

Synthesis and Characterisation of Polydiphenyl Amine Coated adsorbent and its Applications

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Abstract- In the present innovative study a microwave assisted, acid catalyzed synthesis of polydiphenyl amine- has been carried out by using Ammonium Per Sulphate as an oxidizing agent in presence of acrylic acid as 85% overall yield. Product obtained is characterized and reviewed for water purification by coating over mesoporous silica gel.

Keywords- Polydiphenyl amine, Ammonium Per Sulphate, Mesoporous silica gel.

I. INTRODUCTION

The hazardous ill effects of heavy metals or respective ions on the hydrosphere of environment and public health are a matter of serious concern. Due to modernization, the industrial use of metals especially, heavy metals, has risen alarmingly. The intensification of industrial activity and environmental stress greatly contributes to the significant rise of heavy metal pollution in water resources making threats to terrestrial and aquatic life. The toxicity of metal pollution is slow and interminable, as these metal are non bio-degradable. Among all water contaminations, heavy metal ions like Pb²⁺, Cd²⁺, Ni²⁺, Zn²⁺, and Hg²⁺, are highly toxic and can cause severe health problems in animals and human beings. Waste water from many industries such as chemical manufacturing, battery manufacturing industries, metallurgical, leather, tanning and mining discharge heavy ions into natural water directly, causing precipitation, adsorption and harmed human health through the food chain. The removal of such toxic metal ions from waste water is becoming a crucial issue.

Until now, various methods of removing of these metals have been considered, including the use low price materials. Heavy metal ions could be eliminated by several traditional techniques including chemical precipitation, reverse osmosis, electrochemical treatment techniques, ion exchange, irradiation and adsorption.

Due to its low cost effective, high efficiency and simple to operate for removing trace levels of heavy metal ions, adsorption technology is regarded as the most promising one to remove heavy metal ions from eluents.

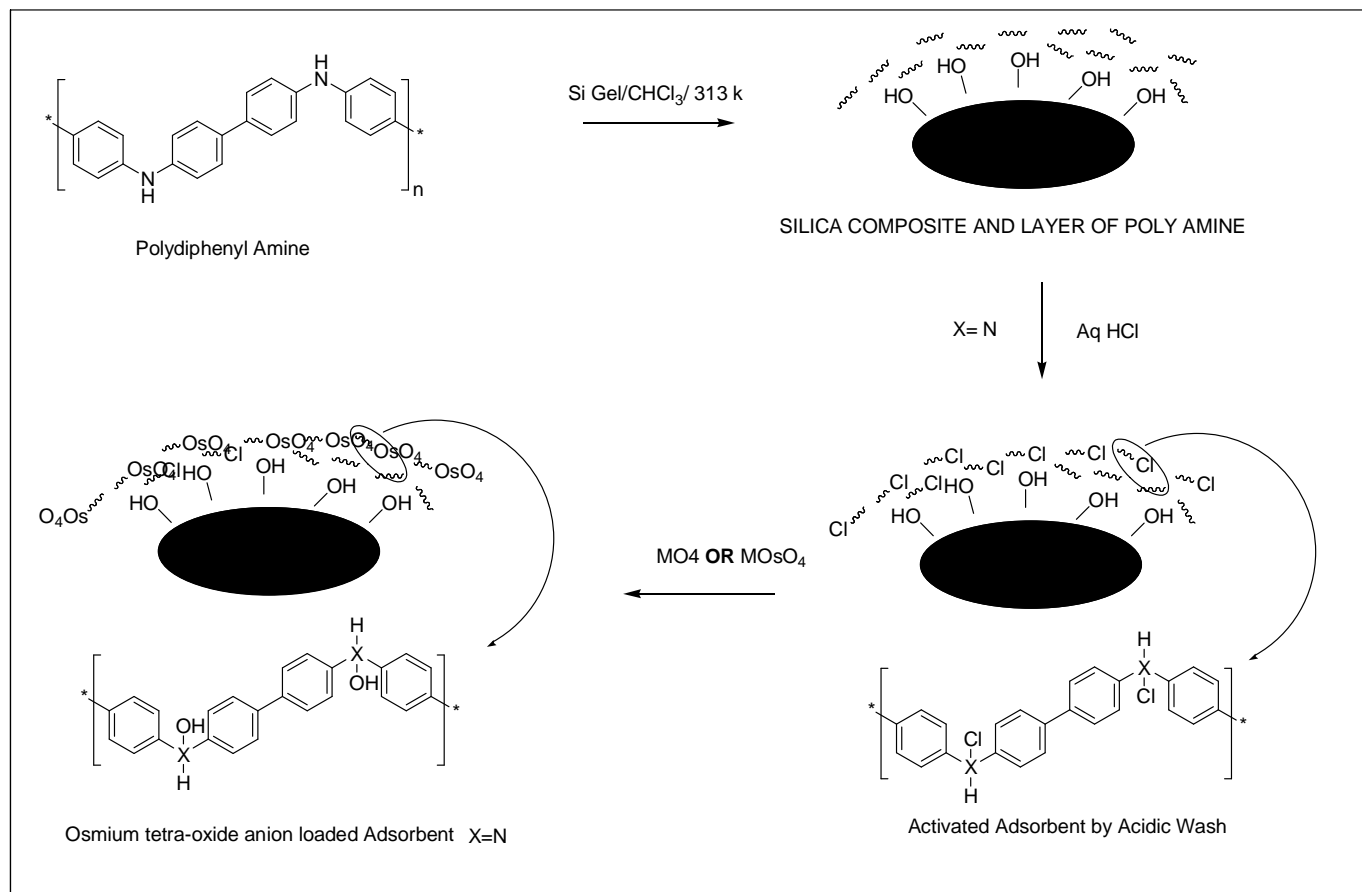
Several types of materials, such as activated carbons, clay materials, chitosan and natural zeolites have been researched to adsorb metal ions from aqueous solutions. Although traditional sorbents could remove heavy metal ions from waste water, the low sorption capacities and efficiencies limit their applications deeply.

