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Purification by Ketoconazole Adsorption from Sewage

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ABSTRACT
Activated coal is widely used in the decontamination of by-products. One of the antioxidant antioxidants found in waste water was its adsorption ability using ketoconazole granulated activated carbon (GAC).
Keywords: Wastewater, granulated activated carbon, ketoconazole, highly effective liquid chromatography.

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INTRODUCTION

As a result of the development of the chemical industry, in recent years, thousands of organic compounds have been synthesized, which have been divided into natural, stable, semi-light and light oxidants, according to the oxidative ability of natural processes. There is a special place in medicine [1]. At present, foreign countries have been widely studied by the fact that pharmaceuticals, as well as personal hygiene products, have a considerable amount of underground and surface water sources and their harmful effects on ecosystems. The negative effects of medications on hydrobioids and their habitats are increasing day by day [2].

The main reason for the entry of the medicines to the tanks is the discharge of untreated and untreated wastewater [3].

It is clear that drugs and compounds that have anti-malarial activity are currently inadequate for the discharge of sewage, penetrating into the water sources and potentially affecting human health through potable water. Some persistent medicines can reach the birds, mammals, and humans through the nutritional chain [4].

Meeting the bacteria, anti-malaria pharmaceutical ingredients in sewage, and bacteria encountered in sewage can contribute to resistance to these drugs. Also, bacterial density and nutrient content may change, causing new strains to resist pharmaceuticals [5].

In the environment, there are many self-medicating biodiversity medicines. Pharmaceutical wastewater is sophisticated. One of the components of them is ketoconazole. The studies that have been carried out before us prove that ketoconazole, found in waste waters, is the most dangerous drug for the environment in terms of environmental considerations. The problem of pharmaceutical pollution in sewage is one of the most pressing environmental problems in Kazakhstan [6, 7].

In the world practice trends in the use of adsorption methods for industrial wastewater treatment are becoming increasingly clear. As the absorbent, the last sorbent is used as zeolites, silica, aluminum gel, organic sorbents and activated carbon. For example, in the United States, activated coal production increased more than three times from 1952 to 1970. Activated carbon can be used, for example, for the removal of carbon dioxide, surfactants from waste water (production of caprolactam waste, various dyes, phenols, oils, etc.) [8, 9].

Activated charcoal is a type of carbon material that has a high porosity, high adsorption ability. Thanks to its high adsorbing capacity and low cost, activated carbon is currently used as an adsorbent and is widely used for household, industrial waste water and contaminated water. Granulated activated carbon is characterized by high abrasive stability. For this feature, it can be applied to several filters [10, 11].

Granulated activated charcoal adsorption allows to purify not only the natural ponds but also the waste water. Particularly, the process of production and disposal of carbon disulfide from waste water was made from artificial fibers. Nevertheless, the active carbon was not used for the purification of pharmaceutical toxicants from aquatic environment [12, 13].

Based on the foregoing, the purpose of the study was to investigate the potential for purification of ketoconazole-treated wastewater by activated charcoal adsorption.

MATERIALS AND METHODS

Ketokonazole was chosen as the study subject because it was identified as the most active pharmaceutical ingredient in surface water of Kazakhstan. Kinetokonazole yeast (Candida, Malassezia, Torulopsis, Cryptococcus) is a synthetic derivative of imidazole dioxolane with anti-fungal and mycostasis action. [(±)-cis-1-acetyl-4-(4-{[2-(2,4dichlorophenyl)-2-(1H-imidazol-1-ylmethyl)-1,3-dioxolan4-yl] methoxy} phenyl) piperazine] is a weakly divalent substance that is dissolved and absorbed in acidic medium. It was first synthesized in 1977 [14, 15]. The drug is associated with the destruction of ergosterol, triglycerides and phospholipids biosynthesis necessary for the formation of the fungal membrane cell membrane. Immunological resistance of the organism by prophylactic method can be prevented from reducing fungal infections [16].

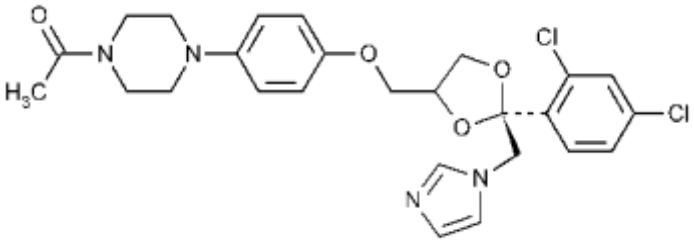


Fig. 1: Chemical structure of ketoconazole

It was found out that the level of ketoconazole in one of the active pharmaceutical ingredients that may have an impact on the environment in Kazakhstan exceeds the maximum permissible concentration by B.N. Aubakirova. In her works, all the experimental ecological data on the BPH's acute endpoints in water bodies are collected from the Web of Knowledge and SCOPUS, a collection of online datasets collected by all Google scholars in order to evaluate MACs [7].

