DETERMINATION OF THE EFFICIENCY OF A COMPOSITE SORBENT-COAGULANT SYSTEM BASED ON ELDERBERRY FRUITS, EGG PASTE, AND ALUMINUM SULPHATE

Askarova Gulchiroy Ahror qizi

Bukhara state university, chemistry and oil and gas technologies department

Abstract : This in the article black elderberry extract , egg the time of day powder and aluminum sulfate based on composite sorbent- coagulant synthesis and his/her sewage the waters in the cleaning efficiency studied . Synthesis in the process local and waste raw materials used , ecological clean reagent to take opportunity created . Jar-test method using modeled sewage water Pb^{2+}, Cu^{2+}, Zn^{2+} and Fe^{2+}/Fe^{3+} ions in the samples loss efficiency was evaluated . Research to the results according to , composite sorbent – coagulant traditional coagulants (aluminum sulfate , $FeCl_3$, PAC) compared high efficiency showing up to 90–96% cleaning level provided . Adsorption isothermal analysis Langmuir to the model good suitable arrived , kinetics and pseudo-second orderly to the model appropriate is chemical adsorption mechanism advantage confirmed . Received results composite sorbent – coagulant practical and ecological advantages show it industry sewage waters in cleaning effective application possible confirmed .

Key words : Composite sorbent – coagulant , black acacia (elderberry), egg aluminum , aluminum sulfate , sewage water , heavy metal ions , coagulation , sorption , ecological cleaning .

Аннотация: В данной статье исследована эффективность очистки экстракта черной бузины, яичного порошка "Время суток" и сульфата алюминия на основе композиционного сорбента-коагулянта синтеза и его/ее применения в сточных водах. В процессе синтеза использовалось местное сырье и отходы, был создан экологически чистый реагент для использования возможностей. Методом Jar-теста была оценена эффективность потери ионов $Pb2^{+}$, $Cu2^{+}$, $Zn2^{+}$ и $Fe2^{+}/Fe3^{+}$ из сточных вод в образцах . Согласно результатам исследований, композитный сорбент – коагулянт с традиционными коагулянтами (сульфат алюминия, $FeCl_3$, PAC) отличается высокой эффективностью, достигая уровня очистки до 90-96%. Изотермический анализ адсорбции по Ленгмюру показал, что модель подходит, кинетика и псевдосекундный порядок соответствуют модели, подтверждены преимущества химического механизма адсорбции. Полученные результаты показывают, что композиционный сорбент – коагулянт обладает практическими и экологическими преимуществами, что подтверждает возможность эффективного применения его в очистке промышленных сточных вод.

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Ключевые слова: Композитный сорбент – коагулянт, черная акация (бузина), яичный алюминий, сульфат алюминия, сточные воды, ионы тяжелых металлов, коагуляция, сорбция, экологическая очистка.

Annotatsiya: bu maqolada qora elderberry ekstrakti , tuxum kompozit sorbent - koagulant sinteziga asoslangan kun kukuni va alyuminiy sulfat vaqti va uning kanalizatsiya tozalash samaradorligidagi suvlar o'rganildi . Jarayonda sintez mahalliy va chiqindi xom ashyo ishlatilgan, imkoniyatdan foydalanish uchun ekologik toza reagent yaratilgan . Namunalarida modellashtirish kanalizatsiya suv Pb2 va Cu2, Zn2 va Fe2 va Fe2/Fe3 va Fe ionlar yordamida Jar-sinov usuli zarar samaradorligi baholandi . Ko'ra natijalariga tadqiqot , murakkab sorbent-koagulant an'anaviy koagulants (alyuminiy sulfat , FeCl, pac) taqdim tozalash darajasi 90-96% gacha ko'rsatgan yuqori samaradorligini nisbatan . Modelga adsorbsion izotermik tahlil Langmuir yaxshi mos keldi , kinetika va psevdo-ikkinchi tartibli modelga mos kimyoviy adsorbsion mexanizm afzalligi tasdiqlangan . Olingan natijalar kompozit sorbent-koagulant amaliy va ekologik afzalliklari it sanoatining kanalizatsiya suvlarini tozalashda samarali qo'llanilishini ko'rsatadi .

