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## **Indole: The molecule of diverse pharmacological activities**

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### **ABSTRACT**

*Indole is a fused aromatic heterocyclic ring, consisting of a six-membered benzene ring fused to a five-membered nitrogen -containing pyrrole ring, Indole nucleus is present in compounds involved in research aimed at evaluating new products that possess interesting biological activities like antimicrobial, anti-viral, antitubercular, anti-inflammatory, anticancer, antidiabetic, anticonvulsant, antimicrobial, antioxidant, antidepressant activities.*

**Key words:** Indole, analgesic and anti-inflammatory, anticancer, antifungal, antiviral, antitubercular, antioxidant, antidiabetic.

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### **INTRODUCTION**

The small and simple Indole nucleus is present in compounds involved in research aimed at evaluating new products that possess interesting biological activities like antimicrobial, antiviral, antitubercular, anti-inflammatory, anticancer, antidiabetic, anticonvulsant, antimicrobial, antioxidant, antidepressant, anticonvulsant activities. Indole is used primarily in industry and research. Being an aromatic fused heterocyclic compound consisting of a six-membered benzene ring fused to a five-membered nitrogen -containing pyrrole ring, indole finds use in research as a starting material for the synthesis of larger, usually bioactive structures[1].

#### **Chemistry of Indole[1] :**

Molecular formula C<sub>8</sub>H<sub>7</sub>N, Molar mass 117.15 g/mol, Density 1.1747 g/cm<sup>3</sup>, solid, Melting point 52–54°C, Appearance White solid, Boiling point 253–254°C (526 K), Acidity (pKa) 16.2, Basicity (pKb) 17.6.

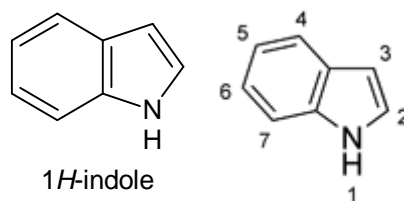


Fig.no.1 Indole

**General properties[2]:**

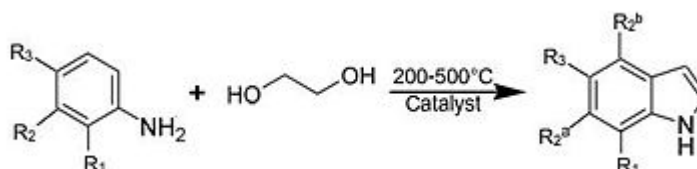
Indole is a solid at room temperature. It occurs naturally in human feces and has an intense fecal odor. At very low concentrations, however, it has a flowery smell, and is a constituent of many flower scents (such as orange blossoms) and perfumes. It also occurs in coal tar. Indole undergoes electrophilic substitution, mainly at position 3. substituted indoles are structural elements of (and for some compounds the synthetic precursors for) the tryptophan-derived tryptamine alkaloids like the neurotransmitter serotonin, and melatonin. Other indolic compounds include the plant hormone Auxin (indole-3-acetic acid, IAA), the anti-inflammatory drug indomethacin, the betablocker pindolol, and the naturally occurring hallucinogen dimethyltryptamine (N,N-DMT). The name indole is a portmanteau of the words indigo dye and oleum, since indole was first isolated by treatment of the indigo dye with oleum.

**Basicity[4]:**

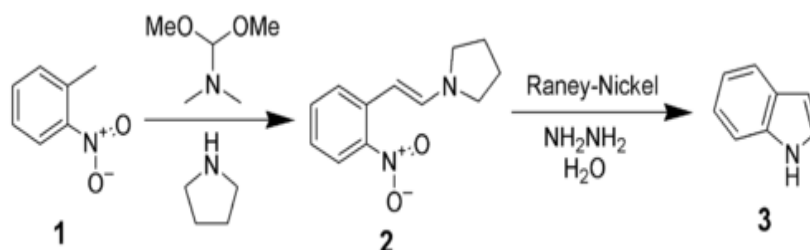
Unlike most amines, indole is not basic. The bonding situation is completely analogous to that in pyrrole. Very strong acids such as hydrochloric acid are required to protonate indole. The protonated form has a pKa of -3.6. The sensitivity of many indolic compounds (e.g. tryptamine) under acidic conditions is caused by this protonation.

