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Application of Guar Gum based Polymers in Drug Removal from Waste Water

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Abstract: ***Biodegradable polymers have unique properties hence finduse in different fields like medicinal, agricultural, industrial, environmental field etc. They lead to zero waste therefore known as speciality materials. Biopolymer guar gum can be extracted from the seeds of the plant Cyamopsistetragonolobus. It is a biopolymer consisting of β, 1-4-linked linear mannose chain interposed with α, 1-6-linked galactose units. Guargum consist of no. of hydroxyl functionalities which give of hydrogel character by the interaction with water molecules through hydrogen bonding. Guar gum is used in various industries for the removal of hazardous dyes. The dye removal studies were performed with respect to contact time, temperature, pH and dye feed concentration removal. This review will help the future researchers who are working on the environmental solutions based on biopolymers.***

Keywords: Guargum, grafting, dyeadsorption.

I. INTRODUCTION

Naturally many polymers are present which can be taken as biopolymers such as cellulose, dextron, starch, guar gum [1].Guargum comes under the family of leguminous and obtained from the seed pericarp of Cyamopistetragonoloba. Generally, guar gum is also called as cluster bean [2]. Guar gum has a very well though-out structure consists of linear chain having β, 1-4-linked linear mannose chain interposed with α, 1-6-linked galactose substituted atalmost every residue point[3]. Guar gum has broad range of application in pharmaceuticallike textile, cosmetic, food industries [4]. The solubility of Guar gum is insoluble inhydrocarbon, fat, alcohol, ester and ketone [5]. It is extremely thixotropic having higher that adsorption of 1% [6]. Complete hydration logically occurs for about 30 minutes, depending on training. Maximum thickness is achieved at 25-40 °C. Thickness is not influence by pH in pH 1.0-10.5. It is unspecified to be since because of this nature non-ionic uncharged molecules [7].

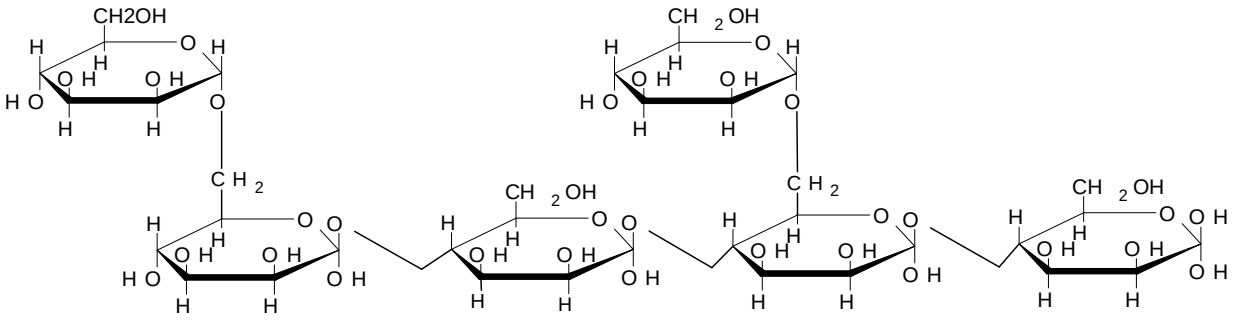

Fig 1: Structure of Guar gum

Hydration speed although maximum hydration rate is at pH 8-9, even as the minimum hydration rate is at pH >10 and pH<4. Though guar gum is non-ionic, it is not unsusceptible to salting out. Though guar gum is non-ionic, it is not unsusceptible to salting out. The dependability of guar gum solution is fine with mono-, di-, and trivalent ions with the thickness increases through increasing attentiveness of salt. Thickness decreases with growing attention of sugar. In literature serve it has proved that guar gum removed many dye like methylene blue, congo red. Now a day's modified Guar gum derivatives are used in the field of medical devices and bio-imaging also which is quiet a challenging area for application [8]. Different types of guar gum derivatives were developed for the better applications as per the industrial needs with water builders, Thickness, emulsifiers, stabilizers, and charge carrier flocculent applications [9]. Biopolymers by cationic derivatives have the applications in shampooing [10]. Guargum can be used in free form or in combined form.

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II. DYE REMOVAL BY THE PURE GUARGUM:

The removal of dye by Guar gum is very helpful technique or method to remove toxicity from the water. Guar gum generally removes many dyes in which the adsorption or desorption of harmful particles in aqueous solution [11]. Many new methods or techniques are used to remove the harmful adsorption of water particles with the help of Guar gum. When Guar gum is mixed with the water having dye solution contents, guar gum make bond with the particles and make a bond with the harmful particles with makes waters polluted. There are many dyes which removal by Guar gum [12].