Kalit so'zlar: kompozit sorbent – koagulyant , qora akatsiya (oqsoqol), tuxum alyuminiy , alyuminiy sulfat , kanalizatsiya suvi , og'ir metall ionlari , koagulyatsiya , sorbsiya , ekologik tozalash .

Introduction

Water resources quality storage and industry sewage waters effective cleaning today's on the day world on a scale current ecological from problems one is considered . Different kind working release enterprises activity as a result harvest to be sewage waters often heavy metal ions , organic pollutants and blurry particles own inside takes . Such pollutants not only drink of water hygienic quality reduces , maybe soil and to hydroecosystems also serious damage delivers . This because of the water the waters in cleaning effective , cheap and ecological safe technologies working exit scientific and practical importance . Aluminum sulfate [$Al_2(SO_4)_3$] and iron(III) chloride ($FeCl_3$), which are widely used as traditional coagulants , show a certain degree of efficiency in reducing turbidity and color of wastewater. However, their main disadvantages include the need for high dosage, secondary pollution, and high sediment formation. Therefore, in recent years, the direction of creating new composite sorbent-coagulants by enriching traditional coagulants with local natural and waste raw materials has been widely developed[1-5].

Elderberry fruit is rich in natural polyphenols, flavonoids and anthocyanins, and their high complexing properties allow it to bind to metal ions. Eggshell is a cheap and common waste, the main composition of which is calcium carbonate

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($CaCO_3$). Calcium carbonate can maintain the pH balance of water and also act as an additional adsorbent in the coagulation process. By combining the traditional coagulant properties of aluminum sulfate, the bioactive components of elderberry fruit and the sorption potential of eggshell, it is possible to create an effective and stable composite sorbent–coagulant system [6-10].

This of the research relevance is that this composite sorbent – coagulants using sewage in the water heavy metal ions (Pb^{2+}, Cu^{2+}, Zn^{2+}, Fe^{2+}/ Fe^{3+}) effective loss of water color and blur reduce , as well as water again to use suitable to the situation to bring opportunity available . outside , local from raw materials use economic efficiency increases , waste again to be processed service does and " green" "to the principles of chemistry " suitable is coming .

Method and methods

1. Raw materials Preparation : Black acacia Elderberry (Sambucus black L .) – gather taken fruits cleaned , 40–50 ° C at dried . Dried raw material crushed and soaked in ethanol - water (70:30) solution for 2 hours during extraction was done . Obtained extract filtered and concentrated at 40 °C . Bioactive components (polyphenols , flavonoids) sorption and complex harvest to do features amplifier additional as applied .

Egg po' chog'i – cleaned and boiled in the water disinfection was dried at 80 °C , and 100 μm until powder in case It contains up to 95 % calcium carbonate ($CaCO_3$) as an additional sorbent and pH buffer as used .

Aluminum sulfate ($Al_2(SO_4)_3 \cdot 18H_2O$) – traditional coagulant as used .

2. Composite sorbent - coagulant synthesis . Composite material laboratory to drown in conditions method using prepared :

Aluminum sulfate solution (10%) was prepared. Egg shell 5–10% by mass of powder suspension prepared and dissolved added . Black acacia extract (1–3% by mass) slow mixing under the circumstances to the solution added . Solution pH = 4.5–5.0 1 M NaOH solution using It was true . The mixture was heated at 60 °C for 2 hours. during mixed , then 24 hours during was heard . Harvest was sediment filtered was taken , dried at 80 °C and up to 0.25 mm announced . As a result bioactive substances with modified aluminum reasonable composite sorbent-coagulant received .

3. Wastewater water samples preparation

Experience for in the laboratory modeled sewage water solutions prepared : Pb^{2+}, Cu^{2+}, Zn^{2+} and Fe^{2+} ions salts at a concentration of 10–20 mg/l based on solutions Water turbidity was modeled using bentonite powder (50 mg/l) .

