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EVALUATION OF BIOSORPTION CAPACITY OF AMIDO BLACK DYE USING CHAETOMORPHA ANTENNINA GREEN ALGAE POWDER

G.Prasad[1], Prof Meena Vangalapati[2], Dr.Ch.A.I.Raju[3]

[1]Research scholar, Department of Chemical Engineering, Andhra University Visakhapatnam
presi143@gmail.com
[2]Professor, Department of Chemical Engineering&Andhra university Visakhapatnam,
meenasekhar2002@yahoo.com
[3]Assistant Professor, Department of Chemical Engineering&Andhra university Visakhapatnam
drchairaju@gmail.com

Abstract:

The beginning of water (surface or remote) influences extensively the substance of its impurities. Water virtue utilized in haemo dialysis ought to fulfill explicit requirements and norms to forestall poisonousness either in the intense or the constant condition. Different traditional cycles, like compound precipitation, film filtration, particle trade, invert assimilation, vanishing and electrolysis, are normally applied to the treatment of modern seepage. Notwithstanding, the utilization of such cycles is frequently restricted due to specialized or monetary requirements. Presently a day we frequently run over the expression save water however it's an ideal opportunity to understand that the presence of water on earth obtained the presence of life on it which is novel among planets. The present research was investigated using Chaetomorpha Antennina powder as a potential biosorbent for the removal of Amido Black dye. The operating parameters involved are effect of agitation time, effect of biosorbent dosage, effect of p^H, effect of initial concentration, effect of dosage and effect of temperature of the solution.

Keywords: Amido Black, Chaetomorpha Antennina, Biosorbent, Percentage of dye removal

1. INTRODUCTION

The Earth's surface is obviously overwhelmed by water: 70.8% of it (361.2 million km²) is covered by the seas, around 3.16% (more than 16.1million km²) by ice ashore. Lakes cover approx. 2 millionkm² (0.39%). Counting waterways and wetlands, with approx.2.7 million km² (0.53%), the absolute water-shrouded surface of our planet is above 75%). Water is the significant constituent of the human body. The last can't deliver sufficient water by digestion or get sufficient water by food ingestion to satisfy its requirements. As a result, we need to focus on what we drink for the duration of the day to guarantee that we are meeting our everyday water needs, as not doing as such may have negative wellbeing impacts. Water is the principal constituent of cells, tissues and organs and is essential for life. The numerous issues overall related with the absence of perfect, new water are notable: 1.2 billion individuals need admittance to safe drinking water, 2.6 billion have next to zero sterilization, a great many individuals pass on yearly 3,900 kids' day from illnesses sent through risky water or human excreta. In the present study we have done removal of Amido Black dye by using Chaetomorpha Antennina green algae powder from waste water by biosorption process.

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II.EXPERIMENTAL PROCEDURE

The procedure of the experiments is divided into the below mentioned steps:

1. Gathering the Chemical and Reagents required.
2. Preparing the respective Biosorbents.
3. Each Biosorbent Characterization.
4. Stock solutions preparation.

Experimentation in the Batch mode include the following studies

A. Chemicals and reagents required:

Amido Black dye were used to prepare stock solutions.

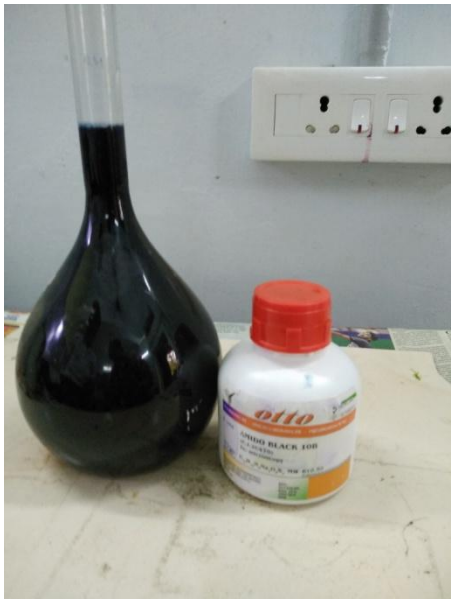

Fig.1.1 Amido Black Dye

B. Preparation of the Biosorbents

The proposed biosorbents are ChaetomorphaAntennina. This biosorbent is widely available and collected from the banks of the Godavari River in Rajahmundry, Andhra Pradesh, India. The collected plants are cleaned until the dirt is removed with distilled water. The cleaning is then continued with the process of drying the plants under the hot sun so that the plants become too dry so that they can only be torn apart by squeezing the palms of the hands. The dried leaves were then ground into powder and then sieved with various sizes such as 53 µm, 75 µm, 105 µm, 125 µm and 152 µm. So the sifted powder, without any preventive treatment, is used as a biosorbent

