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Selective hydrogenation of 2 phenoxy aniline with various catalysts to make the drug intermediate's manufacturing environmentally viable

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ABSTRACT

Many catalysts are available which are claimed to have good Hydrogenation Catalytic capacity but catalyst like sulphur cast iron are not becoming suitable as far as solid waste is concern. In the present study an attempt has been made to study activity of three catalyst along with from sulfur as a traditional to compare the quality and quantity of the 2 phenoxy aniline and their effectiveness as far as waster reduction is concern. The study was to eliminate the waste which was from sulfur to make manufacturing process more envirofriendly and effective. Different concentrations of palladium on charcoal are studied and results are compared with the traditional catalysts. Reactions were carried out with keeping other parameters constant. This catalyst has showed significant reduction in the waster disposal without deviating stiochemistry of the reactions. The study revealed a considerable difference in waste disposals of the products. On comparison the concentration of catalysts the product is evaluated for the quality and quantity of the product.

Key words: Hydrogenation, Palladium on charcoal, Platinum on Charcoal, Rany Nickel, Sulphur.

INTRODUCTION

Hydrogenation is a class of reductive chemical reactions in which the net result is an addition of hydrogen (H_2). Targets of hydrogenation are often alkenes or imine. Most hydrogenations involve the direct addition of diatomic hydrogen under pressure, often in practice with catalysts. Some hydrogenations involve the indirect addition of hydrogen, these are called transfer hydrogenations.

The classical example of a hydrogenation is the addition of hydrogen on unsaturated bonds between carbon atoms, converting alkenes to alkanes. Numerous important applications are found in the pharmaceutical and petrochemical industries. The reaction is carried out at different temperatures and pressures depending upon the substrate. Hydrogenation is a strongly exothermic reaction Hydrogenation in Bulk Drugs Intermediates manufacturing like 2 Phenoxy Aniline was carried out by using Sulphur as catalyst. These catalysts are replaced by catalysts of new generation like Platinum on Charcoal, Palladium on Charcoal, Rany Nickel. This catalyst has helped to reduce the waste and made process economic. The above said catalysts are studied for comparison quality and quantity of the product.

MATERIAL AND METHODS

Nimesulide, a COX-2 selective drug, possesses anti-inflammatory and analgesic properties. Moreover, it has low gastrointestinal and renal toxicity. This paper presents industrially viable, new and improved synthesis of nimesulide starting from o-chloro nitrobenzene to 2 phenoxy nitro benzene. (PNB) followed by hydrogenation to get 2 Phenoxy Aniline. This hydrogenation is carried out by different catalyst like Sulphur, Rany Nickel, 10% Palladium on Charcoal, Platinum on charcoal without deviating the other parameters. The end products are studied for their quality and quantity. 2Phenoxy aniline can be manufactured by using 4 different catalysts. The diiferent catalyst though giving same yield butcatalyst like sulphur cause the environment. The use of sulphur creat solid waste and thus polute the environment. Therefore catalysts like palladium on charcoal, platinum on charcoal were studied and found environmentally effective .

Estimations

The formed 2 Phenoxy Aniline was estimated for its quality by High Performance Liquid Chromatography as per validated analytical method.

RESULTS AND DISCUSSIONS

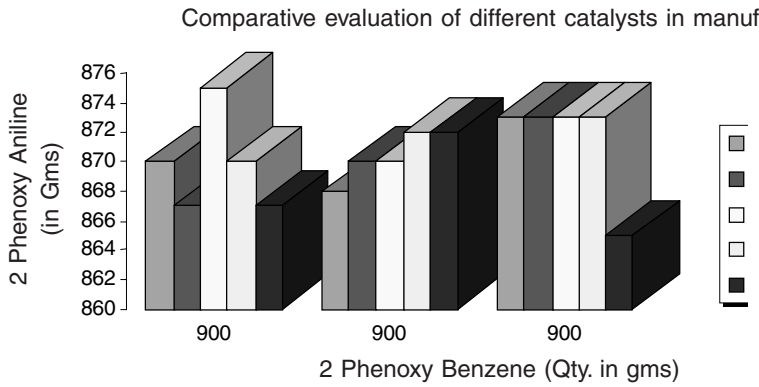
The result tables and Graph are sufficient to explain the quality and quantity comparision data amongst the studied catalyst as compared with Sulphur as a catalyst. The catalysts of new generation are good as compared to traditional catalysts. These catalysts have not only helped to work out the reaction but also helped to reduce the waste. The recycle of these catalysts also helped to reduce the waste.

