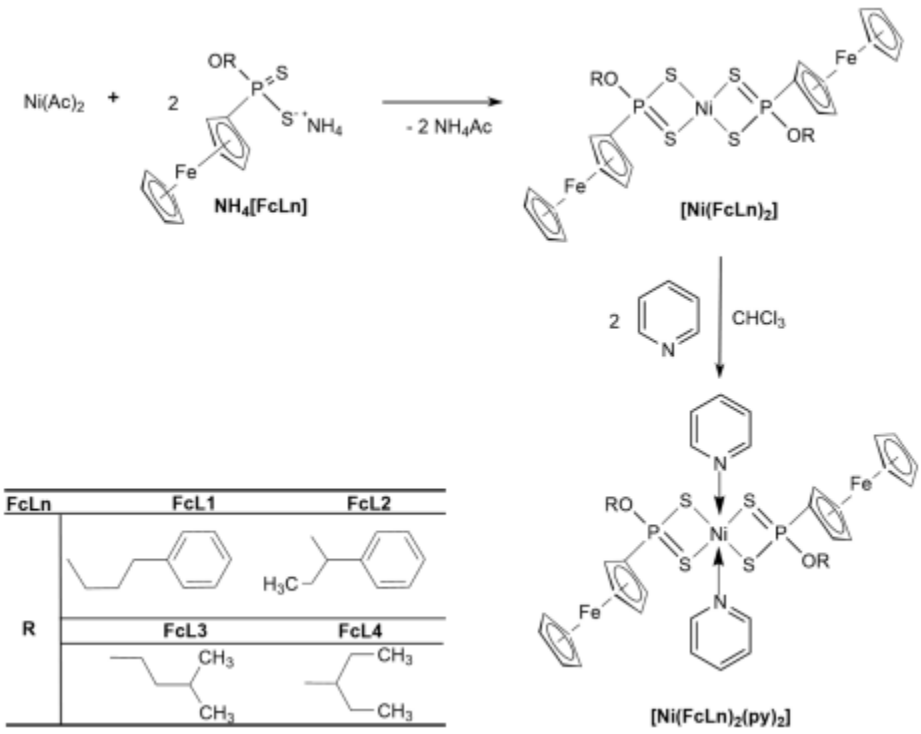

Figure 6. Synthesis of nickel(II) ferrocenyldithiophosphonato complexes

The study conducted by Koca and his colleagues in 2022 includes the synthesis of pyrazolyl-benzoxazinone derivative compounds and their anticancer activity studies (Figure 7) [7]. The results obtained explained the activities of the newly synthesized compounds against breast cancer.

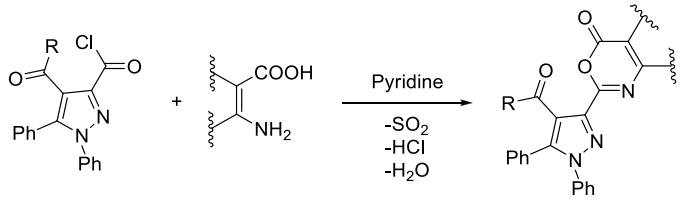

Figure 7. Synthesis of pyrazolyl-benzoxazinone compounds

The study conducted by Kıbrız et al. in 2022 includes the synthesis of hydrazone functionalized thioparabanic acid and rhodanine derivative compounds and their anticancer activity studies (Figure 8) [8]. The results obtained explained the antiproliferative activities of the newly synthesized compounds against liver and colon cancer.

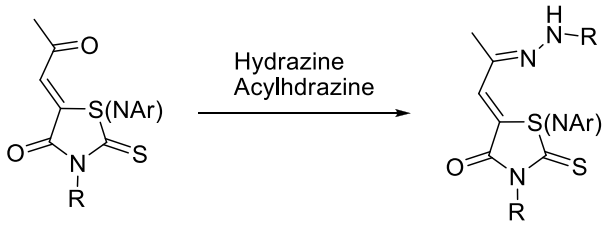

Figure 8. Synthesis of hydrazone compounds

3. CONCLUSION

Cancer is the uncontrolled growth and proliferation of cells because of damage to the DNA in the cell. Syntheses of drug-active substances that can prevent both growth and proliferation are abundant in the literature. Many studies have been carried out by Yozgat Bozok University Department of Chemistry since 2013 and information has been provided about the syntheses of active pharmaceutical substances that can be used in cancer treatment as well as their activity studies.

AUTHOR'S CONTRIBUTIONS

All authors have made essential contributions to this study. IEK: Writing - review and editing. The final version of the article has been read and approved by all authors.

CONFLICTS OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

RESEARCH AND PUBLICATION ETHICS

The author declares that this study complies with Research and Publication Ethics.

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