C. Preparation of 1000 Mg/L of Amido Black dye stock solution

Sources for the manufacture of dye stock solutions are Amido Black dye powders. Double distilled water was used for the preparation of the required solution. Amido Black stock solution with a concentration of 1000 mg/L was prepared by dissolving 1 g of Amido Black dye in 1 L of distilled water. Then the aquadest is poured up to the mark of the 1000 ml volumetric flask so

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that the solution is made or made. In the same way, all other solutions were also prepared whose concentrations varied accordingly [(20, 50, 100, 150, 200) mg/L].

D. Studies on Equilibrium Biosorption Process

The biosorption was carried out in a batch process by adding a pre-weighed amount of the Chaetomorpha Antennina green algae powder to a known volume of aqueous solution for a predetermined time interval in an orbital shaker. The procedures adopted to evaluate the effects of various parameters via. Agitation time, biosorbent size, pH, initial concentration, biosorbent dosage and temperature of the aqueous.

Batch studies

Effect of agitation time

About 15 of the latest generation Erlenmeyer flasks were washed with the help of distilled water and then dried using an oven that works with hot air. It is known that the drying temperature is 60^{o}C with duration of 15 minutes. In each of the above-mentioned conical flasks having 50 ml of dye, a predetermined amount of biosorbent is added. Now for the incubation process, the flask is placed in an orbital shaker whose speed is maintained at 180 revolutions per minute. The process takes place at room temperature. The incubation process was controlled for various shaking times such as 1 minute, 3 minutes, 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes, 30 minutes, 40 minutes, 50 minutes, 60 minutes, 90 minutes, 120 minutes, 150 minutes and 180 minutes. Then the prepared sample was filtered using Whatman filter paper. The analysis was carried out in an Ultra Violet spectrophotometer to obtain the final concentration of the dye.

The equation for calculating the percentage of biosorption = $\frac{C_o - C_i}{C_o} \times 100$

Whereas,

C_o= Initial concentration of the dye in the present aqueoussolution. (mg/L)

C_i= Final concentration of the dye in the present aqueous solution. (mg/L)

The uptake of the dye is given by the formula = [V (C_o-C_i)] / [Wx1000]

Whereas,

V = considered dye solution volume.

W = Added dosage of biosorbent.

Effect of biosorbent size

The value obtained from the process discussed above is considered the optimal value for the stirring time. To determine the effect of the size of the biosorbent, an aqueous solution of about 50 ml was taken simultaneously into various conical flasks with a capacity of 250 ml. Each flask is filled with biosorbents of different sizes. To maintain full contact between the sample and the biosorbent, a conical flask was placed on the shaker for optimal stirring time. This stirring process is passed to temperature. After shaking, the sample was allowed to stand for decantation, followed by filtration and then brought under a UV spectrophotometer to determine the final concentration of the dye by analysis.

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Effect of pH

Various pH values were considered for the analysis of the effect of pH on the absorption equilibrium. The pH of the solution can be changed simply by adding the required amount of NaOH and HCL having 0.1 N at the same time. The optimal amount of biosorbent which has been obtained from the above experiment is added to the aqueous solution as much as 50 ml. The flask was placed in a shaker, at room temperature, which was running at 180 rpm. The stirrer is operated for optimal stirring time. The sample is then allowed to settle. After sedimentation, the sample was filtered and examined with a UV spectrophotometer to determine the absolute metal concentration.

