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A.M. Serikbayeva[1]– *main author,*
A.S.Ushkempir[2], E.B. Satkozhaeva[3], K.R. Toktibayeva[4]

[1]Master, Senior Lecturer, [2]Senior Lecturer, [3,4]Students

ORCİD *[1]https://orcid.org/0000-0002-8204-7851*

[1,2,3,4]South Kazakhstan University named after M. Auezov, Shymkent, Kazakhstan

[1]Ali_2006.82@mail.ru

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PURIFICATION OF HEAVY METALS CONTAINED IN WATER WITH ACTIVATED CARBON AND CHARACTERIZATION OF PHYSICO-CHEMICAL PROPERTIES

Abstract. In this research work, we describe the synthesis of activated carbon adsorbents obtained from agricultural residues and their physicochemical properties. The resulting adsorbents are used to remove heavy metal ions contained in water. Currently, activated carbon is used in water purification, air and gas purification, as well as in many production facilities. Activated carbon obtained for removing heavy metal ions from water was made from cotton, apricot, buckwheat and pumpkin residues.

Key words: adsorbent, activated carbon, heavy metal ions.

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Introduction. Activated carbon sorbent is a material with a developed porous structure, which is made from various carbon-containing substances of organic origin, including charcoal, petroleum coke, coal coke, coconut and walnut shells, apricot seeds and other fruit crops [1]. Activated carbon is considered to be a widely used adsorbent consisting of a carbon material with a porous configuration and an increased surface area. Active carbon, based on chemical science, is one of the varieties of carbon with an imperfect structure, practically free of impurities. In its chemical structure, activated carbon is similar to graphite [2]. Activated carbon has an infinite number of holes, so activated carbon has a very large surface, which is why it has the highest sorption. One gram of activated carbon will have a surface area of 500 to 1500 m^2, depending on the production method. The maximum porosity makes activated carbon "active" [3].The main characteristics of activated carbon and its porosity depend on the raw material and its processing [4]. In economically developed and globalized times, water sources and resources are of particular importance. One of the global problems is that it is necessary to solve economical and environmentally friendly harmless substances for water purification.

Conditions and methods of research. Chemicals and devices.Agricultural waste: cotton, apricot, buckwheat and pumpkin, sulfuric acid (H_2SO_4) (purity ≥

99%), potassium hydroxide (KOH), (purity ≥ 99%), hydrochloric acid(HCl) (purity ≥99%).

Results and discussions.

Removal of chromium and copper from the composition of wastewater during the adsorption process. Studies have been conducted related to the values of the adsorbent over time to remove chromium ion and Copper ion from activated carbon wastewater as an adsorbent.

During the verification of the effect of activated carbon on the adsorption process over time, 7 different time periods were obtained on the adsorbent. 0.15 minutes, 30 minutes and 1,2,4,6 hours, i.e. 7 samples were prepared for different times. The known sample was analyzed over 7 different time periods.The result was determined using an atomic emission spectrometer (NPP).It has undergone an activation process to change its textural properties and the chemical composition of the surface to increase the adsorption capacity of the burnt material. Charred apricot and cotton samples were activated with concentrated sulfuric acid (H_2SO_4) in a ratio of 1:3, heated to 200°C for 1 hour, and then cooled to room temperature. The resulting suspension was dispersed in ultrapure water, and the solid was filtered and washed with distilled water until the pH of tap water became neutral. Activated carbon adsorbent acid treatment:

1. 1.5 grams of activated carbon were placed in a flask with a convex bottom per 100 ml.
2. In the presence of 1:3, concentrated sulfuric acid (H_2SO_4) was poured.
3. The resulting sample was heated at a temperature of 200 ° C for 1 hour, and then cooled to room temperature.
4. The sample was passed through filter paper and washed with distilled water until the pH value became a neutral medium.
5. the washed adsorbent was dried.
6. The resulting adsorbent has developed an adsorption process to remove heavy metal ions in water, including the element copper.

