Polymerization of Starch for Reducing Challenges of Pollution

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Abstract:
This study involved synthesis without solvent via Cross-linked amino modified starch by using different w/w ratios of starch and thiourea in the presence of zinc oxide. Starch as a poly saccharide has motivating characteristics such as susceptibility to microbial degradation, nontoxicity and biocompatibility., Starch as a polysaccharide has motivating characteristics such as susceptibility to microbial degradation, nontoxicity and biocompatibility.

Keywords: starch, Challenge, contamin, saccharide.

1- Introduction

Polymers are important material to reduce society challenges in field of pollution problems ,modern synthetic polymers are extremely useful in bottles and plastic bags (polyethene) crates and ropes (polypropene) insulation of electric cables (polychloroethene); one of the least cost polymer is starch; a natural polysaccharide polymer synthesized mainly via polymerization of glucose units that is produced in photosynthesis process in higher plants and found chiefly in cereal , fruits, root tubers and legumes ranging between 25-90 % . Starch as a polysaccharide has motivating characteristics such as susceptibility to microbial degradation, nontoxicity and biocompatibility. It is composed of two structural components the amylose (a linear macromolecule) containing of 250 – 300 α(1-4)linked D-glucose units and highly branched less hydrophilic amylopectin which is consisting of about 1400 D-glucose units linked together by α(1-4) and α(1-6) linkages[(1-5)]. Amylopectin have content of about 75 ± 5% w/w of starch while amylose content of starch is about 25 ± 5 w/w. in contrast several genotypes exhibit different amylose/amylopectin (AM/AP) ratio; for instance some waxy starches have about 100/100 w/w of amylopectin[(6,7)]. The inner structure of conventional model of starch is formed of two regions crystalline and amorphous lamellae which together responsible to form crystalline and amorphous growth rings of starch[(1, 8)] .although the rhodamine family of the great interesting due to both technological and medical relevance[(9-12)] such as drug delivery measurements, sensors and solar cells[(13-17)], dyes can cause dermatitis, provoke cancer, allergy, skin irritation and mutation to human[(18-21)]. Rhodamine 6G (Fig. 1) is a synthetic dye used in cotton, wool, silk, leather, paper, plastic production and baste fiber. The carcinogenic and toxicity nature of rhodamine 6G nature have been reported by US Department of Health and Human Services[(22-24)]

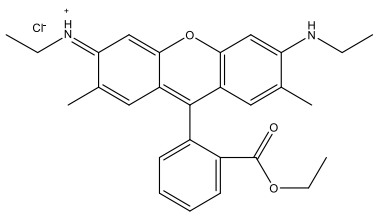


Figure 1: chemical structure of Rhodamine 6G dye

2- Materials and Methods

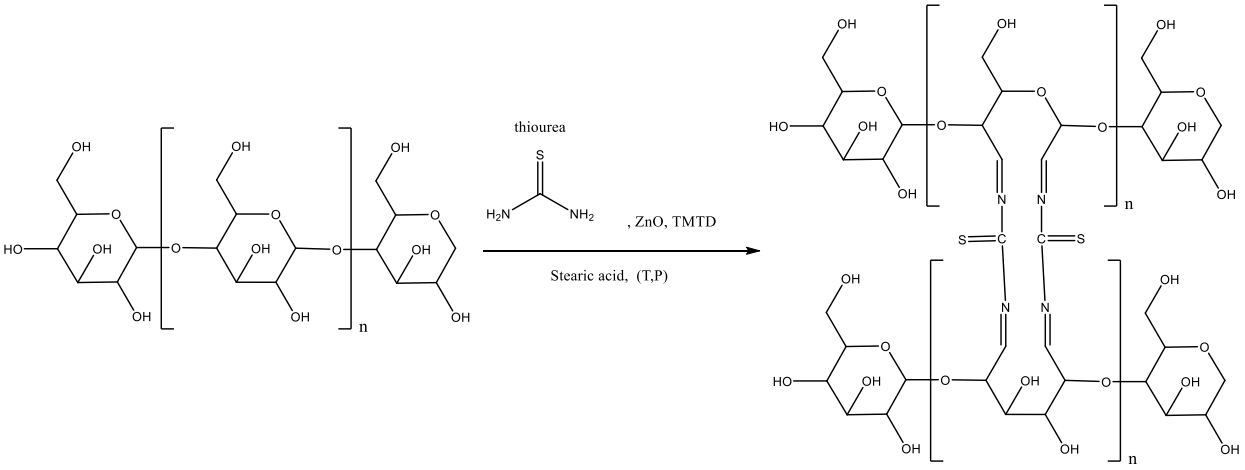
2.1: **Material:** all chemical were purchased from Merck, Germany

2.2: Synthesis of Sorbent

Cross-linked amino modified starch was synthesized without solvent, by using different w/w ratios of starch and thiourea in the presence of 1.2 g of zinc oxide, 1.2g of stearic acid, and also 1.2g of TMTD for all samples as catalysts. All samples are individually mixed very well and put in a molds, then after exposed to high pressure(p=2500 psi) and temperature of (110 ^{O}C ±10) for 20min ±1. The w/w ratio was written down in the table 1.Then every sample product passed into 100ml hot distilled water and filtered off ,then after carefully washed with 200ml distilled and 75ml ethanol, after washing, filtration all samples were dried at about 40 ^{O}C under vacuum.