Effect of the Initial concentration of dye:

Although the pH and size of the biosorbent were at their optimum values, a predetermined amount of biosorbent was added to a 50 ml aqueous solution at various dye concentrations. The sample is then placed in a shaker for the optimal time at room temperature. The samples were then prepared following the classical filtering procedure and analyzed in a UV spectrophotometer to find the final concentration of the dye.

Effect of the dosage of biosorbent:

Various amounts of biosorbent were brought into a conical flask of 250 ml each, which was supplemented with 50 ml of an aqueous dye solution, which had the biosorbent size, initial dye concentration and solution pH at their respective optimal values. Placing the flask in an orbital shaker at room temperature will facilitate continuous contact between the biosorbent and the solution because the shaker will be operated for optimal stirring time. The normal procedure is then followed by allowing the sample to settle and then filtering the sample for analysis on a UV spectrophotometer to determine the final concentration of the dye.

Effect of Temperature:

A 250 ml conical flask was filled with 50 ml of aqueous dye solution and maintained at each of five different temperatures, having parameters such as solution pH, biosorbent size and initial dye concentration at their optimal values. The flask is made to sit in the shaker for the appropriate and optimal time. Whatman filter paper is used to filter the sample. The filtered sample was then analyzed with the help of a UV spectrophotometer to obtain the final dye concentration value.

III. RESULTS AND DISCUSSIONS

In the present investigation, the prospectives of sorbents namely Chaetomorpha Antennina green algae powder were evaluated to estimate their performance for the decolorization of Amido Black dye present in aqueous solutions. The effects of parameters on decolorizationof Amido Black dye were measured, data consisting of effect of agitation time, sorbent size, pH of the solution, initial concentration, sorbent dosage and temperature.

A. Sorption of Amido Black dye using Chaetomorpha Antennina green algae powder.

1. Effect of agitation time

The % biosorption of Amido Black is drawn against agitation time in fig.1.2it is found from the plots that the % biosorption is gradually increased in the first 60 min of agitation. Beyond the agitation time of 60 min, the % biosorption is constant. So, the equilibrium agitation time is 60

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min. for a typical experiment with 50 mL of aqueous solution adding 10 g/L of 53 µm size biosorbent, the % biosorption is increased from 12% to 69% in the agitation time period of 5 to 60 min.

The rate of percentage biosorption is higher in the initial stages because adequate surface area of the biosorbent is available for the biosorption of Amido Black. As time increases, more amount of Amido Black is biosorbed onto the surface of the biosorbent and surface area available decreases.

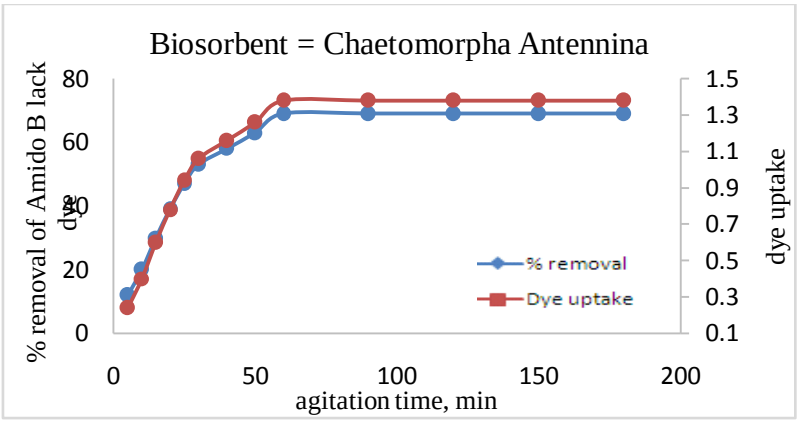

Fig. 1.2.Effect of agitation time on % removal of Amido Black dye

2. Effect of biosorbent size

The variations in % biosorption of Amido Black with biosorbent size are drawn in fig. 1.3 The percentage biosorption is increased from 45 % to 69 % as the biosorbent size decreases from 152 to 53 µm. The surface area of the biosorbent increases as the size of the particle decreases and the number of activesites on the biosorbent are better exposed to the biosorbate.

