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ADVANCES IN PYRAZOLE DERIVED MOLECULES AS ANTI-CANCER AGENTS

Sayyeda Rushan

Department of Chemistry, Integral University, Lucknow-226026, India

ORCID ID: 0009-0003-7484-4812

Saimah Khan

Department of Chemistry, Integral University, Lucknow-226026, India

ORCID ID: 0000-0002-6483-4325

Abstract:

Pyrazole-derived molecules have gained considerable attention in recent years as promising candidates in anticancer drug discovery due to their structural diversity and wide-ranging biological activities. This study highlights recent advances in the design, synthesis, and biological evaluation of pyrazole-based compounds as antitumor agents. The pyrazole scaffold serves as a versatile pharmacophore capable of interacting with multiple molecular targets involved in cancer progression, including cyclin-dependent kinases, tyrosine kinases, and topoisomerases'. These compounds exhibit significant anticancer activity through mechanisms such as induction of apoptosis, inhibition of cell proliferation, suppression of angiogenesis, and modulation of inflammatory pathways. Recent studies emphasize the importance of structure–activity relationship (SAR) analysis, where strategic substitution and hybridization with other bioactive moieties have led to enhanced potency and selectivity against various cancer cell lines. Furthermore, advancements in drug design approaches, including molecular docking and nanotechnology-based delivery systems, have improved the therapeutic potential of pyrazole derivatives. Although encouraging results have been observed in preclinical studies, several challenges—such as toxicity, limited bioavailability, and hurdles in clinical translation—still need to be addressed. Nevertheless, pyrazole-derived molecules continue to represent a rapidly evolving and promising class of compounds with substantial potential for the development of effective and targeted anticancer therapies.

Keywords: Structure–activity relationship (SAR); Apoptosis; Enzyme inhibition; Cycling-dependent kinases; Tyrosine kinase inhibitors; Drug design; Molecular docking; Cancer therapeutics; Angiogenesis inhibition; Hybrid molecules.