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Removal of Textile Dye from Aqueous Solution Using Hydro gel Beads Adsorbent – A Review

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ABSTRACT: This review article's objective is to offer a thorough synopsis of the most recent developments that have been made in the application of hydro gel beads as adsorbents for the removal of textile dyes from aqueous solutions. This will be accomplished by providing a comprehensive overview of the topic. The use of hydro gel beads as adsorbents is going to be one of the focal points of the study that will be carried out. Because of the damage it does to aquatic ecosystems as well as to human health, pollution from textile dyes is one of the most significant causes of worry for the environment today. The dyes that are used in textiles are the source of this pollution. Researchers have just begun to take notice of hydro gel beads as a potentially useful adsorbent material. These beads are composed of hydro gel. This is because the structure of the hydro gel beads is very porous, they have a large surface area, and they are quite adaptable. The article examines the many types of hydro gel beads that are used for the removal of dye, the processes that are utilized in order to manufacture them, and the aspects that influence the degree to which they absorb various substances. The adsorption behavior of hydro gel beads is investigated in this research, and the different equilibrium and kinetic models that were utilized to achieve this job are discussed. The purpose of this study is to better understand the adsorption of hydro gel beads. In conclusion, the article provides a view on the future possibilities of employing hydro gel beads for the removal of textile dyes and highlights the important problems that need to be solved in order to maximize their performance. Additionally, the article provides a view on the future possibilities of employing hydro gel beads for the removal of textile dyes. In addition, the study offers a perspective on the potential use of hydro gel beads in the future, particularly with regard to the removal of textile colors. In addition to that, a review of the findings of the research is presented in the form of a summary that is included in the study.

KEYWORDS: Hydro gel beads, Textile dye, Aqueous solution, Adsorbents, Pollution

I. INTRODUCTION & SURVEY

This article's goal is to provide readers with an overview of the most current developments in the use of hydrogel beads as adsorbents for the removal of dye. It describes the many various types of hydrogel beads, the procedures that are used to produce them, as well as the uses of these beads in the process of dye removal. The modelling of the adsorption behaviour of hydrogel beads is also covered in this study [1], along with a discussion of the numerous parameters that impact the adsorption performance of hydrogel beads. This study was carried out in order to investigate a problem that has not previously been investigated. The results of this study give information on the production of mesoporous polydopamine-coated magnetic hydrogel beads and their use as an adsorbent for the removal of organic dyes. The research indicates that the hydrogel beads have a strong capacity for adsorption and selectivity towards a number of different types of dyes [2]. This study provides a report on the synthesis and characterization of hydrogel beads based on nanocellulose, as well as their use in the removal of dyes from aqueous solutions. In addition, the hydrogel beads were utilised in this research. The research indicates that the hydrogel beads have a high capacity for adsorption and that it is not difficult to regenerate them so that they may be utilised again [3]. This article is a report on the synthesis of a hydrogel adsorbent that was made from a natural polysaccharide and its use in the removal of a cationic dye from aqueous solution. The hydrogel adsorbent was synthesized from a natural polysaccharide. Researchers from both the United States and the United Kingdom were responsible for carrying out the study. According to the results, the hydrogel adsorbent has a high capacity for adsorption and has the capability of being easily regenerated for reuse [4]. This study describes the manufacture of chitosan hydrogel beads that have been treated with tannic acid and their use as an adsorbent for the removal of anionic dyes from aqueous solutions. This article contains a report on the results of the investigation that was carried out. The purpose of this work was to investigate the



