



GREEN CHEMISTRY,"REPLACEMENT OF ORDINARY FILTER PAPER BY NYLON FABRIC FILTER PAPER AS A WASHABLE AND REUSABLE FILTER FABRIC IN INDIAN UNDERGRADUATE STUDY LABORATORY

Pankaj Laxman Wabale

A/P-Bramhangaon Tal-Kopargaon Dist-A.Nagar, Maharashtra (India) Pin-423601

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ABSTRACT

In chemical study or in practical there are vast use of ordinary filter papers for filtration purposes. There are many such practicals included undergraduate study mostly in India require ordinary filter paper for filtration purposes. It causes wastage of number of ordinary filter papers and ultimately environment, which it is coming from.

The use of Nylon Fabric Filter Paper having the important parameters are wet strength, porosity, particle retention, volumetric flow rate, compatibility, efficiency and capacity and the pore size greater than 1000nm same as ordinary filter paper. It gives simplicity and replacement option for ordinary filter paper.

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INTRODUCTION

Filtration is the process in which solid particles in liquid or gaseous fluid are removed by the use of filter medium that permits the fluid to pass through but retains the solid particles. Either the clarified fluid or the solid particles removed from the fluid may be the desired product. In some processes use in the production of chemicals, both the fluid filtrate and the solid filter cake are recovered. Other media, such as electricity, light and sound, also can be filtered. The art of filtration was known to early humans, who obtained clear water from a muddy river by scooping a hole in the sand on a river bank to a depth below the river water level. Clear water filtered by the would trickle into the hole. The same process on a larger scale and with refinements is commonly used to purify water for cities.

The basic requirements for filtration are: (1) A filter medium (2)A fluid with suspended solids (3) a driving force such as a pressure difference to cause fluid to flow ;and (4) A mechanical device(filter) that holds the filter medium , contains the fluid , and permits the application of force. The filter may have special provisions for removal of the filter cake, and possibly for drying the cake. The various methods used for treating and removing the cake, for removing the clarified filtrate, and for creating the driving force on the fluid have been combined in various ways to produce a great variety of filter equipment.

Filtration involves such a variety of fluids and solids that special technique are required in many cases. If the filter cake is extremely compressible, gelatinous ,or slimy and tends to blind the filter, a filter aid of porous, easily filtered solids such as diatomaceous earth or bone black may be added to the slurry to improve filtration. In another technique used with very slimy precipitate, a layer or precoat of filter aid, usually one or two inches thick, is deposited first on the drum of rotary vacuum filter. Successive layers of the precoat and slimy solids are then cut from the precoat bed as the filter rotatesto provide a new nonblinded surface to the slurry continuously. Highly corrosive slurries used in some chemical industries and in the processing of nuclear reactor fuels are difficult to handle. Special filter media such as porous ceramics and porous stainless steels have been used to handle these materials both in the laboratory and in industry.

Filtering Force

The fluid to be filtered will pass through the filter medium only if some driving force is applied. This force may be caused by gravity, centrifugation, application of pressure on the fluid above the filter, or application of vacuum below the filter or by a combination of such forces . Gravitational force alone may be used in large sand bed filters and in simple laboratory filtration. Centrifugation containing a bowl with a porous filter medium may be considered as filters in which gravitational force is replaced by centrifugal force many times greater than gravity. If a laboratory filtration is difficult a partial vacuum is usually applied to the container below the filter medium to increase the rate of filtration. Most industrial filtration

**Corresponding author: Pankaj Laxman Wabale*

A/P-Bramhangaon Tal-Kopargaon Dist-A.Nagar, Maharashtra (India) Pin-423601

processes involve the use of pressure or vacuum, depending upon the type of filter used, to increase the rate of filtration and also to decrease the size of the equipment required.

Development of Filter Cloth

Design of filter media depends on thermal and chemical conditions, filtration requirements, equipments consideration and cost. The type of polymer which should be selected for filtration depends on the thermal and chemical conditions of the material which is going to be filtered. Natural fibers like cotton which can produce highly efficient media for filtration but in terms of longevity it is limited for use in comparison with synthetic fibers. Polyamide, polyester and polypropylene may be used as filter cloth but most effective is PTFE (Polytetra Fluoroethylene) for manufacturing filter bag as it is resistance to all chemicals and it is biostable, biocompatible and hydrophobic in nature. Due to low melting point, low thermal conductivity and low load carrying capacity it is only used in low speed applications.