Experimental studies have been undertaken to achieve our goals. A total of 12 samples were obtained from the study. Including one control group and three pilot groups. Each of them was done with a 3-repeat. 100 mg of standard ketoconazole were obtained for each sample. Then, in experimental groups 2, 100 mg of samples were added, 250 mg of group 3 samples and 500 mg activated charcoal for samples in group 4. All samples were shifted on a rotating table (~ 200 rpm). Suspensions containing reagents were left at least for 24 hours prior to use.

According to the United States Pharmacopoeia, ketoconazole is a pure substance according to the potentiometric method, and is often used as a formal method for the quantitative determination of drug forms using highly effective liquid chromatography (HPLC) [17, 18]. Experimental samples were taken from the filtrate for 24 hours and the suspension was quantified by the High Effective Liquid Chromatograph.

During the study, High Effective Liquid Chromatograph (HPLC) C-20 Prominence (Shimadzu Corporation, Kyoto, Japan) was used. The zigzag zones were collected using the Borwin Chromatography Software package. The mobile phase is acetonitrile and dissolved water at a ratio of 75: 25 (v / v), a flow rate of 1.0 ml / min and an ultraviolet detection of 220 nm; the price is 150 mm, the pH value is 4.0; room temperature (24 ± 2 ° C). Distilled water was disinfected through the disinfectant Millipore (Watford, Hertz, Great Britain). Examples of ketoconazole tablets were purchased from pharmaceutical chemistries and acetonitrile (C2H3N) Sigma Aldrich, for High Effective Liquid Chromatograph. Based on the results of the study, 5 chromatographic scents were obtained (1-5,538; 2 - 6,084; 3 - 7,414; 4 - 8,872; 5 - 12,12).

All results are expressed as mean ± deviation (SD). The average arithmetic (M), its mean error (m), the mean deviation of the mean (δ) and the results were processed. To ensure that the differences are determined, the probability and probability of the contributing factor were evaluated (P).

RESULTS AND DISCUSSION

The results of the study revealed that contaminated water with ketoconazole can be purified by activated charcoal. The results of the experiment are presented in Table 1.

Table 1: Results obtained from numerical determination of standard solution of ketoconazole

Group	Sample High Performance Liquid Chromatography Concentration		
	Ketoconazole, (mg/ml)	GAC, (mg/ml)	Found, %
1	100	0	70,73
2	100	100	76,75
3	100	250	51,95
4	100	500	33,08

As can be seen in Figure 2, the results from the 1 group (control group) and 4 groups (500 mg activated charcoal) are significantly different from each other. Compared to the control group, there was no difference in 2 groups of 100 mg activated charcoal. That is, the ratio of ketoconazole in the samples was 76%. Comparing 3 groups with a control group, the ratio of ketoconazole in the 250 mg activated charcoal samples is 51.95%. When comparing the last 4 groups with the control group, the level of ketoconazole decreased by 2 times in the samples after activation of 500 mg of activated carbon, on an average of 33,077%.

