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# Synthesis, Characterization and Biological activity newly synthesized benzoic acid and phenylthiourea derivative

# Mansi Santosh Valate<sup>1</sup>, Riya Anand Khadse<sup>2</sup>, Dr. Shital Dnyaneshwar Gaikwad<sup>3</sup>

123 Samarth Institute of pharmacy, belhe, India

## ABSTRACT:

Benzoic acid, a simple aromatic carboxylic acid, has a rich history of use and study due to its diverse biological activities and applications. Historically, it has been known since ancient times, originally obtained from natural sources like gum benzoin, and later synthesized for industrial use. The synthesis of benzoic acid has evolved from early methods such as the oxidation of toluene to more modern, efficient techniques involving catalytic reactions. The structure of benzoic acid consists of a benzene ring with a carboxyl group (-COOH) attached, which contributes to its acidic properties and influences its reactivity. The structure-activity relationship (SAR) of benzoic acid is characterized by its ability to interact with a variety of biological targets, with modifications to the aromatic ring or the carboxyl group affecting its potency and specificity. Benzoic acid derivatives, such as esters and salts, exhibit a wide range of applications in medicine, agriculture, and the food industry. It is used as an antimicrobial agent, a food preservative, and a precursor in the synthesis of various pharmaceuticals .The mechanism of action of benzoic acid and its derivatives typically involves the disruption of cellular processes through their acidic nature, interactions with enzymes, or membrane disruption. In the pharmaceutical field, benzoic acid's derivatives exhibit anti-inflammatory, antimicrobial, and anticancer properties. The compound's widespread applications and continued research into its bioactivity make it an essential molecule in various scientific and industrial domains.

Key words: Benzoic acid, History, Preservatives, Antimicrobial activity, Synthesis, Structure activity Relationship, mechanism of action.

# **INTRODUCTION:**

Benzoic acid is a compound consisting of a benzene ring attached to a carboxylic acid group is a white, crystalline solid with a characteristic odour, commonly used as a food preservative, Antifungal agent and Pharmaceutical Intermediate, benzoic acid and Its derivatives have been Extensively studied for their diverse biological activities Including antimicrobial, anti-Inflammatory antioxidant & anticancer properties Historically, benzoic acid was first Isolated from gum benzoin, a resin obtained from the Bark of certain trees in the genus styrax Today, benzoic acid Is produced Industrially through Benzamide and oxidation of toluene or other aromatic hydrocarbons. posed by antibiotic resistance.

Benzoic acid is a white or colorless solid that is made up of a benzene ring attached to a carboxyl group (-COOH). It has the chemical formula C6H5COOH and weighs 122.1 g/mol. The substance appears as a white crystalline powder and is only slightly soluble in water (about 2.9 g/l at 20°C) but dissolves easily in ethanol. It is the simplest type of aromatic carboxylic acid. Benzoic acid got its name from "gum benzoin," which was once the primary source of this compound. It can be found naturally in many plants and is involved in the production of various secondary metabolites in plants. Additionally, benzoic acid has a unique effect on

human biology, where it helps inhibit a process called macroautophagy, which has led to its use as a food preservative.[Mr. Nitish Kumar Et.al.2024].

Benzoic acid is a common organic compound found in everyday products like food, cosmetics, and personal care items. It's often used as a preservative in products such as pickles, jams, lipsticks, and face creams. Additionally, benzoic acid plays an important role as a building block in the creation of many other organic compounds.

Benzoic acid is part of a larger group of chemicals called phenolic substances, which include flavonoids and other carboxylic acids. These compounds help plants protect themselves from microbes and also play a role in plant interactions with microbes. Some phenolic compounds have antimicrobial properties and are involved in plant defense. They are categorized into two groups: phytoalexins (produced in response to stress or infection) and phytoanticipins (pre-existing in the plant). While it is well-known that these compounds help protect plants from fungal infections, it is not always clear whether a specific phenolic compound or its breakdown product is responsible for the effect. [Dr.Pushpendra Sharma Et.al 2023]