Table 1 : w/w starch to thiourea ratio

Starch No.	Weight of starch/g	Weight of thiourea/g	Starch/thiourea w/w %
Starch 1	2.8	1.2	70%
Starch 2	2.4	1.6	60 %
Starch 3	2	2	50 %
Starch 4	1.6	2.4	40 %
Starch 5	1.2	2.8	30 %



Scheme 1: Synthesis of Sorbent

Results and Discussion

2.2.1: FTIR Spectrometry analysis

FTIR spectra was achieved by BrukerFT-IR model 4800 ,without using KBr, FTIR spectra of starch derivative is shown in Figs. (3&4). The broad absorption peak at 3257.77 cm^{-1} attributes to the OH stretching, sharp peaks at (2972.1, 2916.9, 2853.1)cm^{-1} assign to aliphatic CH Stretching vibration, the peak at 1642cm^{-1} assigns to formation of the C=N functional group[20] and thus extremely enhances the progress of the reaction of the starch derivative. The peaks at 2357.9 cm^{-1} and 1537 cm^{-1} attribute the presence of thioamide NCS[(21)], and 999,4 cm^{-1} assigns to ν(C-O-C)[(22)].

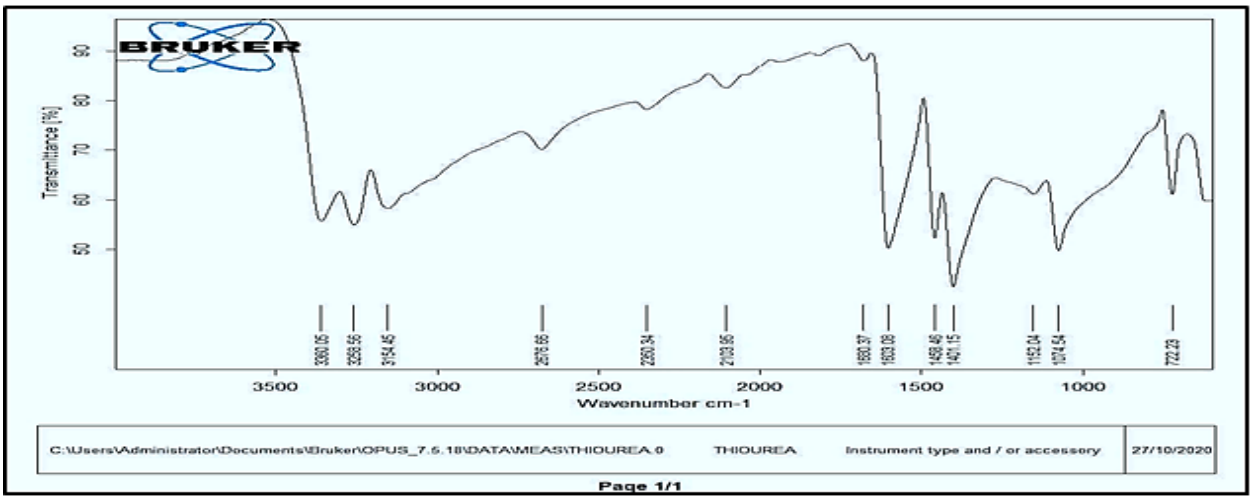


Fig.2 FTIR of thiourea

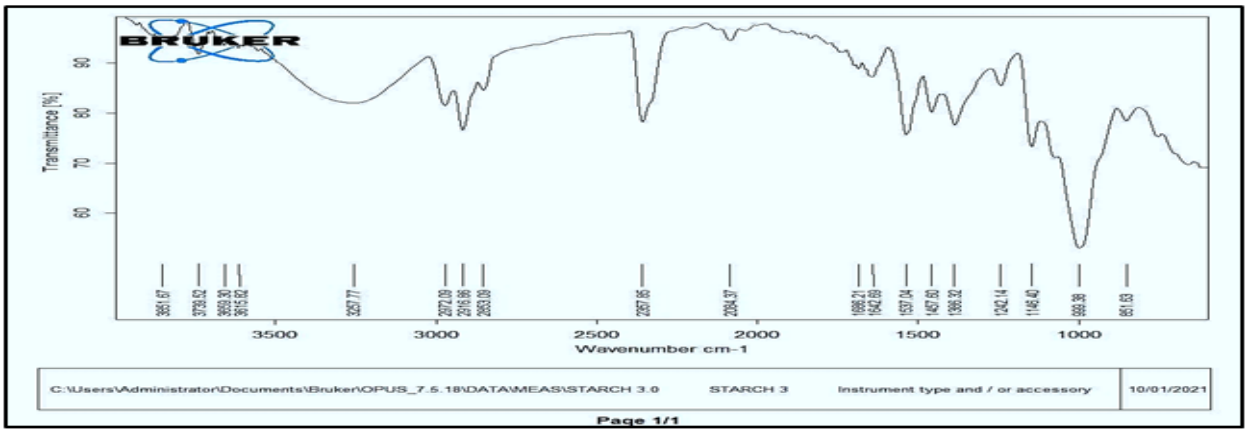


Fig.3 FTIR of starch3 trial3

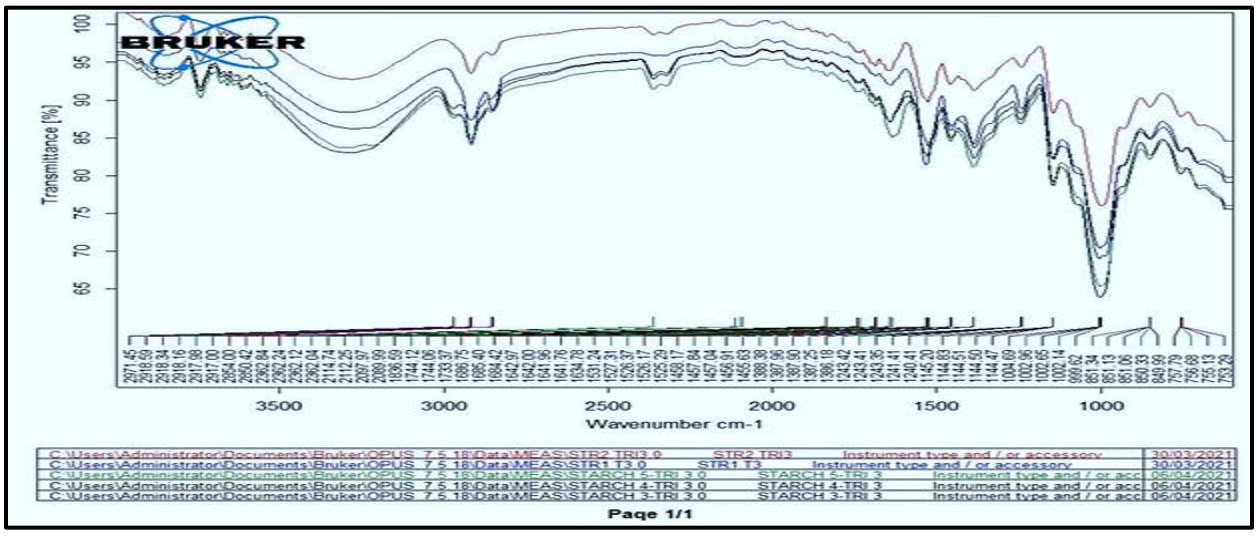


Fig 3.4 FTIR chart of starch drevivative 1-5 trial three

3.1 Analytical application of the paper

3.1.1: Rhodamine 6G (adsorbate) adsorption on cross-linked amino modified starch as adsorbent was tableted down at different factors.

1- Time factor: Contact time is changing; at constant T= 303K ±2 , $m_{adsorbent}$= 5mg , and the concentration of adsorbate is 5ppm .

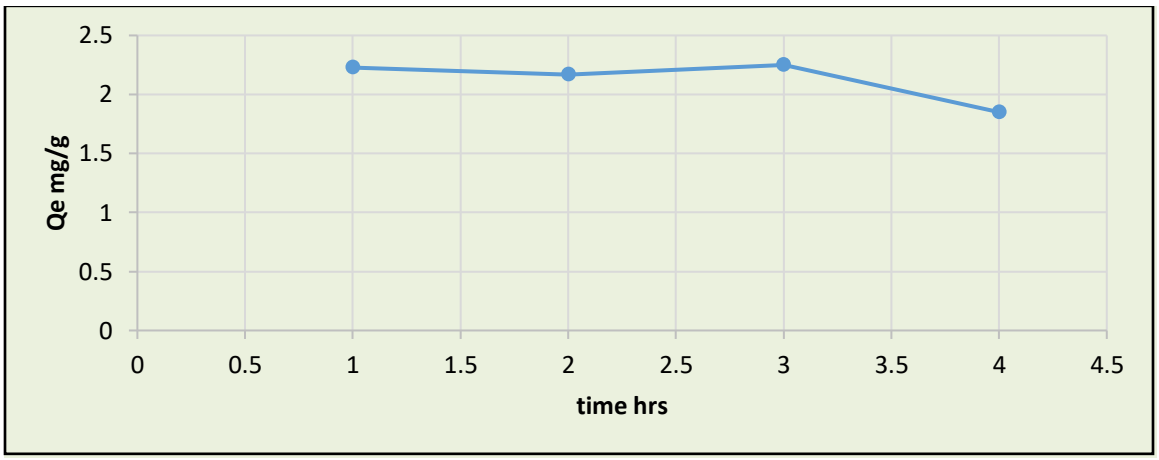


Fig.1 time factor against Qe mg/g

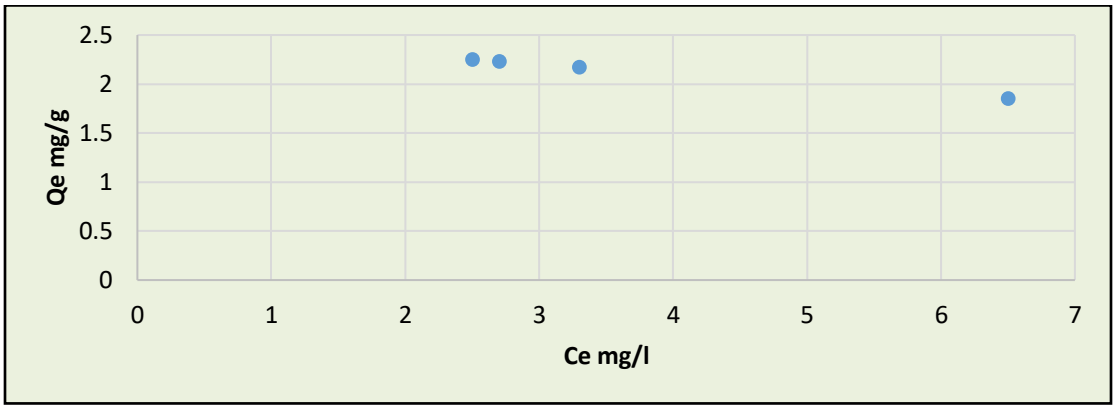


Fig. 2 Qe mg/g against Ce mg/l at constant time (3hrs)