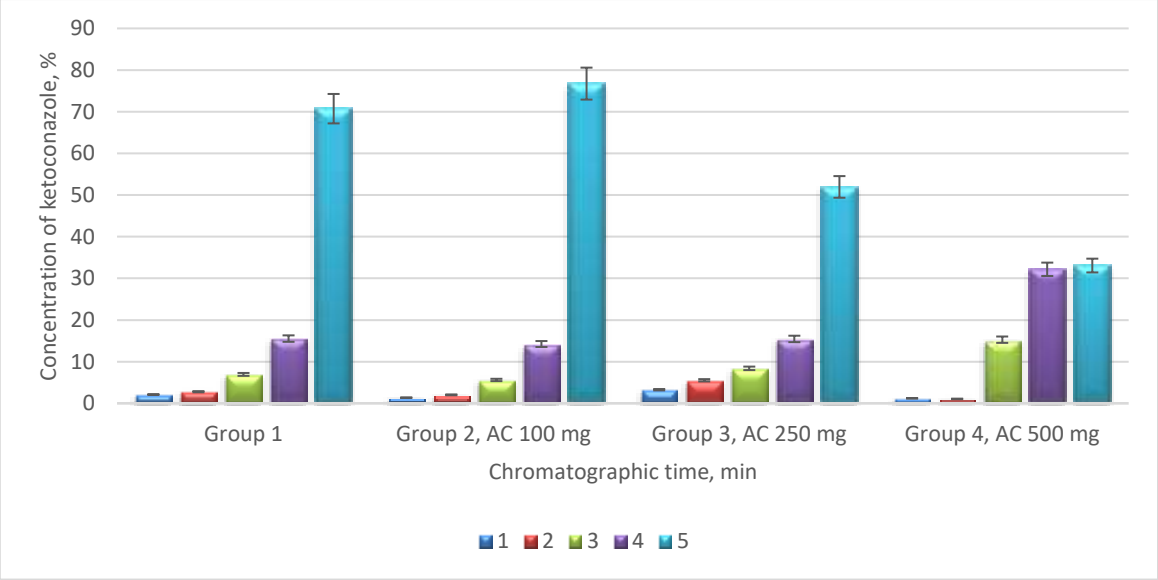


Fig. 2: Concentration of ketoconazole at chromatography after adsorption with granulated activated calcula (24 h)

Figure 3 shows the spectrum of the samples of the control group and the experimental group 2 comparatively. Compared to the control group 2, the mean deviation of ketoconazole with activated charcoal was 1.36 ± 0.57 in 5 minutes ($p < 0.05$); 6.04 ± 0.8 for 6 minutes; 7 by 5.61 ± 2.1; 9 minutes to 14.24 ± 3.7; 12 minutes was 76.75 ± 19.57 ($p < 0.05$).

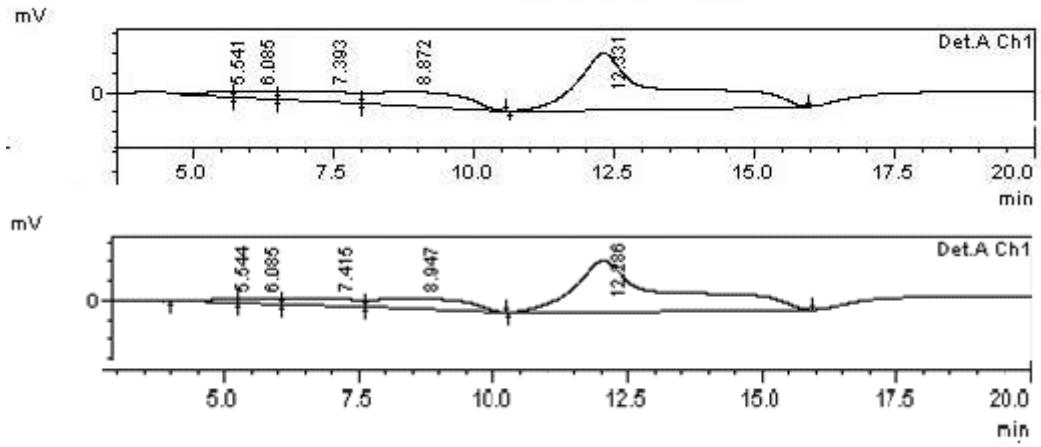
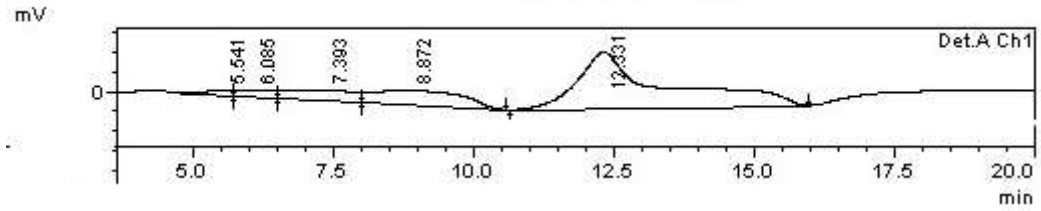


Fig. 3: A - Chromatogram RP - HPLC. Practical spectrum for sampling of the control group. B - Chromatogram RP - HPLC. 2 - Experimental spectrum for samples of the experimental group (100 mg GAC)

Figure 4 shows the spectrum of samples of the control group and experimental group 3. Compared to the control group of the 3rd experimental group, the mean deviation of ketoconazole after activated charcoal adsorption was 3.27 ± 1.04 in 5 minutes; 5.5 ± 2.1 in 6 minutes; 8.4 ± 2.1 in 7 minutes; 9 minutes to 15.46 ± 3.9; 12 minutes 51.95 to 14.37.