To solve this problem of traditional sorbents, nonmaterial or mesoporous silica are used as the efficient adsorbents to provide platform for removal of heavy metal ions from waste water.

Since adsorbing materials have high metal binding capacity it is relatively suitable technique. It can be used to reduce the contamination of heavy metals in the waste water via industrial effluents/eluents.

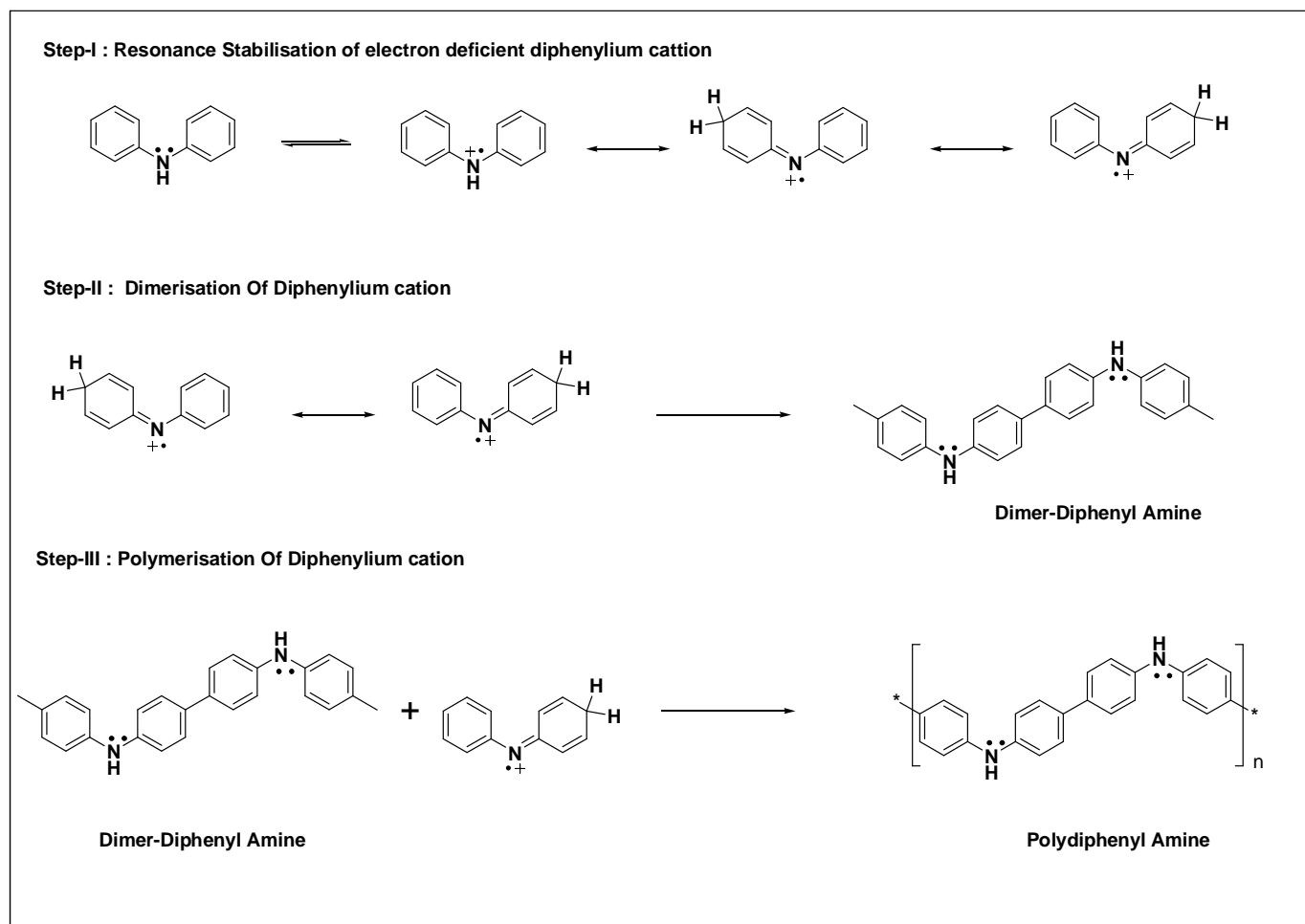
In the present plan polydiphenyl amine coated mesoporous adsorbents (Silica Gel) is used effectively for removal of heavy metal ions as shown below in the scheme-1

II. PRINCIPLE SCHEME



Scheme-1

Different approaches are reported for the synthesis of this polydiphenyl amine. But all of the above reported protocols are comprised of either lengthy reaction sequence or longer reaction time with low overall yields & with variable optical purity of the product. Further, above methods include use of carcinogenic solvents and narcotic drugs. Whereas, ecofriendly protocols such as microwave assisted synthesis are not yet explored. Owing to the significance of water purification in the present innovative study a microwave assisted, acid catalyzed synthesis of polydiphenyl amine has been carried out by using Ammonium PerSulphate as an oxidizing agent in presence of acrylic acid. During the sequence overall yield is 85% and further product obtained is characterized by various analytical techniques like U.V, I.R, NMR, and followed by X-ray crystallography for characterization.