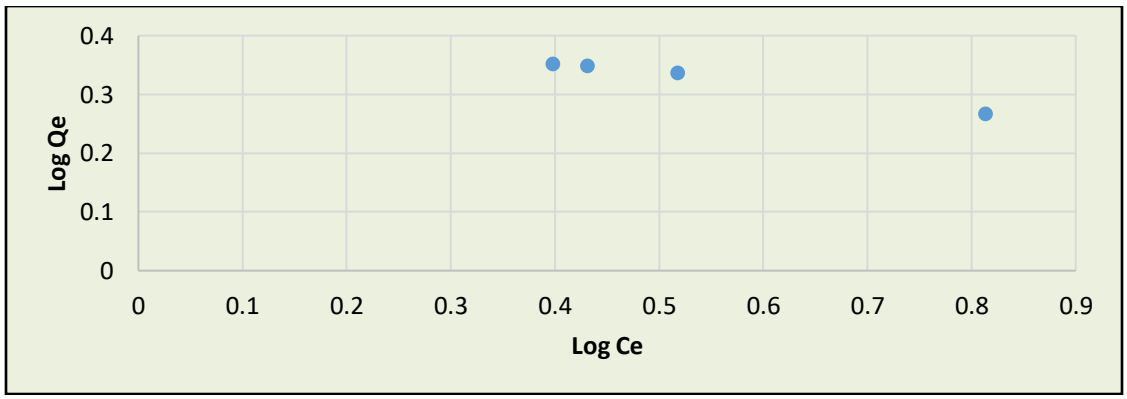


Fig.3 log Qe against log Ce at constant time (3hrs)

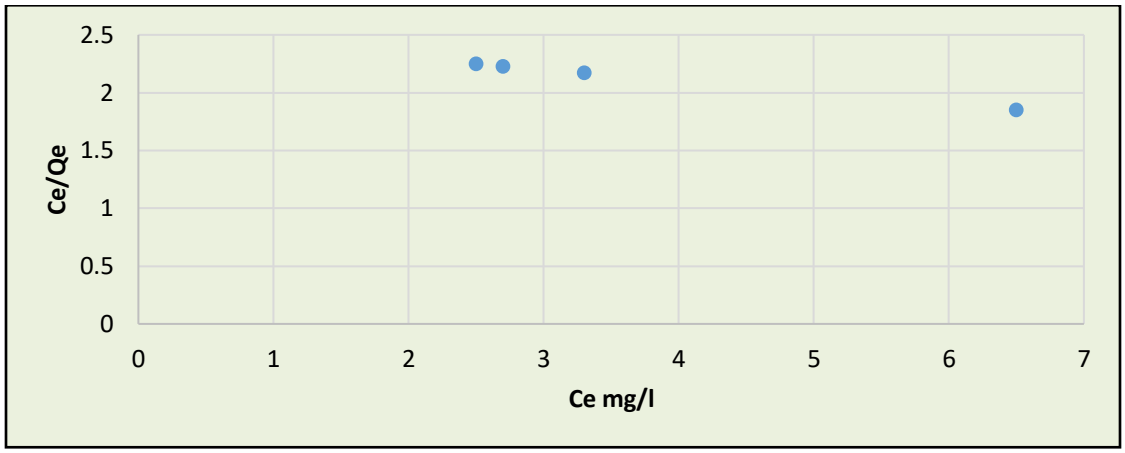


Fig. 4 Ce/Qe against Ce mg/l at constant time (3hrs)

2- **Mass Factor**: Contact time is 3 hr. ; the concentration of adsorbate is 5ppm .