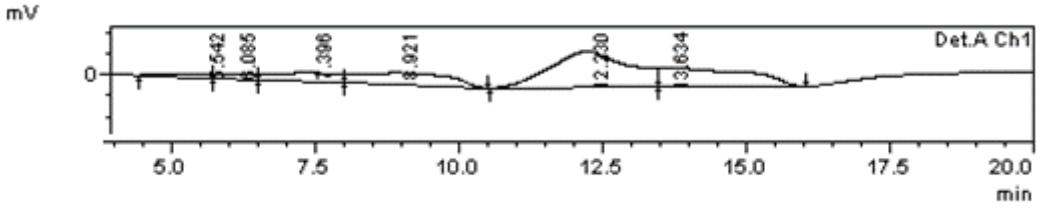


Fig. 4: A - Chromatogram RP - HPLC. Practical spectrum for sampling of the control group. B - Chromatogram RP - HPLC. Practical spectrum for samples of 3 experimental groups (250 mg GAC)

Figure 5 shows the spectrum of samples of the control group and experimental group 4 comparatively. The 4th experimental group was compared with the control group, mean deviation of ketoconazole after activated charcoal adsorption was 1.21 ± 0.91 (p <0.05) for 5 minutes, 1.072 ± 0.8 (p <0.001) for 6 minutes, 15 minutes in 7 minutes, 28 ± 9,16 (p <0,01), 32,17 ± 11,05 in 9 minutes and 33,076 ± 11,05 (p <0,05) for 12 minutes.

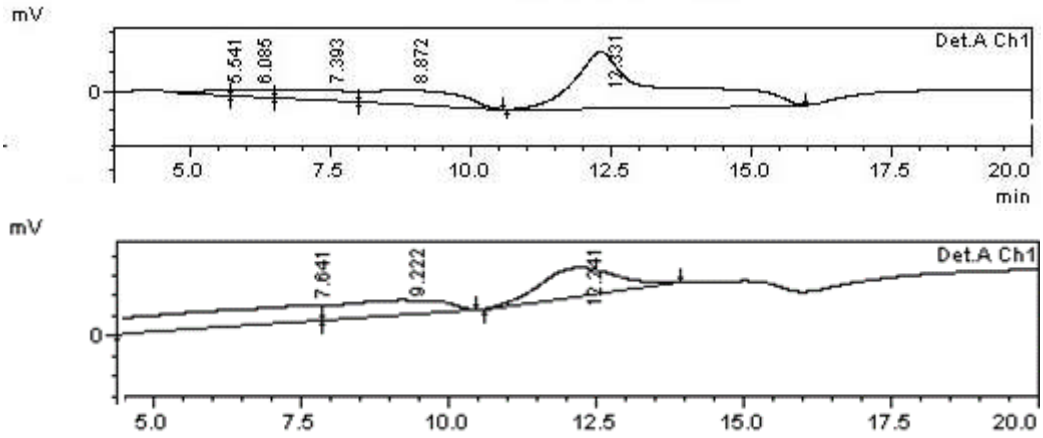


Fig. 5: A - Chromatogram RP - HPLC. Practical spectrum for sampling of the control group. B - Chromatogram RP - HPLC. 4 - Experimental spectrum for samples of experimental group (500 mg GAC)

Thus, the concentration of toxic pollutants in waste water can be reduced by using granulated activated carbon.

CONCLUSION

The results of this study have shown that the use of granular activated carbon can reduce the level of eco-rich ketoconazole in waste water. That is, ketokonazole was inactivated by adsorbing by physicochemical activated charcoal. In the 2nd experimental group, ketoconazole was found to be 76.75% in the experimental group, 51.94% in the third experimental group and 33.08% in the 4th experimental group, with the concentration of ketoconazole decreased by 2 times after adsorbing with 500 mg of activated charcoal. If we clean the waste water through the adsorption method, 5 kg of activated charcoal in 5 liters of water should be added, and activated charcoal of 500 kg per 1 m3 of water should be used.

In subsequent studies, pharmaceutical preparations such as ketoconazole should be filtered through granulated activated charcoal from waste water.

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