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Synthetic strategies and therapeutic applications of sulfur-containing molecules

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Abstract

Sulfur-containing molecules play a crucial role in medicinal chemistry, with over 300 FDA-approved sulfur-based drugs exhibiting diverse biological activities and therapeutic potentials. Notably, recent trends show a steady rise in their prevalence, with sulfur incorporated into approximately 10–20 % of newly FDA-approved drugs from 2020 to 2024, rising from 11 % in 2020 to 20 % in 2024. The unique chemical properties of sulfur, including its ability to exist in multiple oxidation states, engage in varied bonding interactions, and enhance molecular stability and solubility, contribute to improved pharmacokinetic and pharmacodynamic profiles. This review highlights synthetic approaches for incorporating sulfur, including sulfonamides, sulfones, and thioethers, and explores their therapeutic applications across antibacterial, antidiabetic, anticancer, and anti-inflammatory drugs. In conclusion, sulfur-based compounds remain essential for drug development, driving innovation and offering broad-spectrum therapeutic solutions. © 2025 Elsevier Masson SAS

Author keywords

Drug development; Sulfur-based drugs; Synthetic strategies; Therapeutic applications

Indexed keywords

MeSH

Animals; Anti-Bacterial Agents; Anti-Inflammatory Agents; Antineoplastic Agents; Humans; Hypoglycemic Agents; Molecular Structure; Sulfones; Sulfur; Sulfur Compounds

EMTREE drug terms

antidiabetic agent; antiinfective agent; antiinflammatory agent; sulfide; sulfonamide; sulfone; sulfur; antidiabetic agent; antiinfective agent; antiinflammatory agent; antineoplastic agent; sulfone; sulfur derivative

EMTREE medical terms

antibacterial activity; antineoplastic activity; biological activity; cancer inhibition; controlled study; drug development; Food and Drug Administration; human; medicinal chemistry; molecular stability; nonhuman; oxidation; pharmacodynamics; pharmacokinetics; prevalence; review; solubility; animal; chemical structure; chemistry; synthesis

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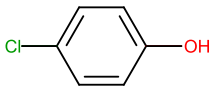
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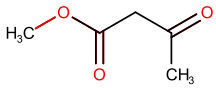
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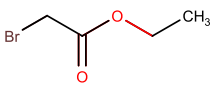
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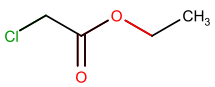
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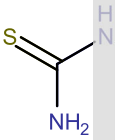
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Chemicals and CAS Registry Numbers

Unique identifiers assigned by the Chemical Abstracts Service (CAS) to ensure accurate identification and tracking of chemicals across scientific literature.

sulfide	18496-25-8
sulfone	67015-63-8
sulfur	13981-57-2, 7704-34-9

Anti-Bacterial Agents

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Funding sponsor	Funding number	Acronym
Ministry of Higher Education, Malaysia See opportunities by MOHE	FRGS/1/2022/STG04/UIAM/02/2	MOHE

Funding text

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