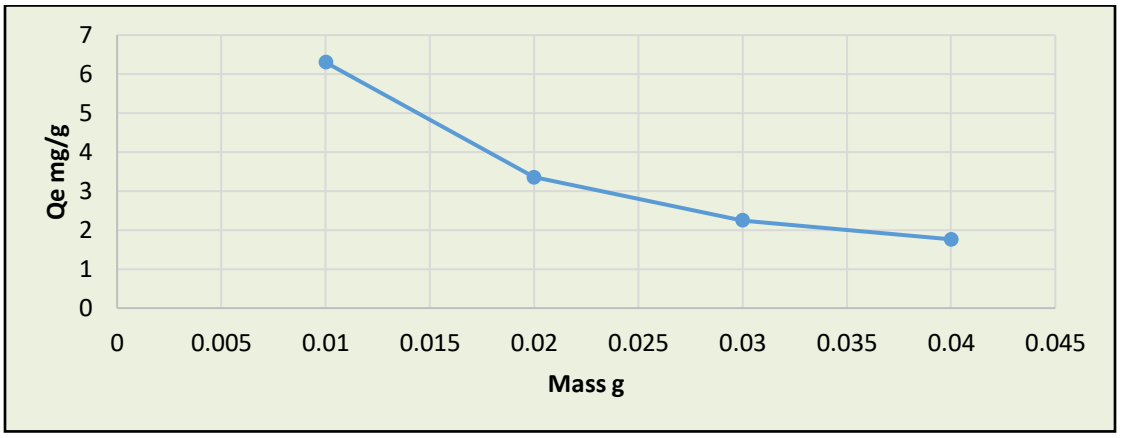


Fig.5 mass factor against Qe mg/g

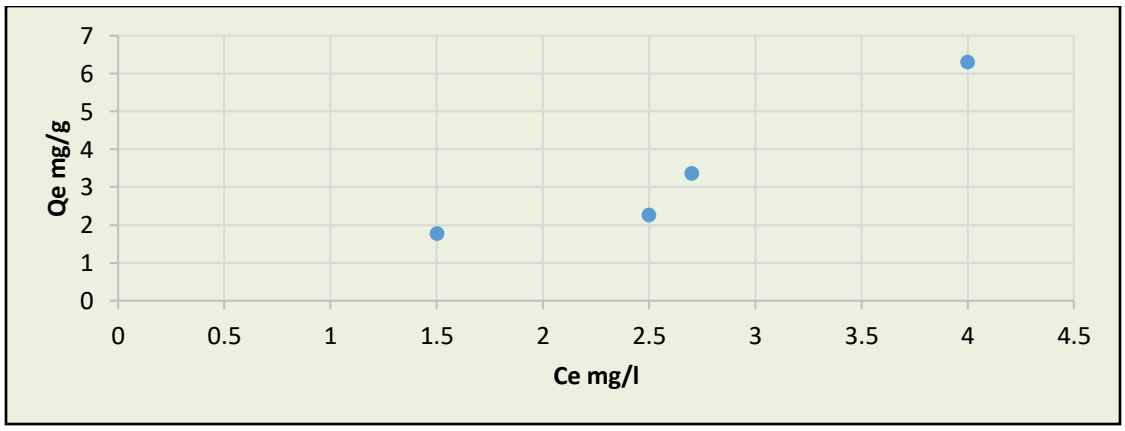


Fig. 6 Qe mg/g against Ce mg/l (10mg of absorbent)

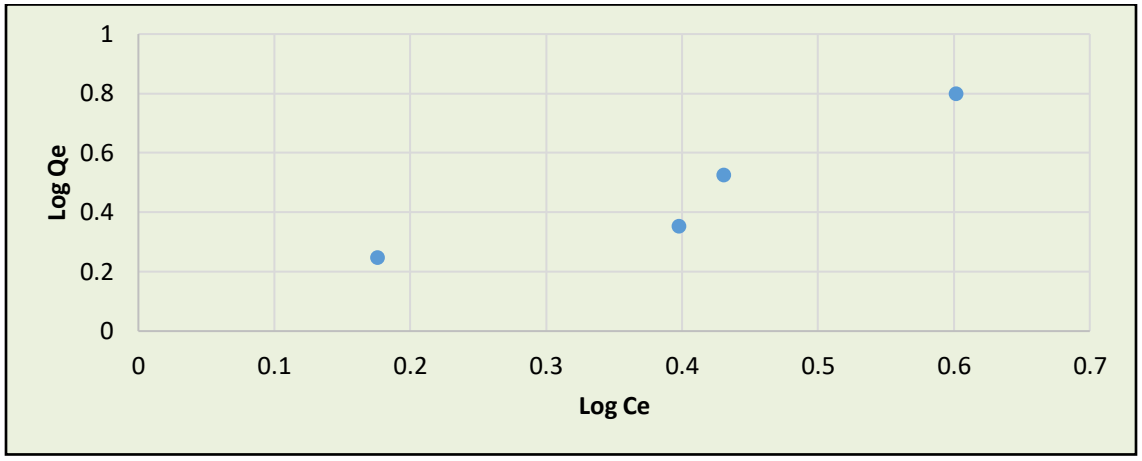


Fig.7 logQe against logCe (10mg of absorbent)

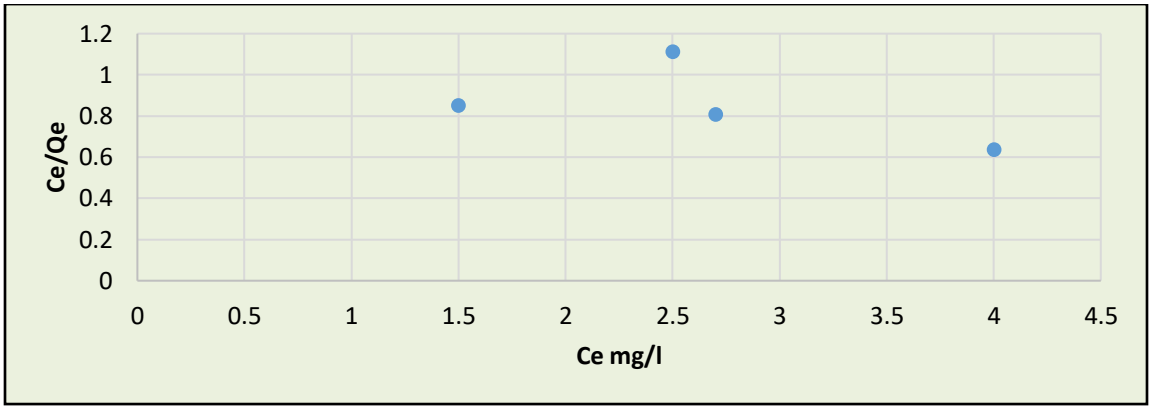


Fig. 8 Ce/Qe against Ce mg/l (10mg of absorbent)

3- **Effect of Temperature** : all other parameters are constant; contact time is 3hr.; , $m_{adsorbent}$= 50mg , and the concentration of adsorbate is 5ppm .