Table I.Literature survey on the Removal of Dye by Guar gum

S. No	DYE	BIO POLYMER	APPLICATIONS	REF.
1	Malachite Green dye	Guar gum	Malachite Green dye adsorption starts after 24hr under time taken with maxi. 6.4 pH solution.	13
2	Crystal violet dye	Guar gum	Maximum temperature taken is 273K at pH 7.6.	14
3	Reactive blue/Congo red Dye	Guar gum	The batch experiment results showed that at pH 3 and contact time 30 min.Temperature 318K maximum dye was adsorbed.	15
4	Methylene blue	Guar gum	Hydrogel adsorb showed best results at pH 7.4, room temperature and 6 h contact time.	16
5	Methylene blue/methyl violet	Guar gum	The maximumdye adsorption occurs at 6h contact time and pH 2.9.	17
6	Methylene red	Guar gum	Nano compositeform hydrogen bonding with the solvent and showed maximum dyeadsorption at pH 7.4 and room temp.	18
7	Methylene Blue	Guar gum	Guargum based hydrogel adsorb methylene blue from waste water at pH 9.9 and 4h contact time.	19
8	Methyl red	Guar gum	Guargum give best results for adsorption at pH 7.9.	20
9	Azo dye	Guar gum	Maximum dye adsorbed by the hydrogel in 24 h contact time.	21

III. DYE REMOVAL BY MODIFIED GUAR GUM

After the modification of Guar gum the nature and the adsorption of harmful dye solution content capacity also increases [22]. Many literatures survey take part of technique to modify Guar gum using different technique [23]. Biopolymers form hydro gel by deficient amount of adsorption of dye from water which affects the purity. This removal of dye by modified Guar gum can be done on different dye solution which pollutes the water. Different dye solution takes different free radical with guar gum for the removable of dye from water [24]

Table II. Literature Survey on Removal of DYE by Modified FORM OF GUAR GUM

S. No	Dye	Backbone	Modified technique	Application	Ref.
1	Anionic dye (RB,CR)	Guar gum	Graft co-polymerization	Hydrogels give maximum adsorption at 4hr, pH 10.	25
2	Malachite green	Guar gum	Block co-polymerization technique	Maximum dye adsorption occurs within 24h time and 7.7 pH.	26
3	Crystal violet dye	Guar gum	Blockco-polymerization technique	Highest adsorption took place at 6h contact time.	27
4	Violet dye	Guar gum	Alternate co-polymerization Technique	Maximum adsorption was reported in 6h time and room temp.	28
5	Congo Red, Reactive blue dye	Guar gum	Graft co-polymerization technique	Optimum adsorption was reportedin 24h and pH 9.4.	29
6	Cationic Dye	Guar gum	Block co-polymerization technique	Maximum adsorption of dye occurs at 9.0 pH and7 h contact time.	30
7	Voilet Dye	Guar gum	Graft co-polymerization technique	Hydro gel gives maximum adsorption in 24h and 35^{o} C temperature.	31

IV. REMOVAL OF DYE BY GRAFT CO-POLYMERS OF GUAR GUM:

Graft co-polymers of guar gum have been synthesized by using different solution using polymerization techniques. Graft co-polymerization technique can done using different variation [32]. Modification by grafting onto guar gum can be done using different variation different monomer, pH, Temperature [33]. With the help of Graft co-polymers Dye adsorption by guar gum can done easily and give finite result with less time taken. The hydro gel formation of Guar gum gives maximum formation of the sample when dye is generally adsorbed [34]. Mainly grafting techniques is the best and easiest way to get good result by using grafting onto guar gum [35].

Table III. Literature survey on Removal OFDYE Bygraft Copolymers of GUAR GUM:

Sr. No	Dye	Backbone	Monomer	Application	Ref.
1	Methylene blue	Guar gum	AM/PAM	Maximum adsorption of dye with 7.0 pH dye solution with 24hr time taken.	36
2	Congo red Dye	Guar gum	HEMA	Dye adsorption value gives its finest result with time 4hr and pH 6.4 solutions.	37
3	Methylene blue	Guar gum	AA	Dye adsorption value gives its finest result with time 6hr with pH 2.	38
4	Reactive blue, Congo red	Guar gum	AA	The dye adsorption value gives its maxi. Adsorption with 4.48 pH solution or temp.318K, 40min.	39
5	Congo red	Guar gum	Poly-AA	The dye adsorption value gives its maxi. Adsorption with 7 pH solution or temp. 30 min.	40

The removal of Bismarck brown dye by graft co-polymers Guar gum is a novel work. This dye is helpful for removal of toxicity from the water by hydrogel formation of Guar gum using grafting technique.