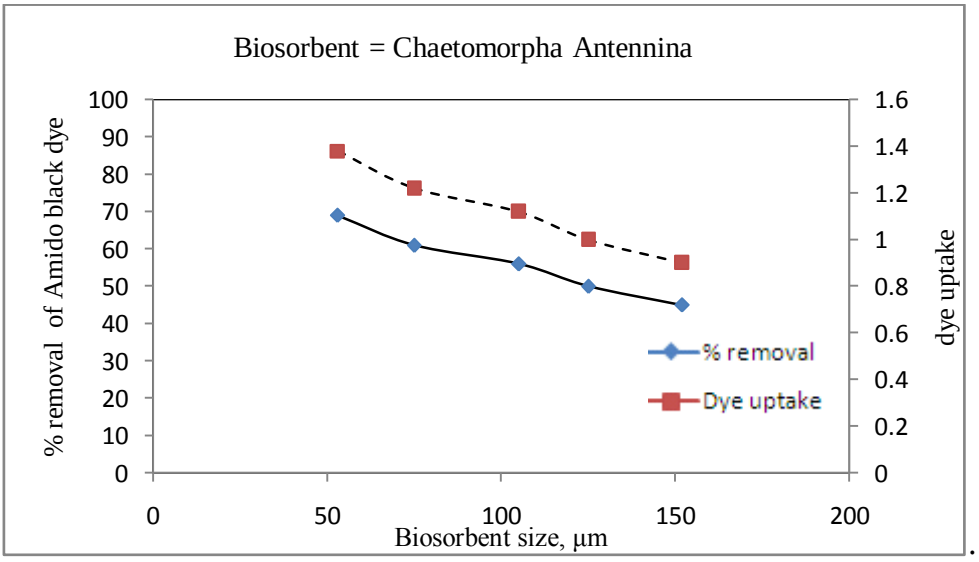

Fig.1.3.Effect of Biosorbent size on % removal of amido black dye

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3. Effect of pH in aqueous solution

A plot is drawn in fig. 1.4 between % biosorption of Amido Black and pH of aqueous solution. Significant increase in percentage biosorption of Amido Black is observed as pH is increased from 2 to 7 and downward trend of the % biosorption is noted with an increase in pH above 7 for a typical experiment with 50 mL of aqueous solution, adding a biosorbent dosage of 10 g/L of 53 µm size, the extent of biosorption is increased from 45 % to 69 % in the pH range from 2 to 7. The results indicate that the chemical interactions may have been exchanged between the ions. The carbonyl, hydroxyl, carbonyl and amide groups of the biomass are mainly involved in the biosorption of Amido Black. further, presence of - SO_3 stretching, S = O and C–S–O bands, from ester sulfonate groups are very rich due to their ion-exchange involvement in biosorption.

