AIM: To prepare and submit benzimidazole from o-phenylenediamine.

REFERENCES:

1. Vogel's Textbook of Practical Organic Chemistry by Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith & Austin R. Tatchell; Fifth Edition; Page No.- 1162

2. Practical in organic chemistry, by Hitesh G. Raval, Sunil L. Baldania and Dimal A. Shah, Nirav Prakashan, Page No.- 301.

REQUIREMENTS:

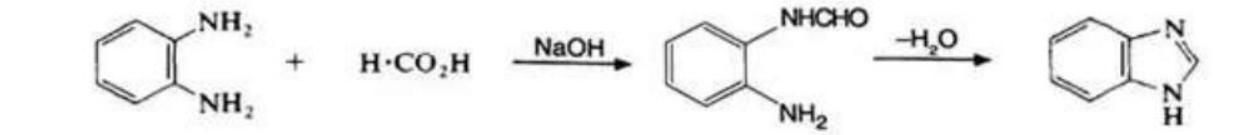
Chemicals: p-Nitrobenzoic acid, Tin powder, Conc. HCl, Conc. Ammonia, Celite (filter aid), Glacial acetic acid, Prepared p-aminobenzoic acid, Absolute ethanol, Sodium carbonate.

Apparatus: RBF, Reflux condenser set, Gas inlet tube, Beaker, Buchner funnel, Measuring cylinder, Filter paper, Litmus paper, etc.

PRINCIPLE:

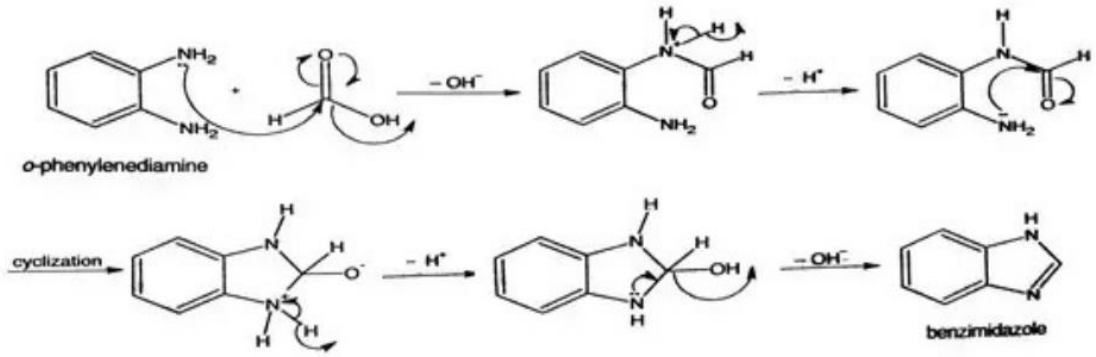
The two Carbon-nitrogen bonds in benzimidazole when disconnected give o-phenylenediamine and formic acid. Therefore, the synthesis of benzimidazole is affected by simply heating the o-phenylenediamine and formic acid together (condensation type of reaction).

Reaction:



o-phenylenediamine Formic acid Benzimidazole

Mechanism:



Uses: Antitumor, antifungal, antiparasitic, analgesics, antiviral, and antihistamine, as well as used in cardiovascular disease, neurology, endocrinology, and ophthalmology.

PROCEDURE:

Place 27 g (0.25 mol) of o-phenylenediamine in a round-bottomed flask of 250 ml and add 17.5 g (16 ml, 0.34 mol) of 90% formic acid. Heat the mixture in a water bath at 100 °C for 2 h. Cool and add 10% sodium hydroxide solution slowly, with a constant rotation of the flask, until the mixture is just alkaline to litmus. Filter off the synthesized crude benzimidazole by using the pump, wash with ice-cold water, drain well, and wash again with 25 ml of cold water.

Recrystallization: Dissolve the synthesized product in 400 ml of boiling water, add 2 g of decolorizing carbon, and digest for 15 min. Filter rapidly through a preheated Buchner funnel and a flask at the pump. Cool the filtrate to about 10 °C, filter off the benzimidazole, wash with 25 ml of cold water, and dry at 100 °C. The yield of pure benzimidazole, m.p. 171-172 °C, is 25 g (85%).

Calculation of yield:

Here limiting reagent is o-phenylenediamine; hence yield should be calculated from the amount taken.

The molecular formula of o-phenylenediamine = C6H8N2

The Molecular formula of benzimidazole = C7H6N2

The Molecular weight of o-phenylenediamine = 108 g/mole

The Molecular weight of benzimidazole = 118 g/mole

Theoretical yield:

108 g o-phenylenediamine forms 118 g benzimidazole

Therefore, 27 g o-phenylenediamine will form ……? (X) g benzimidazole

X = (118 × 27)/108 = 29.5 g

Theoretical yield = 29.5 g

Practical yield = ————- g

% Yield = (Practical Yield) / (Theoretical Yield) × 100 % Yield = ------

RESULT: Benzimidazole was synthesized and the percentage yield was found to be……..%