Table 1

Adsorption results obtained by removing copper (Cu) from the water composition of adsorbents from the remains of cotton and apricot grains

Adsorbent	Time (hour)	Volume	Adsorbent g/l	[Cu(II)]mg/l	Cu(II)]m g/l
Activated carbon	0	25	0.25	5.24	3.65
	0.25		0.25	3.83	3.08
	0.5		0.25	3.37	2.18
	1		0.25	2.67	2.04
	2		0.25	2.41	1.97
	4		0.25	1.94	1.76
	6		0.25	1.84	1.44

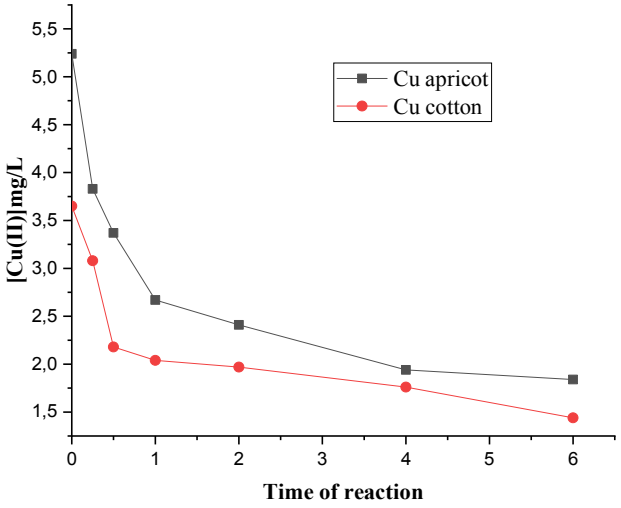

Fig. 1. Results shown by the starting materials in the adsorption process

Table 2

Adsorption results obtained by removing copper(Cu) from the water composition of adsorbents prepared at a temperature of 400°C

Adsorbent	Time (hour)	Volume	Adsorbent g/l	[Cu(II)] mg/l	Cu(II)] mg/l
Activated carbon	0	25	0.25	8.06	6.41
	0.25		0.25	7,02	5.11
	0.5		0.25	4.6	4.85
	1		0.25	4.39	3.37
	2		0.25	4.18	2.98
	4		0.25	3.9	2.93
	6		0.25	3.75	2.75

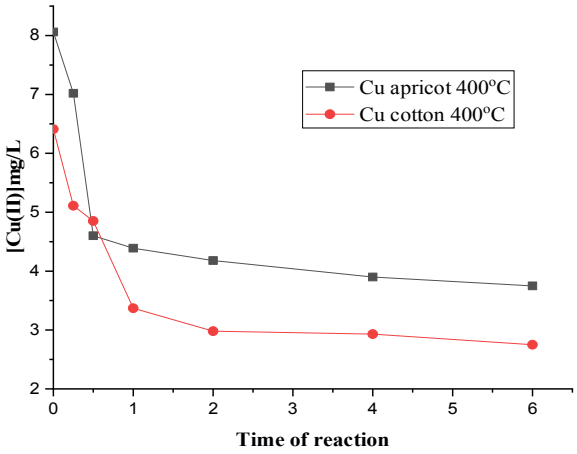

Fig. 2. The results of adsorbents prepared at a temperature of 400 °C

Table 2

The results of adsorption obtained when removing copper (Cu) from the water composition of adsorbents prepared at a temperature of 500°C

Adsorbent	Time (hour)	Volume	Adsorbent g/l	[Cu(II)] mg/l	Cu(II)] mg/l
Activated carbon	0	25	0.25	7.73	5.85
	0.25		0.25	6.78	4.38
	0.5		0.25	5.72	4.01
	1		0.25	5.66	3.38
	2		0.25	5.43	3.29
	4		0.25	5.21	1.53
	6		0.25	5.02	1.51