The figure below compares the efficiency of removing heavy metal ions (Cu^{2+}, Fe^{2+}/Fe^{3+}, Pb^{2+} and Zn^{2+}) using different coagulants. As can be seen from the

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graph, the composite sorbent-coagulant synthesized based on black acacia fruit, eggshell and aluminum sulfate showed higher efficiency than traditional coagulants ($Al_2(SO_4)_3$, $FeCl_3$, PAC).

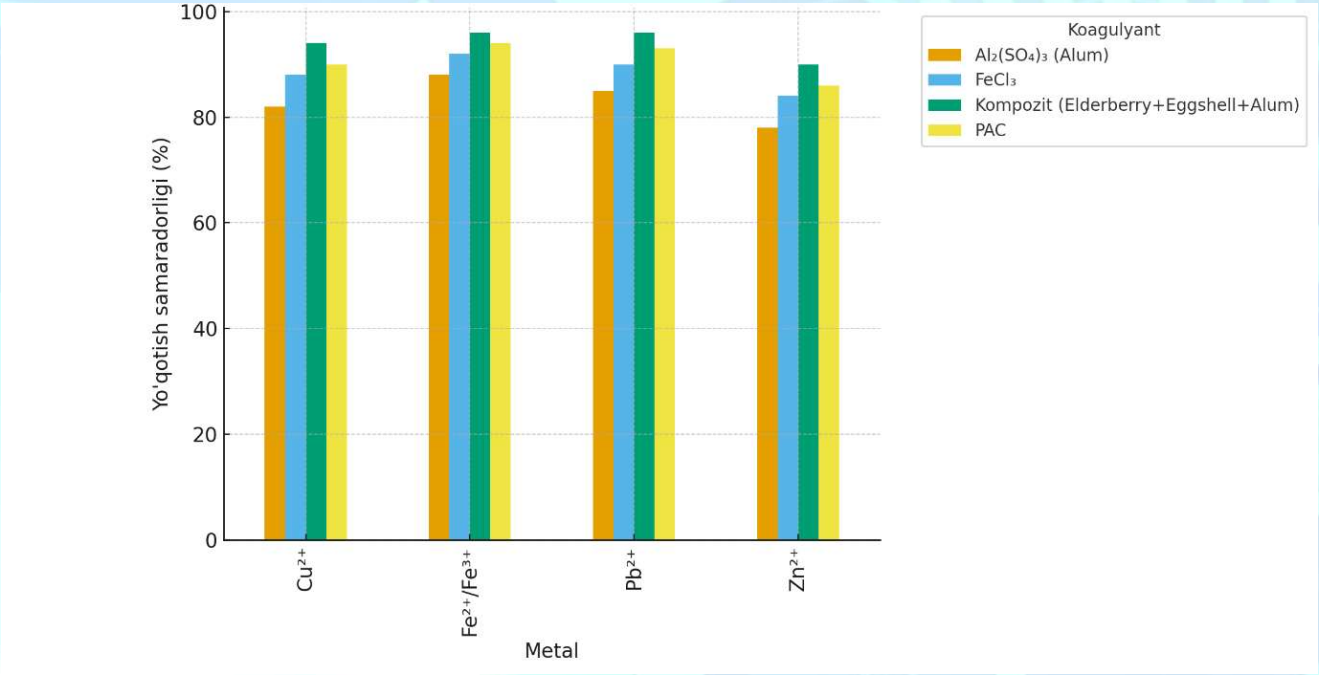


Figure 1. Variety coagulants using heavy metal loss of ions (Cu^{2+}, Fe^{2+}/Fe^{3+}, Pb^{2+} and Zn^{2+}) efficiency comparison

In Figure 1, various coagulants heavy metal loss of ions (Cu^{2+}, Fe^{2+}/Fe^{3+}, Pb^{2+} and Zn^{2+}) efficiency compared . From the graph visible as usual , traditional coagulants – $Al_2(SO_4)_3$ (Alum), $FeCl_3$ and PAC – in the range of 80–94% efficiency shown if , black elderberry fruit , egg shell and aluminum sulfate based on synthesis made composite sorbent – coagulant all metal ions according to higher (90–96%) result manifestation Especially Pb^{2+} and Fe^{2+} / Fe^{3+} ions at a loss composite of the system advantage obvious is noticeable .