It is solid substance commonly used in cosmetics to help maintain the product's pH and act as a preservative. It has the European approval number E210. Preservatives like benzoic acid are added to products to prevent spoilage, extend shelf life, and stop harmful bacteria or fungi from growing. These preservatives are carefully regulated to ensure they don't negatively affect the product's quality or safety. Additives and preservatives are given an E-number, which means they have been tested for safety. Some common preservatives include sorbic acid, propionic acid, and benzoic acid, with parabens being widely used in cosmetics. However, these chemicals can sometimes cause allergic reactions, migraines, asthma attacks, and may even be linked to issues like obesity or behavioral problems, especially in children.[Larisa Alagić-Džambić\*et al 2023 ]

# Aim :

To synthesize, characterize and biological activities of newly synthesized of benzoic acid & phenyl thiourea

## Phenylthiourea derivatives

IUPAC Name	Benzene carboxylic acid
Molecular formula	C6HN2O2S
Molecular weight	122 g/ mol
Melting point:	122 c
Appearance	White crystalline form
Odour	Characteristic
solubility	In Ethanol, water
category	Antibiotic, Antimicrobial

# Chemistry:



It has seven carbon atoms, six hydrogen atoms, and two oxygen atoms. It is a ring of six carbons attached with alternate bonds with a -COOH group attached to it in one of the vertices. The -COOH group makes it benzoic acid.

# **APPLICATION :**

#### Food Industry

• Preservative: Used as a food preservative (E210) due to its antifungal and antibacterial properties. It helps prevent spoilage in acidic foods like fruit juices, soft drinks, pickles, and jams.

#### Pharmaceutical Industry

- Antiseptic and Antifungal Agent: Used in topical formulations to treat fungal skin diseases.
- Expectorant: Sometimes used in cough syrups to help relieve congestion.
- Component in Ointments: Combined with salicylic acid in treatments for skin conditions like psoriasis and eczema.

# **Industrial Applications**

- Plasticisers: Used in the manufacture of plasticizers like benzyl benzoate.
- Intermediate in Chemical Synthesis: Used to synthesize dyes, perfumes, and other organic compounds.
- Precursor for Benzoyl Chloride: Benzoic acid is chlorinated to form benzoyl chloride, used in the production of peroxides and pharmaceuticals.

## **Cosmetics and Personal Care**

· Preservative in Cosmetics: Prevents microbial growth in products like lotions, creams, and shampoos.

• pH Adjuster: Helps stabilize formulations by maintaining the pH balance.

#### Laboratory Use

• Standard Substance: Used as a calibration standard in bomb calorimetry for measuring heat of combustion.

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# **CONCLUSION:**

Sulfanilamide, a pioneering antimicrobial agent, has significantly impacted the field of medicine. This review delves into its rich history, diverse synthetic methods, structure-activity relationships, broad applications, and elucidates its mechanism of action. The historical journey highlights the serendipitous discovery of its antibacterial properties, leading to the development of a class of life-saving drugs. The synthesis section explores various strategies for preparing sulfanilamide and its derivatives, encompassing both classical and modern approaches. The structure-activity relationship analysis reveals the crucial role of the sulfonamide group and its substituents in determining antimicrobial activity. The versatility of sulfanilamide is showcased through its applications in treating a wide range of bacterial infections, including urinary tract infections, pneumonia, and meningitis. Additionally, its potential in other therapeutic areas, such as cancer and autoimmune diseases, is discussed. Mechanistically, sulfanilamide acts as a competitive inhibitor of dihydropteroate synthetase, a key enzyme in bacterial folic acid synthesis. This disruption of folate metabolism ultimately halts bacterial growth and proliferation. In conclusion, the legacy of sulfanilamide endures as a testament to the power of serendipity in scientific discovery and the continuous evolution of medicinal chemistry. Its historical significance, diverse applications, and well-understood mechanism of action solidify its place as a cornerstone in the development of antimicrobial agents.

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- Chemistry Research Journal, 2023, 8(6):5-9Available online www.chemrj.orgResearch Article Synthesis and characterization of Benzoic AcidLarisa Alagić-Džambić\*1, Dženana Ćosić2, Minela Dacić3, Minela Hukić2, Mirsad Džambić4
- VOLUME 23: ISSUE 06 (June) 2024a COMPREHENSIVE REVIEW ON BENZOIC ACID AND ITS DERIVATIVES Km Anupam Verma\*1 Mr. Nitish Kumar2 Ms. Sweta Shukla3Student1Assistant Professor2, Assistant Professor3Goel Institute of Pharmacy and Sciences, Lucknow 226028, Utt ar Pradesh, India.