V. DYE ADSORPTION STUDY

The adsorption of BB Y azo dye by guar gum and its graft copolymers was studied by the batch experiments. Different concentration of BB Y dye solution were prepared with de-ionized water at different ppm solution was scanned on Double beam UV−Vis spectrophotometer (shimadzu-1900) for λmax which comes out to be λmax = 463nm. The calibration curve is grafted for the various concentration solution of BB Y dye at λmax = 463nmto verify Beer's law.After specific time intervals, dye solution aliquots were withdrawn and the concentration of the remaining dye was determined at the characteristic wavelength (λmax = 463nm Bismarck brown dyes, respectively) with the help of UV spectrophotometer. Once the effect of variation of contact time was studied than at optimum contact time effect of temperature, pH and dye feed concentration were studied. Dye adsorbed (qt) and percent dye uptake (De) were calculated as:

$$Qt = \frac{C_0 - C_t}{W_d} \times V$$

$$De = \frac{C_0 - C_t}{C_0} \times 100$$

Where, C_o = Initial dye concentrations, C_t= Dye concentrations in the solution after time's', V = Volume of the dye solution and, W_d= Weight of adsorbent taken. Using it with different behaviour of guar gum when react with different time, temperature, pH solution.

VI. CONCLUSION

From this review paper it can be concluded that guar gum could be modified to form guar gum based hydro gel using different modification technique of graft co-polymers. Graft co-polymerization technique is the easiest and best technique to modify guar gum. Guar gum is a biopolymer which helps in different fields and can easily adsorb. Guar gum can easily contact with different dye and give different adsorbed value by using dye adsorbed formula. This dye adsorbent value tells us about the different behavior of guar gum by testing it with different time, pHand temperature solutions.

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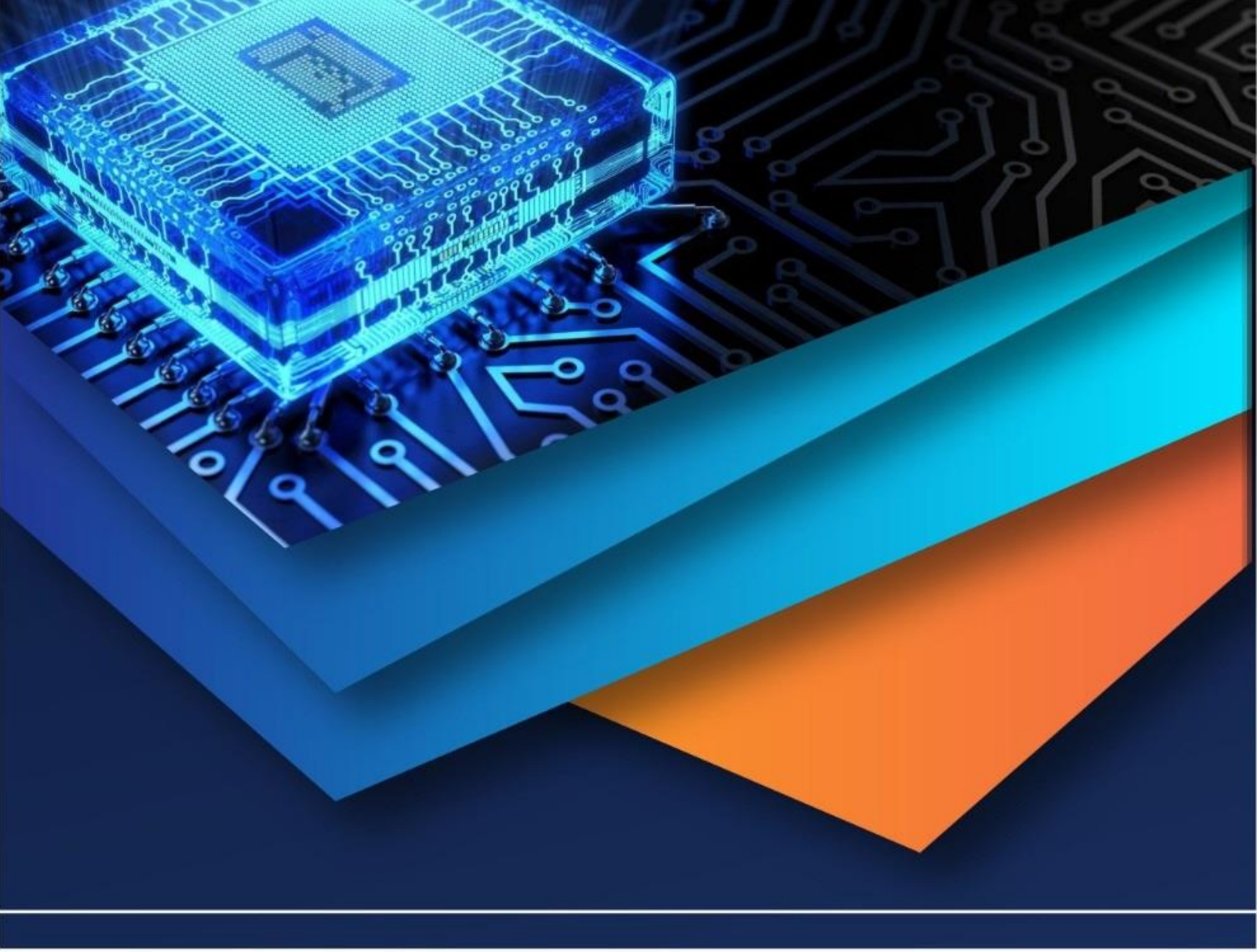

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