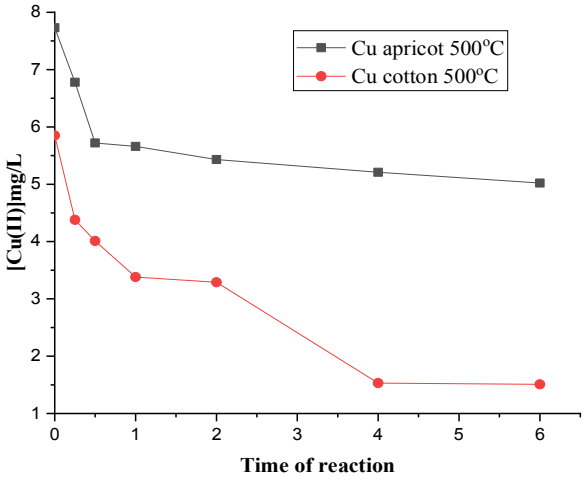

Figure 3. Results shown by adsorbents prepared at a temperature of 500°C

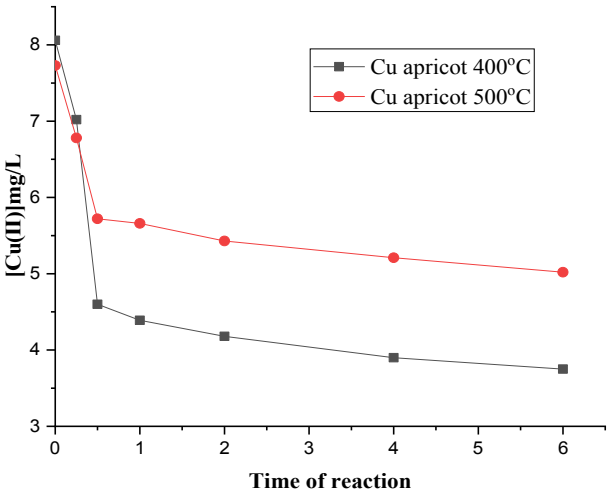

Figure 4. Comparative indicators of adsorbents manufactured at temperatures of 400°C and 500°C apricot grains

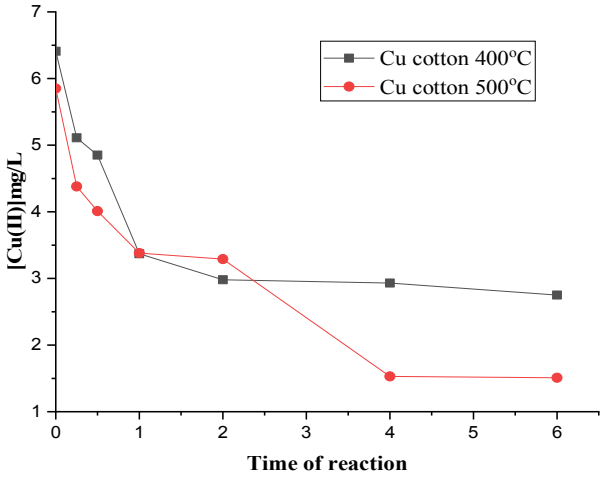

Figure 5. Relative indicators of adsorbents made from cotton residue at temperatures of 400°C and 500°C

1. Pumpkin and buckwheat were dried for 3 days.

2.T he dried material is crushed and sieved through a 0.3 mm sieve.

3.The materials were washed with distilled water through a sieve and dried in an oven at 80°C for 3 hours.

4. Put ground pumpkin seeds and 4 grams of buckwheat in a boat.

5.Buoyancy at 300°C and 600°C.

Shredded activated carbon.The following is the included activity of carbonized acid:

1.Pumpkin and also prepared from a porcelain plate of 1 gr.

2. Put 3 grams of CON on a porcelain plate.

3. A muffle furnace was installed in a removable furnace for 2 hours at 500°C.

4. The muffle furnace was blown, distilled and distilled.

5.The washed containing 3 mole HCl 25 ml was poured into a glass.

6. HCL approximately 1 hour.

7. Within 1 hour, the contract of the post office is permanently released.

8. The adsorption process when removing from the resulting metal.

Table 4

The result of the analysis of the effect of the interaction time on the adsorption process for removing Cr ions from natural pumpkin seeds and buckwheat

Adsorbent	Time (hour)	Volume	Adsorbent g/l	[Cu(II)]mg/l	Cu(II)]mg/l
Activated carbon	0	25	0.25	2.79	1.94
	0.25		0.25	2.62	1.72
	0.5		0.25	2.12	1.51
	1		0.25	2.08	1.38
	2		0.25	1.69	1.12
	4		0.25	1.59	0.98
	6		0.25	1.51	0.9

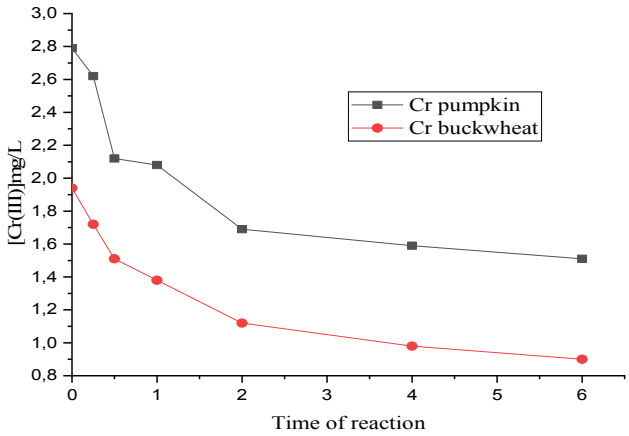

Figure 6. The result of the adsorption process of natural pumpkin seeds and buckwheat

Table 5

The result of the nuclear power plant analysis of the effect of the interaction time on the adsorption process for removing the Cr ion from activated carbon, ready at 300°C