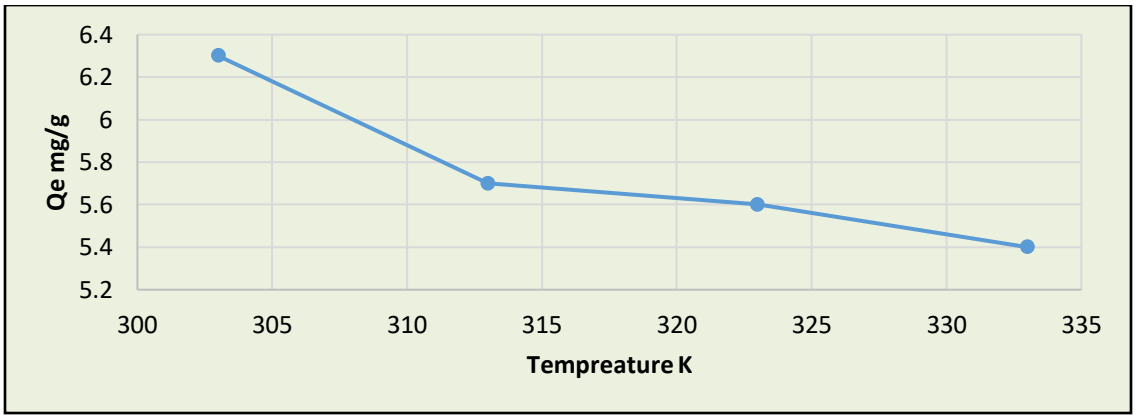


Fig. 9 effect of temperature on Qe mg/g

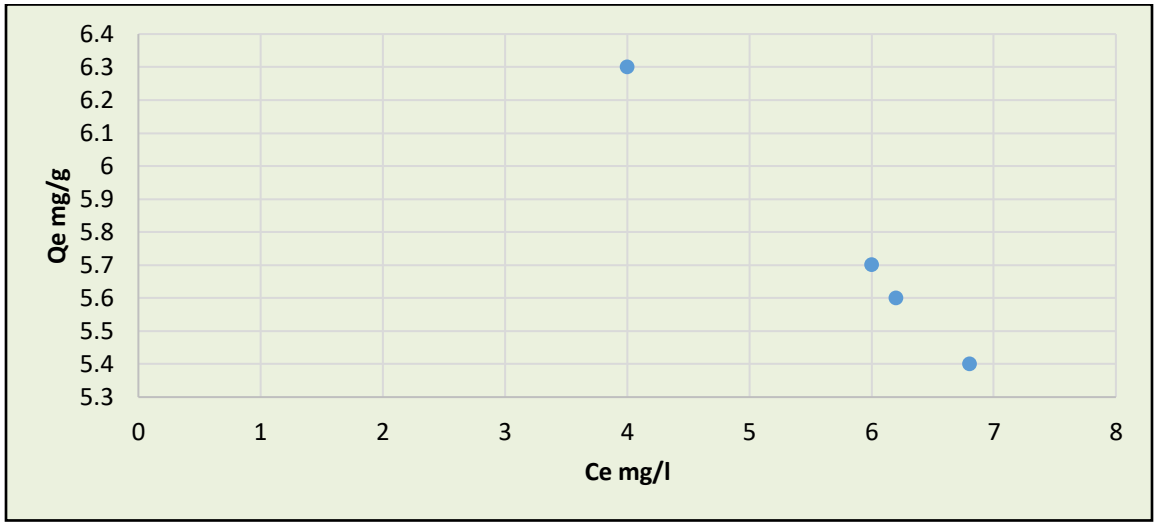


Fig. 10 Qe mg/g against Ce mg/l (at constant temperature 303k)