Scheme-2

Scheme1. Reagents and conditions: (Step-I) Diphenyl Amine, AcOH; (Step-II) Acrylic Acid, Almond Oil; (c) Ammonium Per Sulphate / HOH;

III. EXPERIMENTAL TECHNIQUE

As shown in the **scheme-2** above, 0.05 M diphenyl amine and 0.1 M AcOH was taken in 100 mL Distilled water in 250 mL Round bottom flask. The flask was placed in a cooling bath maintained at -5°C . The reaction mixture was stirred vigorously on a magnetic stirrer. Acrylic acid and almond oil was added to the reaction mixture. Polymerization was enhanced by addition of 0.1 M APS by using Soxhlet Funnel. Further the oxidant solution was added to the stirred monomer solution dropwise. After consumption of the oxidant over period of 20 min, the flask was capped and left stirring for 6 hrs.

Progress of the polymerization was monitored by viscosity study and conductance measurement. The product polymer obtained appeared to be dark green film and was dried in oven at 50°C for 1 hr. Filtrate obtained was characterized by various analytical techniques.

IV. CONCLUSION

In conclusion, we have established protocol for the microwave assisted, acid catalyzed synthesis of polydiphenyl amine by using Ammonium Per Sulphate as an oxidizing agent in presence of acrylic acid as 85% overall yield further product obtained is applied for water purification.

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