Adsorbent	Time (hour)	Volume	Adsorbent g/l	[Cu(II)]mg/l	Cu(II)]mg/l
Activated carbon	0	25	0.25	2.97	3.23
	0.25		0.25	2.91	3.02
	0.5		0.25	2.69	2.96
	1		0.25	2.18	2.58
	2		0.25	1.69	1.45
	4		0.25	1.21	1.17
	6		0.25	0.71	1.07

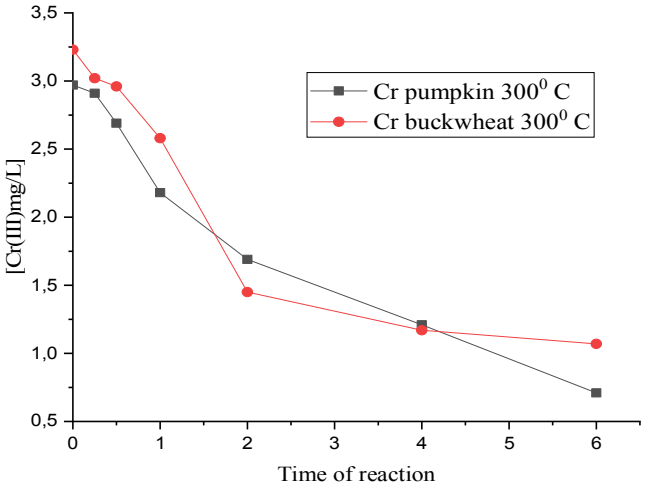

Figure 7. The result of the adsorption process of pentacarbon obtained at 300°C

Table 6

The result of the nuclear power plant analysis of the effect of the interaction time on the adsorption process for removing the Cr ion from activated carbon, ready at 600°C

Adsorbent	Time (hour)	Volume	Adsorbent g/l	[Cu(II)]mg/l	Cu(II)]mg/l
Activated carbon	0	25	0,25	3,17	3,59
	0.25		0,25	3,01	3,17
	0.5		0,25	2,88	3,09
	1		0,25	2,43	2,63
	2		0,25	2,4	2,55
	4		0,25	2,26	2,49
	6		0,25	1,8	2,02

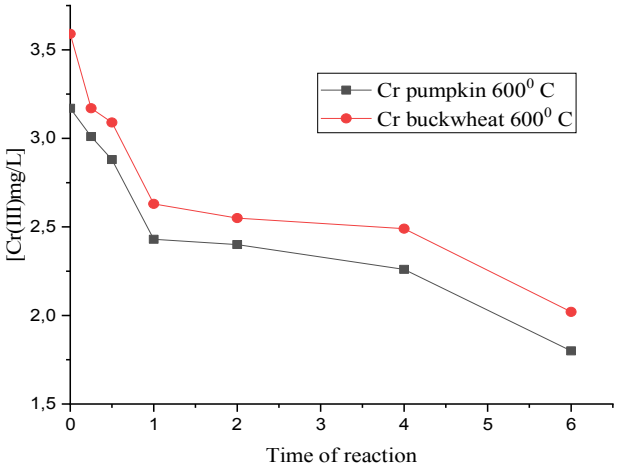

Figure 8. The result of the process of adsorption of the obtained bespoke carbon at 600°C