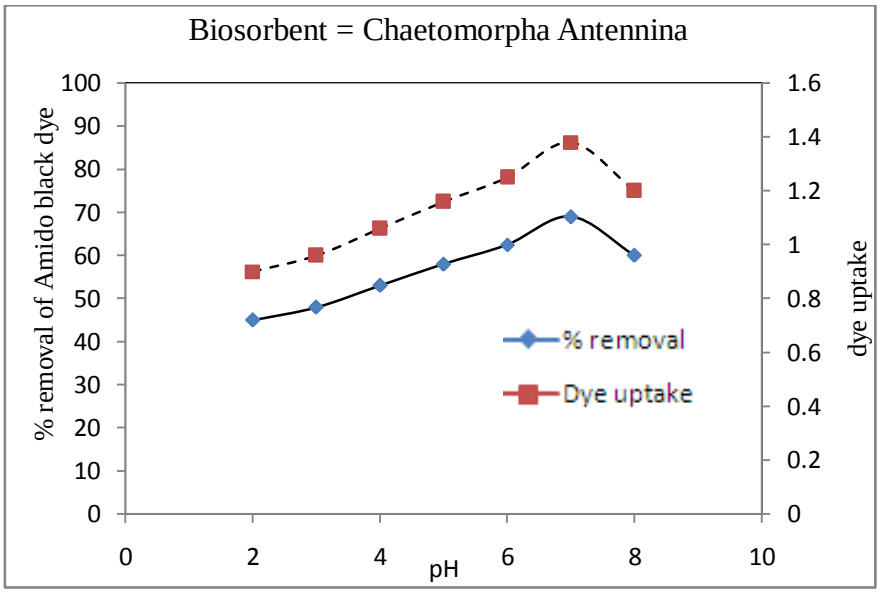

Fig.1.4.Effect of pH on % removal of amido black dye

4. Effect of initial concentration of Amido Black

The effect of initial concentration of Amido Black in the aqueous solution on the percentage biosorption at equilibrium agitation time is shown in fig. 1.5. The % biosorption is gradually decreased from 69 % to 49.9 % (9.98 to 1.38 mg/g) by increasing Amido Black Concentration from 20 to 200 mg/L. Lesser percentage of Amido Black is removed for higher concentration of Amido Black in the aqueous solution. This behavior is due to the increase in the amount of biosorbate to the unchanging number of available active sites on the biosorbent.

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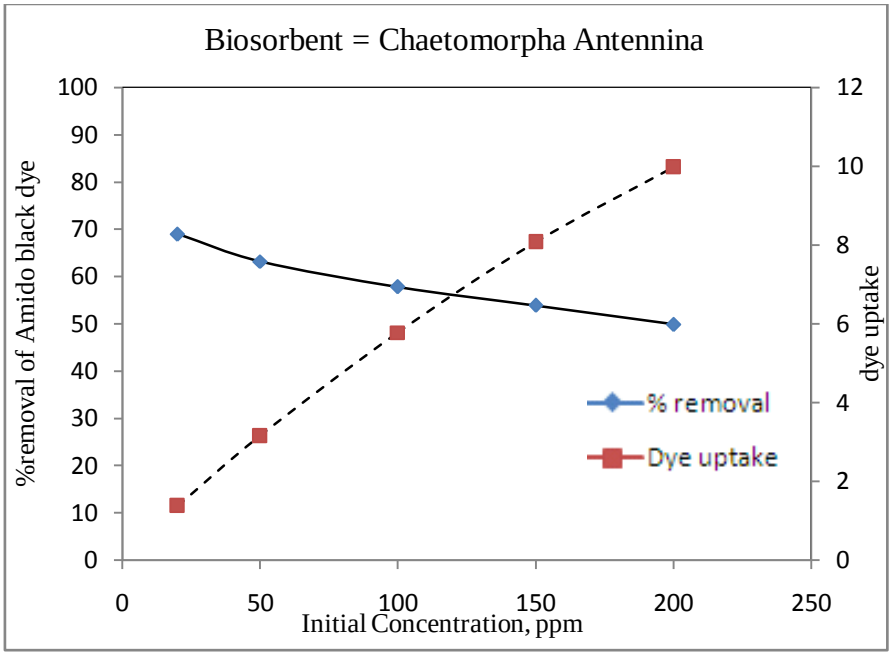

Fig.1.5.Effect of initial concentration for the % removal of Amido black dye

5. Effect of biosorbent dosage

Fig. 1.7 represents the variation in percentage biosorption of Amido Black from the aqueous solution with biosorbent dosage. The % biosorption is increased from 69 % to 91% as dosage is increased from 10 to 35 g/L. The % biosorption from the aqueous phase increases with an increase in the biosorbent amount. This is so because the number of active sites available for dye uptake would be more as the amount of the biosorbent is increased. The % biosorption is constant as dosage is increased from 35 to 70 g/L. Hence all other experiments are conducted at a dosage of 35 g/L.