Table 1 .

Heavy metals cleaning efficiency – comparative

Metal ions	Initial C_0 (mg/l)	$Al_2(SO_4)_3$ (Dose:60 g/l, pH 6.0)	$FeCl_3$ (Dose:50 g/l, pH 6.0)	PAC (Dose:40 g/l, pH 6.5)	Composite (Dose:35 g/l, pH 6.5)
Pb^{2+}	2.0	85 %	90%	93 %	96 %
Cu^{2+}	3.0	82 %	88 %	90%	94 %
Zn^{2+}	5.0	78 %	84 %	86 %	90%
Fe^{2+}/Fe^{3+}	10.0	88 %	92 %	94 %	96 %

1- In the table different coagulants heavy metal loss of ions (Pb^{2+}, Cu^{2+}, Zn^{2+} and Fe^{2+}/Fe^{3+}) efficiency compared . From the results visible as usual , traditional coagulants – $Al_2(SO_4)_3$, $FeCl_3$ and PAC – average efficiency 78–94% shown if ,

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black acacia fruit , egg shell and aluminum sulfate based on synthesis made composite sorbent – coagulant up to 90–96% high result record Especially Pb^{2+} and Fe^{2+} / Fe^{3+} ions at a loss composite system advantage obvious felt .

Composite sorbent– coagulant efficiency different months during modeled sewage water in samples The experiments were carried out to determine the concentration of Pb^{2+}, Cu^{2+}, Zn^{2+} and Fe^{2+}/Fe^{3+} ions . start and residue concentrations determination and average efficiency calculation through done increased . Results are presented in Table 2 below

Table 2 .

Black acacia + egg charcoal + aluminum sulfate based on composite sorbent –coagulant efficiency (model effluent in the water heavy metal ions loss)

Monthly observation	Dose (mg /l)	Pb^{2+}, mg/l		Cu^{2+}, mg/l		Zn^{2+}, mg/l		Fe^{2+}/Fe^{3+}, mg/l		Average efficiency (%)
		start	residue	start	residue	start	residue	start	residue	
January	35	2.0	0.08	3.0	0.18	5.0	0.50	10.0	0.40	93–96
February	40	2.5	0.10	3.5	0.22	6.0	0.60	11.0	0.50	92–95
March	30	1.8	0.06	3.2	0.20	5.5	0.55	9.5	0.45	93–96
April	38	2.2	0.09	3.4	0.21	5.8	0.58	10.5	0.48	92–95
May	32	2.0	0.07	3.0	0.18	5.0	0.52	10.0	0.42	94–96
June	35	2.1	0.09	3.3	0.20	5.2	0.54	10.8	0.45	93–95
Year according to average										
	35	2.1	0.08	3.2	0.20	5.3	0.55	10.3	0.45	93–95

Black in Table 2 acacia fruit , egg shell and aluminum sulfate based on synthesis made composite sorbent – coagulant efficiency monthly observations based on From the table visible It is clear that different months Pb^{2+}, Cu^{2+}, Zn^{2+} and Fe^{2+}/Fe^{3+} ions during noticeable at the level reduced . Composite system year tall stable high result record average efficiency in the range of 92–96% saved . This

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and composite sorbent – coagulant season and temperature from changes strict look sewage the waters effective cleaning to the possibility has that shows .

Conclusion

Research results this showed that black acacia fruit , egg shell and aluminum sulfate based on prepared composite sorbent – coagulant sewage the waters in cleaning high efficiency showed . Optimal At a dose of 35–40 mg / l , Pb^{2+}, Cu^{2+}, Zn^{2+} and Fe^{2+}/Fe^{3+} ions are removed by 90–96% reduce possibility proven . Local and waste from raw materials use reagent cost reduces , secondary waste again to work service does and " green" "to the principles of chemistry " suitable comes . Traditional to coagulants relatively composite of the system advantage – inferior dose with higher cleaning efficiency , less sediment harvest to be and ecological in safety manifestation It happened . So to do , to work issued composite sorbent – coagulant industry sewage waters heavy metal from ions effective in cleaning promising alternative as recommendation is being done .

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