Further more catalyst also helped to reduce the solvent quantity which strengthen the product's quality and quantity to make them more eco friendly and environ friendly. Maximum reduction

Table 1: 2 Phenoxy Aniline with Sulphur as catalyst in Hydrogenation

Expt. No	2PNB	SULPHUR	TEMP(0^C)	2 PA	H2 Gas.	Quality Parameter#
1.	900 Gm	450 Gm	130 -135^{0}C	870 Gm	4.3 Kg/Cm^2	Passes I.H.T.M.
2.	900 Gm	450 Gm	130 - 135^{0}C	868 Gm	4.3 Kg/Cm^2	Passes I.H.T.M.
3.	900 Gm	450 Gm	130 - 135^{0}C	873 Gm	4.3 Kg/Cm^2	Passes I.H.T.M.

#- I.H.T.M. – In House Testing Method.



Graph 1: Yield comparision data of 2PA with various catalyst.

of solid waste was observed by replacing the Sulphur catalyst(Table 1) by Palladium on charcoal (Table 2) as well as Platinum on charcoal (Table 3- 4) with different concentration. As regeneration of Platinum on charcoal is not possible palladium on charcoal catalyst found more useful than Platinum on Charcoal and also better than Sulphur as well as Rany Nickel (Table 5)

The experimental work demonstrate the quality and quantity of 2phenoxy Aniline against different catalyst.

Table 2: 2 Phenoxy Aniline with 5% Palladium on Charcoal

Expt. No.	Qty. of R.M.	Catalyst Qty.	Temp (°C)	H_2 Gas	Quantity of 2PA	Quality Parameter
1.	900 Gm	10 Gm	130-135°C	4.3 Kg/Cm^2	875 Gm	Passes I.H.T.M.
2.	900 Gm	10 Gm	130-135°C	4.3 Kg/Cm^2	870 Gm	Passes I.H.T.M.
3.	900Gm	0 Gm	130-135°C	4.3 Kg/Cm^2	872 Gm	Passes I.H.T.M.

Table 3: 2 Phenoxy Aniline with 10% platinum on Charcoal

Expt. No.	Qty. of R.M.	Catalyst Qty.	Temp (°C)	H_2 Gas	Quantity of 2PA	Quality Parameter
1.	900 Gm	5Gm	130-135°C	4.3 Kg/Cm^2	870 Gm	Passes I.H.T.M.
2.	900 Gm	5Gm	130-135°C	4.3 Kg/Cm^2	872 Gm	Passes I.H.T.M.
3.	900Gm	5 Gm	130-135°C	4.3 Kg/Cm^2	873 Gm	Passes I.H.T.M.

Table 4: With 5% Platinum On Charcoal

Expt. No.	Qty. of R.M.	Catalyst Qty.	Temp (°C)	H_2 Gas	Quantity of 2PA	Quality Parameter
1.	900 Gm	10 Gm	130-135°C	4.3 Kg/Cm^2	867 Gm	Passes I.H.T.M.
2.	900 Gm	10Gm	130-135°C	4.3 Kg/Cm^2	872 Gm	Passes I.H.T.M
3.	900Gm	10Gm	130-135°C	4.3 Kg/Cm^2	865 Gm	Passes I.H.T.M

Table 5: 2 Phenoxy Aniline with Raney Nickel as a catalyst

Expt. No.	Qty. of R.M.	Catalyst Qty.	Temp (°C)	H_2 Gas	Quantity of 2PA	Quality Parameter
1.	900 Gm	10 Gm	130-135°C	4.3 Kg/Cm^2	867 Gm	Passes I.H.T.M.
2.	900 Gm	10 Gm	130-135°C	4.3 Kg/Cm^2	870 Gm	Passes I.H.T.M.
3.	900 Gm	10 Gm	130-135°C	4.3 Kg/Cm^2	873 Gm	Passes I.H.T.M.

Observations

The results demonstrated in tables(1-5) and graph 1 indicate that the quality and quantity of 2Phenoxy Aniline are comparable with the traditionally manufactured with Sulphur catalyst. These catalyst has shown more the reduction in solid waste as compared to Sulphur as well as Pd on Charcoal can also be recycled to make the process economically and environmentally suitable.

The amount of research being conducted on asymmetric hydrogenation is steadily increasing. As the importance of applications range across pharmaceuticals and the petroleum industry, there is a high demand for research regarding this type of reaction. Studies have been conducted that affirm or disprove proposed reaction mechanisms, that characterize and catalog the feasibility of using various catalysts in chemical hydrogenations, and that determine the benefits of using certain metal catalysts over others. As the applications and demand for pathways continues to grow, so will be the research pertaining to asymmetric hydrogenation using metal catalysts.

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