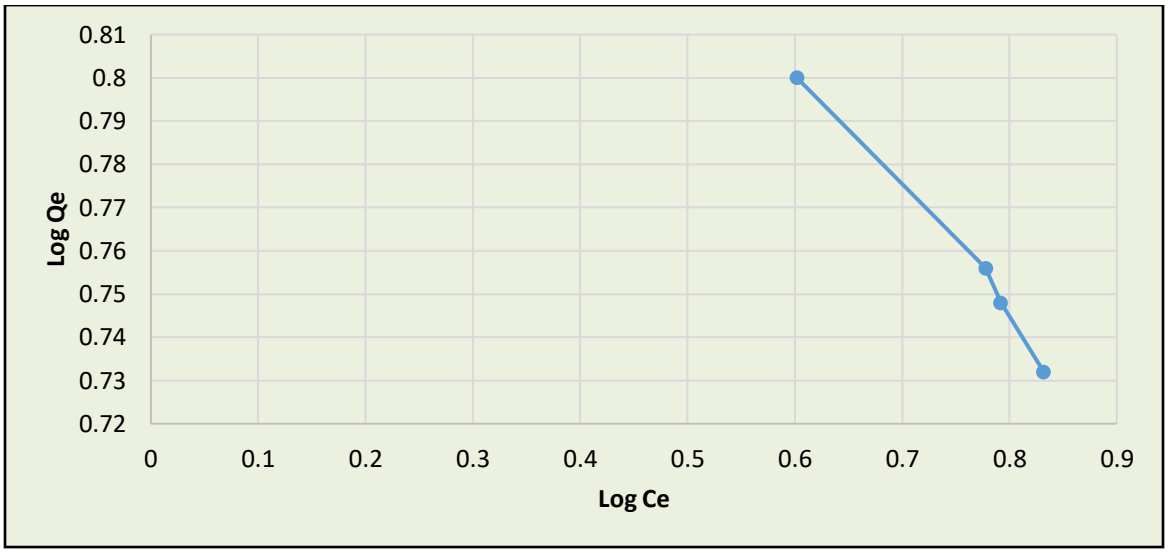


Fig. 11 logQe against logCe (at constant temperature 303k)

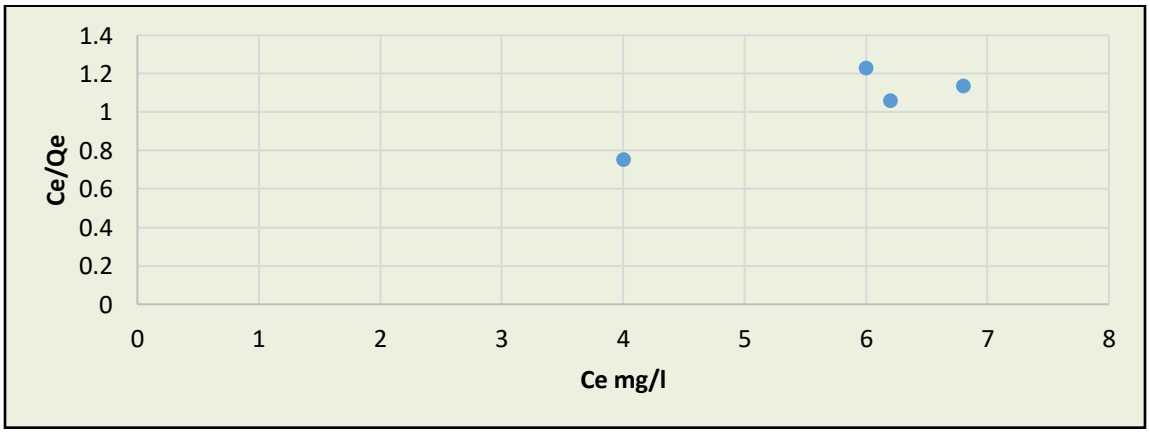


Fig. 12 Ce/Qe against Ce mg/l (at constant temperature 303k)

4- **Effect of pH** : all other parameters are constant; contact time is 3hr., T= 303K ±2 , $m_{adsorbent}$= 50mg , and the concentration of adsorbate is 5ppm .