The filter fabric is used to effect the maximum separation of particles from liquids, absolute clarity is not always necessary. In certain gravity or vacuum assisted screening operations the filter fabric is simply designed to capture particles greater than a specific size and in other filtration systems a measure of solids in filtrate can be tolerated before cake filtration takes over and the necessary clarity is achieved. Different fibrous structures, such as mono, homogeneous over the entire volume, and multilayer (fiber diameter) are manufactured and used for specific purposes. Bio fouling still remains an unsolved problem. The melt blown technology, which is equipped with a twin screw extruder, is able to produce fibrous filters with antibacterial nano particles located on the surface. The bacteriostatic effect reduces the bio fouling effect at the outer surface of the filter.

The nanocomposite membranes showed a promising antibacterial activity against gram negative bacteria. The nano composite membranes prepared by in situ, method exhibited a better antibacterial activity, in composition of those prepared by ex situ and also a decrease in 90% E.coli adhered cells compared to the pristine polysulfone membranes. The in situ procedure can be considered a feasible, simple and reproducible methodology to prepare anti biofouling polysulfone membranes containing silver nanoparticles.

Filter Media Selection

The filter media selection depends upon following factors

1. Retention time.
2. Hydraulic resistance.
3. Cake discharge.
4. Chemical resistance.
5. Swelling resistance.
6. Heat resistance.
7. Pressure resistance.
8. Wear resistance.

Classification of Filter Cloth

There are several types of fiber used in filtration on woven structure.

1. Cotton Filter Cloth.
2. Polyester filter Cloth.
3. Polypropylene Filter Cloth.
4. Nylon Filter Cloth.

5. Nylon Filter Cloth.

Cotton Filter Cloth

For better gasket effect during filtration, cotton filter cloth will swell in alkali solutions. Ordinary cotton cloth are suitable for neutral filter pulp under 100⁰ C for acid filtration upto 20⁰ C and alkali solution under 10⁰ C.

With the development of synthetic fabrics like polyester, cotton fiber cloths are decreasing for weak resistance against mildew and instability of dimensions. However, cotton filter cloth produces no pollutions and poisoned substances to the filtration.



Figure 1 Cotton Filter Cloth

Polyester filter Cloth

As an important factor of filter press, polyester filter cloth has been widely accepted by an increasing number of manufacturers and users of filter press for its strongest acid resistance and excellent resistance against elevated temperature up to 150⁰ C surface finish can be singed, calendared and heat set, each of which has its special property and purpose.

Excellent combination properties such as sleekness, high tensile strength, wear resistance and permeability, empower it to be an effective and popular filtration media. Various types of polyester yarns are provided to satisfy particular applications. For example, multifilament filter cloth not only strengthens its tensile strength but also ensures good cake release. Different woven patterns including plain, stain and twill, are designed with special purposes.

Polyester may be used as filter cloth in chemical plant, fertilizer plant, pharmaceutical, sugar, separation of oil and water, food and beverage.

Advantages of polyester filter cloth

1. High performance resistance against most organic acids except high concentration of nitric, sulphuric and carboxylic acids.
2. High tensile strength.
3. Elongation.
4. High operating temperature up to 150⁰c.
5. Excellent abrasive resistance.
6. Good resistance to weak most oxidizing agents.
7. Good filter cake release.

8. Long life span.



Figure 2 Polyester filter Cloth

Polypropylene Filter cloth

Polypropylene filter cloth is extensively used in liquid-solid filtration for its excellent filter cake release and good resistance to most acids and alkalis. Due to super low moisture absorption, polypropylene is a preferred selection for dye production.

Woven polypropylene cloths can be fabricated by monofilament, staple and multifilament in twill, plain and stain patterns to meet different filtration purposes. Its constant working temperature is 90⁰c.

Polypropylene filter cloth widely used in mine, metallurgy and waste water fields. Polypropylene filter cloth may used in chemical, pharmaceutical, sugar, non-ferrous metal smelting, sewage treatment.

Advantages of PP filter cloth

1. Sleekness surface for optimum cake release.
2. Shorten filter cycle.
3. Lightest weight among synthetic fabrics.
4. Excellent gas permeability.
5. Free of mildew and oxidation.
6. Good resistance against acid ,alkalis and reducing agents.
7. Available for large to fine particle filtration.