synthesis of hydrogel beads based on chitosan and their use as an adsorbent for the removal of cationic dyes from aqueous solutions. The results of this investigation are reported. According to the findings, the hydrogel beads have a high capacity for the adsorption of anionic dyes of a variety of kinds while maintaining a high degree of selectivity. [5] The elimination of cationic dyes from aqueous solutions is another topic that is covered in this paper. The research indicates that the hydrogel beads have a high capacity for adsorption and that it is not difficult to recycle them so that they may be utilized again [6]. In this study, the creation of a novel magnetic hydrogel that is based on alginate and chitosan as well as its use as an adsorbent for the removal of anionic dyes from aqueous solutions is discussed. The researchers discovered that the magnetic hydrogel was able to successfully remove the dyes from the samples. According to the results, the hydrogel beads have a high capacity for adsorption and are able to be easily extracted from the solution by making use of a magnetic field. This was discovered when they were being tested. [7]. In the current study, alginate-based hydrogel beads were synthesized, characterized, and used as an adsorbent for the removal of anionic dyes from aqueous solutions. This work was carried out by the authors of the current study. The results of this investigation are detailed here. The research concluded that the hydrogel beads have a high adsorption capacity and that it is not difficult to recycle them so that they may be used again [8]. In this study, the results of a synthesis of a magnetic hydrogel made from polyvinyl alcohol and alginate are presented, as well as the use of the magnetic hydrogel as an adsorbent for the removal of cationic dyes from aqueous solutions using the magnetic hydrogel. Dyes were removed from the solutions using the magnetic hydrogel. The study found that the hydrogel beads have a high capacity for adsorption and are easily extracted from the solution with the application of a magnetic field [9]. This study describes the production of hydrogel beads based on chitosan and their use as an adsorbent for the removal of anionic dye from wastewater. Chitosan was used as the primary component in the production of the hydrogel beads. The research showed that the hydrogel beads had a high adsorption capacity, and it was easy to regenerate them such that they could be utilised more than once [10]. Graphene oxide-chitosanhydrogel beads were created, characterised, and used in this study as an adsorbent for the removal of methylene blue from aqueous solutions. The findings of this investigation are going to be discussed. The investigation revealed that the hydrogel beads had a high adsorption capacity in addition to a high degree of reusability [11]. According to the results of this study, hydrogel beads consisting of sodium alginate, polyvinyl alcohol, and graphene oxide were effective at removing anionic dyes from aqueous solutions when employed as an adsorbent. The investigation revealed that the hydrogel beads have a high adsorption capacity in addition to an exceptional reusability [12]. Reporting on the creation of a magnetic chitosan/graphene oxide hydrogel composite and its usage as an adsorbent for the removal of cationic dye from aqueous solutions was the objective of this study. The results of the investigation showed that the hydrogel beads had a high capacity for adsorption and that a magnetic field could be used to easily remove them from the solution [13]. In addition, the beads exhibited a high degree of accessibility. After the synthesis of magnetic chitosan-laponitehydrogel beads, those beads were put to use as an adsorbent to remove cationic dyes from aqueous solutions. This research was published in the journal Analytical Chemistry. The findings of this investigation are presented in this paper. According to the results, the hydrogel beads had a high capacity for adsorption, excellent reusability, and were able to be easily removed from the solution by making use of a magnetic field [14]. This study provides a report on the synthesis of magnetic and pH-sensitive PAAm/CMC hydrogel beads as well as their usage as an adsorbent for the removal of methylene blue from aqueous solutions. The research was carried out by PAAm and CMC. According to the results, the hydrogel beads had a high capacity for adsorption, excellent reusability, and were able to be easily removed from the solution by making use of a magnetic field [15]. This study focuses on the manufacture of polyacrylamidehydrogel beads and their use as an adsorbent for the elimination of colour from wastewater. The dye was taken off with the help of the beads. The results of the investigation indicated that the hydrogel beads have a high adsorption capacity, robust reusability, and were straightforward to regenerate for other applications [16]. The synthesis of -carrageenan/PVA hydrogel beads and their use as an adsorbent for the removal of methylene blue from aqueous solutions is documented in this body of work. Furthermore discussed is the work's significance. The results of the investigation indicated that the hydrogel beads have a high adsorption capacity, robust reusability, and were straightforward to regenerate for other applications [17]. In this work, carboxymethyl cellulose-g-poly(acrylic acid) hydrogel beads were synthesised, and then used as an adsorbent to remove methylene blue from aqueous solutions. The findings of this research are presented in the form of a report. According to the findings, the hydrogel beads exhibited a high adsorption capacity, excellent reusability, and were simple to regenerate for further uses [18]. This research describes the production of -cyclodextrin modified polyvinyl alcohol hydrogel beads and their usage as an adsorbent for the removal of anionic dyes from aqueous solutions. The findings of this investigation are reported in this article. According to the findings, the hydrogel beads exhibited a high adsorption capacity, excellent reusability, and were simple to regenerate for further uses [19]. In this investigation, magnetic carboxymethyl cellulose-g-poly(acrylic acid)/Fe₃O₄ hydrogel beads were synthesised. These beads were then used as an adsorbent to remove reactive dyes from aqueous solutions. The results of this study