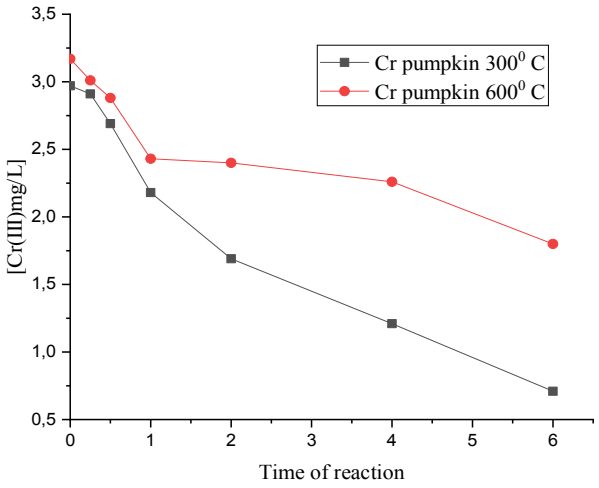

Figure 9.300°Cof burnt pumpkin seeds and 600°Cof burnt pumpkin seeds

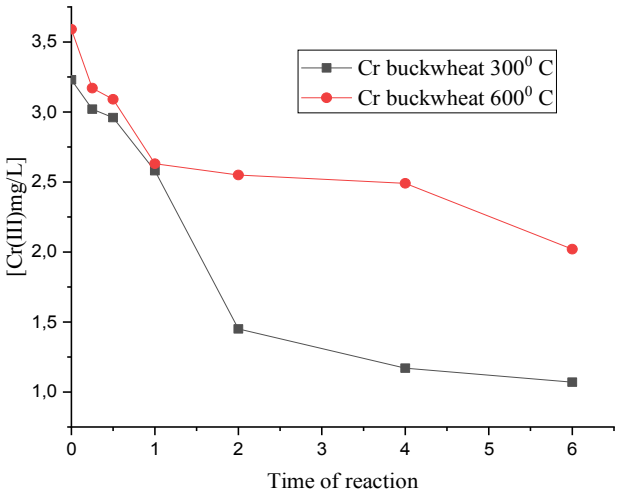

Figure 10. Sg ion calibration in buckwheat fired at 300°Cand buckwheat fired at 600°C

Conclusion. Activated carbon has a wide range of carbonaceous materials with high porosity and surface area. Due to its unique characteristics, it is widely used in water purification, domestic and industrial wastewater, desalination, purification and separation of gases, removal of odors and pollutants, as well as in medicine in many parts of the world. Agricultural waste is very abundant on earth, and it is worth being able to use it effectively. The agricultural waste that you get as an adsorbent is the cheapest and very affordable. Recently, the use of Labeled Coal has yielded many positive results. As a result of the research work, a method for removing chromium and copper from the composition of water based on water purification technology was considered.

1. Activated carbon was burned from biomass waste.
2. Activated carbon was activated by acid treatment.
3. An elemental analysis of the physicochemical composition of activated carbon was carried out and verified by an atomic emission spectrometer.
4. The result of removing chromium and copper from water using activated carbon as an adsorbent is shown.

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А.М. Серикбаева[1], А.С. Ушкемпир[1], Э.Б. Саткожаева[1], К.Р. Токтбаева[1]

[1]М. Әуезов атындағы Оңтүстік Қазақстан университеті, Шымкент, Қазақстан

СУДЫҢ ҚҰРАМЫНДАҒЫ АУЫР МЕТАЛДАРДЫ БЕЛСЕНДІРІЛГЕН КӨМІРТЕГІМЕН ТАЗАЛАУ ЖӘНЕ ФИЗИКА-ХИМИЯЛЫҚ ҚАСИЕТТЕРІНЕ СИПАТТАМА

Аңдатпа.Мақалада ауыл шаруашылығы қалдықтарынан алынған белсендірілген көміртекті адсорбенттердің синтезі және олардың физикалық-химиялық қасиеттері сипатталған. Алынған адсорбенттер судың құрамында болатын ауыр металл иондарын жою үшін пайдаланылады. Судың ластануы бұл экологиялық проблема болып табылады. Ол табиғаттың, адамзаттың өміріне өз кесірін тигізуде. Қазіргі уақытта белсендірілген көміртек суды, ауа мен газды тазартуда, сонымен қатар көптеген өндіріс орындарында қолданылады. Су құрамындағы ауыр металл иондарын жою үшін алынған белсендірілген көміртек мақта, өрік, қарақұмық және асқабақ қалдықтарынан жасалды. Белсендірілген көміртек арқылы суды тазарту қоршаған ортаға зиянсыз және экономикалық тұрғыдан тиімді қауіпсіз процесс.

Тірек сөздер:адсорбент, белсендірілген көміртек, ауыр металл иондары.

А.М. Серикбаева[1], А.С. Ушкемпир[1], Э.Б. Саткожаева[1], К.Р. Токтбаева[1]

[1]Южно-Казахстанский университет им. М. Ауезова, Шымкент, Қазақстан

ОЧИСТКА ТЯЖЕЛЫХ МЕТАЛЛОВ, СОДЕРЖАЩИХСЯ В ВОДЕ, АКТИВИРОВАННЫМ УГЛЕРОДОМ И ХАРАКТЕРИСТИКА ФИЗИКО-ХИМИЧЕСКИХ СВОЙСТВ

Аннотация. В статье описывается синтез активированных угольных адсорбентов, полученных из сельскохозяйственных отходов, и их физико-химические свойства. Полученные адсорбенты используют для удаления ионов тяжелых металлов, содержащихся в воде. В настоящее время активированный уголь используется при очистке воды, воздуха и газов, а также на многих производственных объектах. Активированный уголь, полученный для удаления из воды ионов тяжелых металлов, изготавливали из остатков хлопка, абрикоса, гречихи и тыквы.

Ключевые слова: адсорбент, активированный уголь, ионы тяжелых металлов.