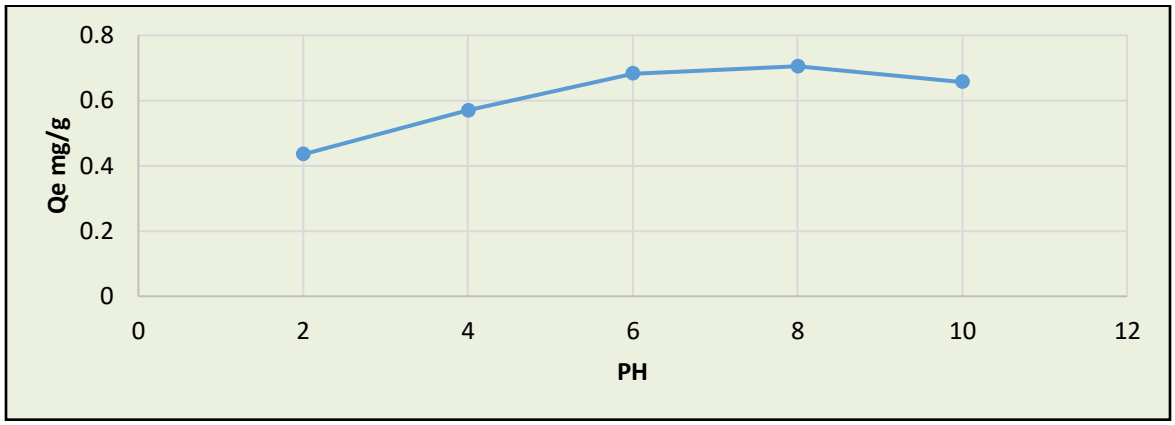


Fig. 13 pH values against Qe mg/g

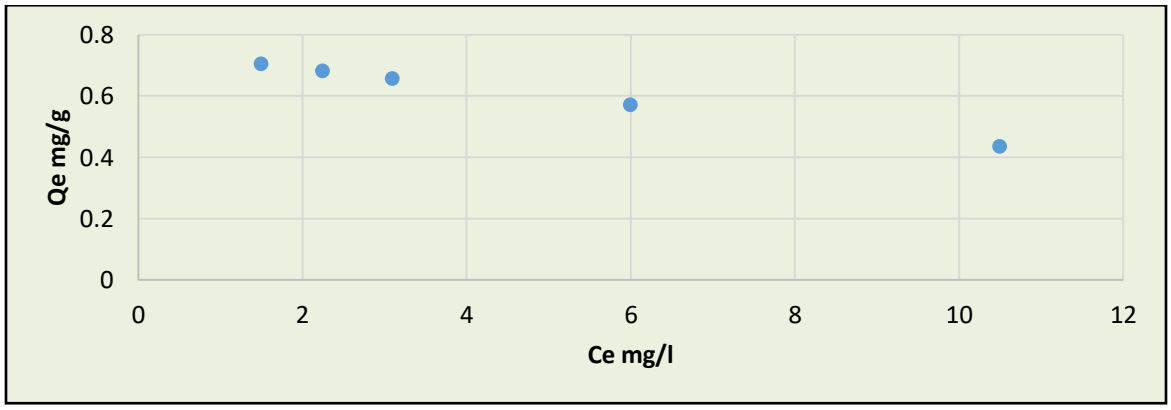


Fig. 14 Qe mg/g against Ce mg/l (at pH=8)

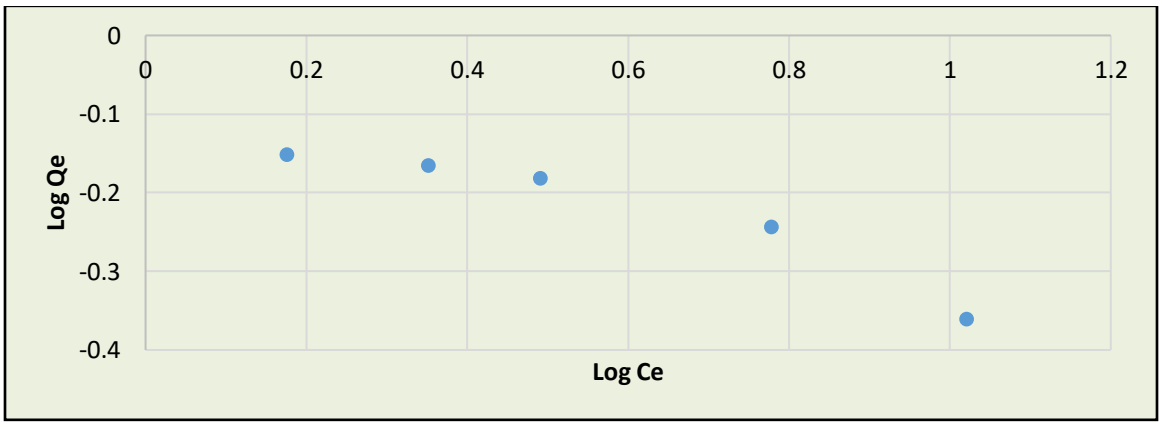


Fig. 15 logQe against Ce (at pH=8)

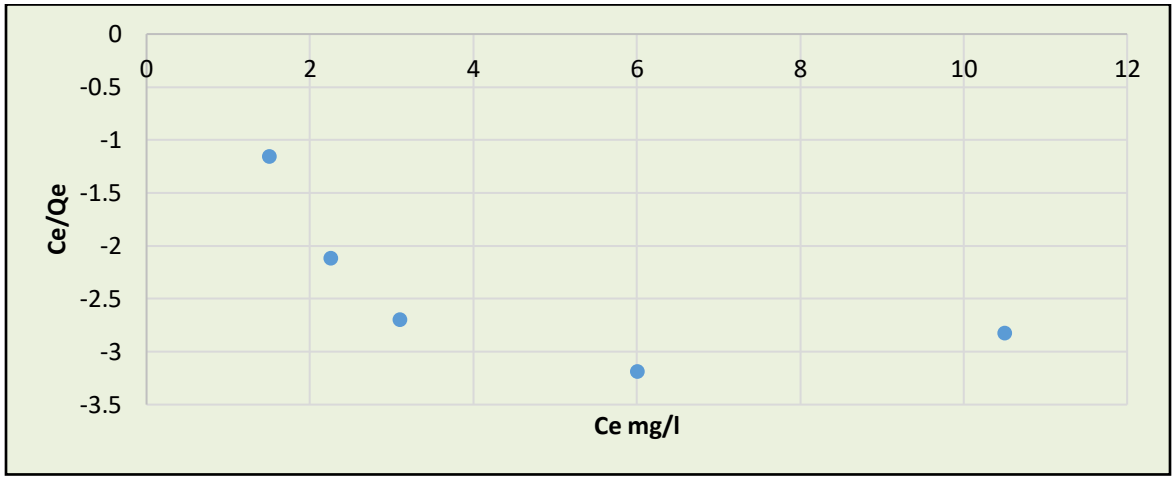


Fig. 16 Ce/Qe against Ce mg/l (at pH=8)

Conclusion:

According to the adsorption studies rhodamine G6 dye exhibited a good result of absorption at the surface of cross linked amino starch, The best contact time for all adsorption investigation was three hours, The best temperature for adsorptions was 303 K.

Funding

This study did not receive any specific grant from any funding agency.

Conflict of interest

The authors have no conflicts of interest to disclose.

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