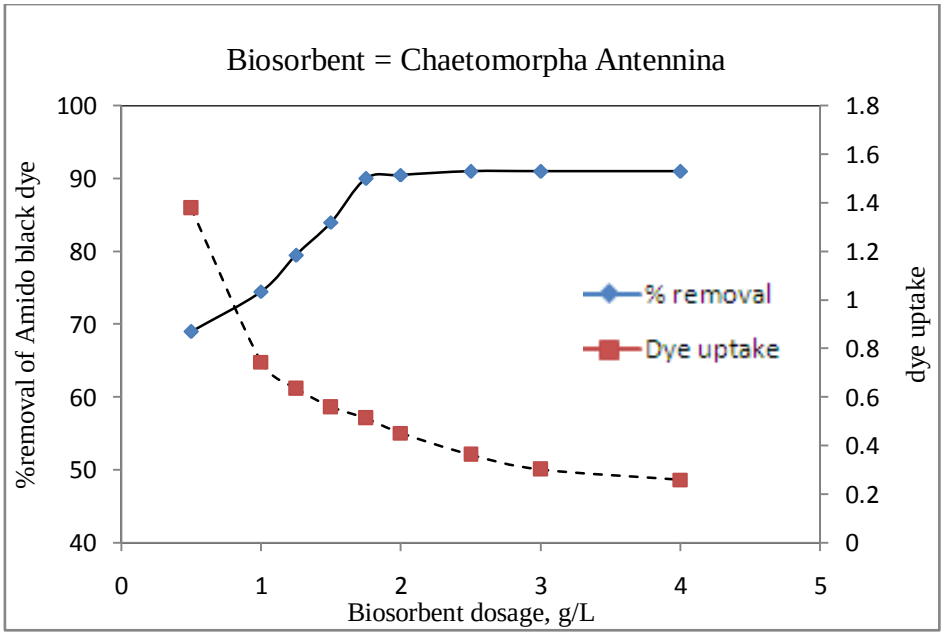

Fig. 1.6.Effect of biosorbent dosage on % removal of Amido black dye

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6. Effect of Temperature

The effect of temperature on the equilibrium dye uptake was significant. The effect of changes in the temperature on the Amido Black dye uptake is shown in Fig. 1.7. Results indicate that the adsorption capacity of Chaetomorpha Antenninaa for the Amido Black dye increased with temperature. This may be a result of increase in the mobility of the large dye ion with temperature. An increasing number of molecules may also require sufficient energy to undergo an interaction with active sites at the surface. Furthermore, increasing temperature may produce a swelling effect within the internal structure of the Chaetomorpha Antenninaa enabling large dyes to penetrate further.

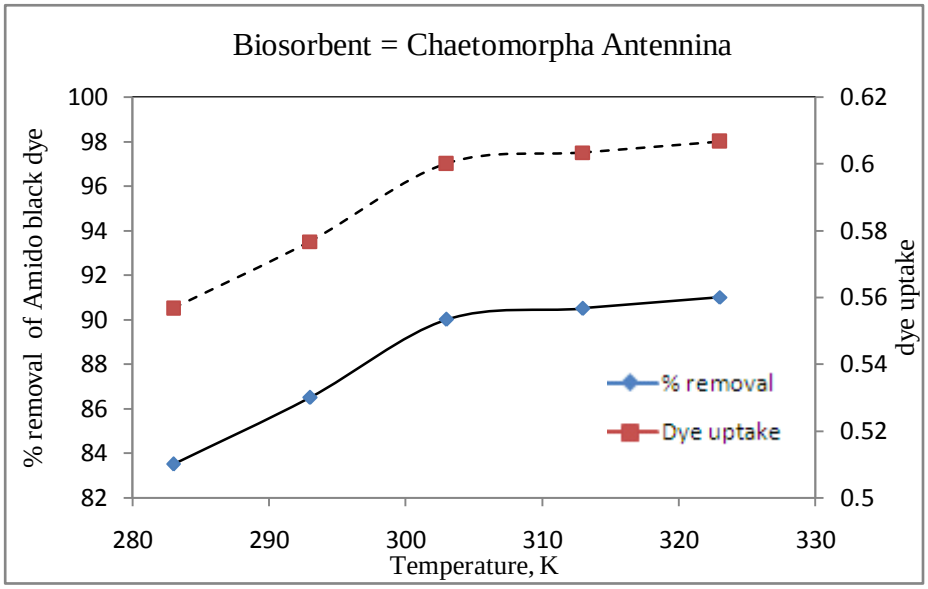

Fig. 1.7 Effect of temperature for the % removal of Amido black dye

IV. CONCLUSIONS

1. The equilibrium agitation time for Amido black dye sorption is 60 minutes.
2. The optimum dosage for sorption is 35 g/L.
3. Maximum extent of sorption is noted at pH = 2 to 7

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