**Methodology[5]:**

The main industrial routes start from aniline. Illustrative of such large-scale syntheses, indole (and substituted derivatives) form via vapor-phase reaction of aniline with ethylene glycol in the presence of catalysts.



In general, reactions are conducted between 200 and 500 °C. Yields can be as high as 60%. Other precursors to indole include formyltoluidine, 2-ethylaniline, and 2-(2-nitrophenyl)ethanol, all of which undergo cyclizations. Many other methods have been developed that are applicable.

**Leimgruber-Batcho indole synthesis[6]**



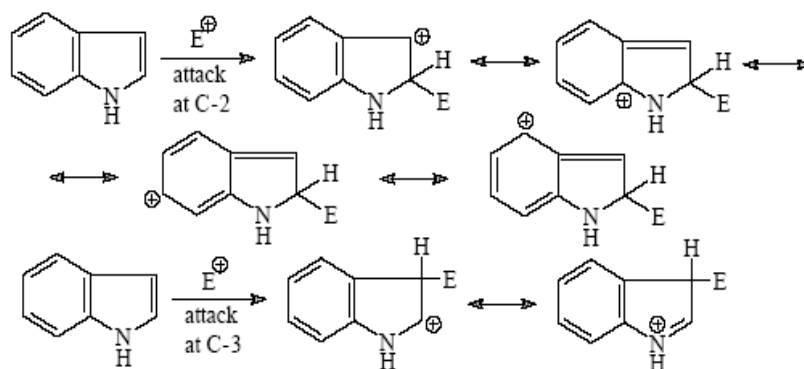


Fig.3

The carbocation resulting from electrophilic attack at C-2 is less favourable than the carbocation resulting from electrophilic attack at C-3 because though the former has more resonance structures, in the latter intermediate, the positive charge resides on heterocyclic ring carbon or the nitrogen atom without affecting the benzene ring[9].

### Pharmacological importance of Indole[10,11] :

Indole possess the following activities that is shown in fig.4

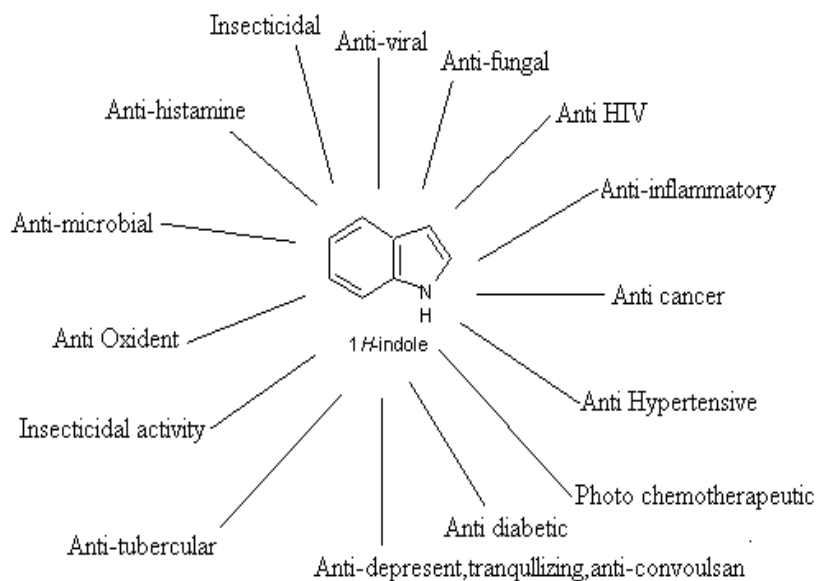


Fig.4

### Applications:

Natural jasmine oil, used in the perfume industry, contains around 2.5% of indole. Since 1 kilogram of the natural oil requires processing several million jasmine blossoms and costs around \$10,000, indole (among other things) is used in the manufacture of synthetic jasmine oil (which costs around \$10/kg).

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