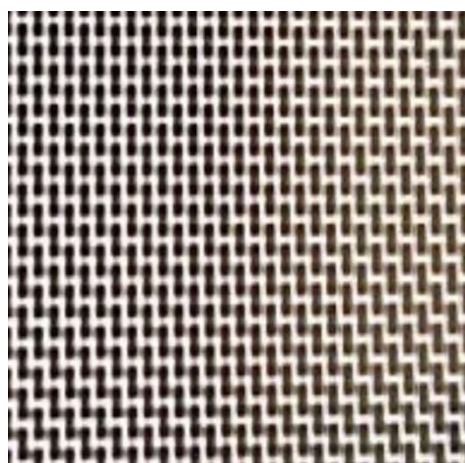


Figure 3 Polypropylene Filter cloth

Vinyon Filter Cloth

Vinyon filter cloth has an outstanding resistance against alkali and good moisture absorption. Its durability is as long as two time of cotton cloth. Vinyonfiber is endowed with high abrasion resistance. At present, Vinyon filter cloth is only available in staple or stun yarns and plain woven pattern. Vinyon filter cloth used in ceramics, chemical industry, metallurgy, food and beverage, suitable for shade cloth and tour tent.

Advantages of Vinyon filter cloth

1. Optimum alkali resistance.
2. Good abrasion resistance.
3. Moisture absorption.



Figure 4 Vinyon Filter Cloth

Nylon Filter Cloth

Nylon filter cloth have the greatest resistance to rubbing among the other three frequently used filter fabrics including polypropylene, polyester and cotton. It is often found in filtration applications of dust and wet solids that are scratching cloth . So, rubbing resistance plays an important factor.

To meet various applications, Nylon filter cloths including spun and multifilament can be woven into plain, leno and stain patterns for fine particle filtration. Nylon filter cloth is used in ceramics, mining, metallurgy, waste water treatment.

Advantages of nylon filter cloth

1. Excellent abrasion resistance.
2. Excellent cake release.
3. Fine particle filtration.
4. Ideal for low temperature.
5. High tensile strength.
6. Good elasticity is ideal for continuous flexing purposes.
7. Suitable for caustic alkali atmosphere like dyestuffs.
8. Working temperature 120⁰c (constant) 135⁰c (surge).



Figure 5 Nylon Filter Cloth

List of practicals having filtration processes and suitable for Nylon Fabric Filter Paper filtration at undergraduate level in India

Organic

1. Prepare semicarbazone derivatives of aldehyde/ketones.
2. Prepare oxime derivatives of aldehyde/ketones.
3. Preparation of 2:4 DNP.
4. Bromination of cinnamic acid using sodium bromate and sodium bromide.
5. Bromination of acetanilide using KBr and ceric ammonium nitrate.
6. Preparation of phthalimide from phthalic anhydride.
7. Preparation of glucosazone from glucose.
8. Preparation of P-bromoacetanilide from acetanilide.
9. Preparation of dibenzylidene acetone from benzaldehyde.
10. Organic qualitative analysis (most of test-recrystallization, Na-fusion test, sodium bicarbonate test, neutral reduction test, separation etc.)

Inorganic

1. Preparation of Mohr's salt.
2. Preparation of Cu_2O from CuSO_4 .
3. Preparation of ferrous sulphate.
4. Preparation of hexa amine nickel chloride.
5. Preparation of potassium tri oxalate iron.
6. Preparation of tetra nitro sulphate copper.
7. Preparation of tri acac manganese.
8. Preparation of trithiourea copper chloride.
9. Gravimetric analysis of –
10. Fe as Fe_2O_3
11. Ni as Ni DMG
12. Al as Aluminium oxide
13. Ba as BaSO_4
14. Inorganic Qualitative analysis.

Physical

Adsorption-Oxalic acid/Acetic acid by Activated charcoal.

Advantages

1. Nylon Filter paper filters all type of solutions at undergraduate level study.
2. It is easy to handle, its working is as same as ordinary filter paper.
3. Reusable.
4. Washable.
5. Good particle retention.
6. Pore size is greater than 1000 nm.
7. Good volumetric flow rate.
8. Good compatibility.
9. Not very costly.
10. Nylon filter paper save environment by saving the ordinary filter paper.
11. No wastage produce after application because it is reusable.

CONCLUSION

Use of Nylon filter paper is good replacement of ordinary filter paper used in chemical laboratory practicals. Now we going towards GREEN CHEMISTRY, I think it is good replacement towards it. It gives relief to dustbins from used ordinary filter papers. Save the paper save the environment.

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