are reported. According to the findings, the hydrogel beads have a high adsorption capacity, great reusability, and were able to be readily separated from the solution by using a magnetic field [20]. This article focuses on the synthesis of chitosan-based hydrogel beads containing multi-wall carbon nanotubes and their usage as an adsorbent for the removal of dye pollutants from wastewater. Chitosan is a kind of chitin, which is a naturally occurring polysaccharide. The study's findings demonstrated that the hydrogel beads had a high adsorption capacity, great reusability, and were simple to regenerate for further uses [21]. Carbohydrate Polymers, volume 257, issue 2021, pages 117619, has an article titled "Preparation of magnetic chitosanhydrogel beads and their use in dye removal" by Lin, H., et al. The fabrication of magnetic chitosanhydrogel beads and their use in dye removal are both discussed in this paper. According to the findings, the magnetic chitosanhydrogel beads have a high adsorption capacity, excellent reusability, and the ability to be readily detached from the solution by utilising a magnetic field [22]. This research presents a report on the synthesis of hydrogel beads based on chitosan and polyacrylamide, as well as their use as an adsorbent for the removal of dispersion dye from aqueous solution. According to the findings, the hydrogel beads exhibited a high adsorption capacity, excellent reusability, and were simple to regenerate for further uses [23]. In this work, alginate hydrogel beads were used to remove reactive black 5 dye from aqueous solution. The results of this research are reported here. According to the findings, the alginate hydrogel beads exhibited a high adsorption capacity, excellent reusability, and were simple to regenerate for further uses [24]. This research presents a report on the synthesis of a new hydrogel adsorbent that is based on modified cellulose and chitosan, as well as its use in the adsorption of anionic dyes from aqueous solution. According to the findings, the hydrogel adsorbent has a high capacity for adsorption, an excellent reusability, and the capability to be readily regenerated for reuse [25]. This research describes the production of hydrogel beads using sodium alginate, chitosan, and graphene oxide, as well as its use as an adsorbent for the removal of colours from wastewater. According to the findings, the hydrogel beads exhibited a high adsorption capacity, excellent reusability, and were simple to regenerate for further uses [26]. This paper reports on the manufacture of a pH-responsive hydrogel based on carboxymethylchitosan and its application as an adsorbent for the removal of cationic dyes. Carboxymethylchitosan was derived from chitosan, which is derived from the carboxymethyl group of chitosan. According to the findings, the hydrogel has a high capacity for adsorption and could be quickly and readily regenerated for reuse by modifying the pH of the solution [27]. This research presents findings on the synthesis of magnetic hydrogel beads using cellulose and polyacrylamide as the starting materials, as well as the usage of these beads as an adsorbent for the removal of anionic dyes from wastewater. According to the findings, the magnetic hydrogel beads have a high adsorption capacity, excellent reusability, and were able to be readily detached from the solution by using a magnetic field [28]. This research presents the results of the synthesis of hydrogel beads using chitosan, alginate, and graphene oxide, as well as the usage of these beads as an adsorbent for the removal of colours from aqueous solution. According to the findings, the hydrogel beads exhibited a high adsorption capacity, excellent reusability, and were simple to regenerate for further uses [29]. According to the findings of this research, sodium alginate and lignin may be used to make hydrogel beads, which can then be put to use as an adsorbent in order to remove cationic dyes from wastewater. According to the findings, the hydrogel beads exhibited a high adsorption capacity, excellent reusability, and were simple to regenerate for further uses [30]. This article reports on the production of magnetic hydrogel beads based on chitosan and graphene oxide and their usage as an adsorbent for the removal of anionic dyes from wastewater. Chitosan and graphene oxide were the two main components of the magnetic hydrogel beads. According to the findings, the magnetic hydrogel beads have a high adsorption capacity, excellent reusability, and were able to be readily detached from the solution by using a magnetic field [31]. This work reports on the production of hydrogel beads based on chitosan and polyvinyl alcohol and their usage as an adsorbent for the removal of cationic dyes from wastewater. The hydrogel beads were used to remove the dyes. According to the findings, the hydrogel beads exhibited a high adsorption capacity, excellent reusability, and were simple to regenerate for further uses [32]. This work reports on the manufacture of magnetic hydrogel beads based on carboxymethylchitosan and its usage as an adsorbent for the removal of anionic dyes from wastewater. The magnetic hydrogel beads were able to remove the dyes more effectively than other adsorbents. According to the findings, the magnetic hydrogel beads have a high adsorption capacity, excellent reusability, and were able to be readily detached from the solution by using a magnetic field [33].

II. CONCLUSION

The elimination of textile dyes from aqueous solutions by means of an adsorbent composed of hydrogel beads is, as a result, a viable strategy for the treatment of wastewater. Hydrogel beads offer various benefits over other adsorbent materials, including their large surface area, strong mechanical strength, and biocompatibility. These features allow them to outperform other adsorbent materials. Recent research has emphasised the potential of hydrogel beads to remove textile colours from wastewater in an effective and environmentally friendly manner. When natural polymers

such as carboxymethyl cellulose and chitosan are used as foundation materials in the production of hydrogel beads, the biocompatibility of these beads is improved, and as a result, they are ideal for use in the treatment of wastewater. The introduction of magnetic particles and functional groups into hydrogel beads has enhanced the beads' adsorption capacity and made it easier for the beads to be separated from the solution. This may make the beads more suitable for use in industrial applications. Nevertheless, more study is required so that the synthesis and performance of the hydrogel beads adsorbent may be optimised for the removal of a broad variety of textile colours from a variety of various kinds of wastewater. In general, the use of hydrogel beads as an adsorbent has shown promising results as a method that is both efficient and kind to the environment in the process of removing textile colours from aqueous solutions.

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