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INFLUENCE OF PHYSICOCHEMICAL FACTORS ON THE SARS-COV-2 STRAIN ISOLATED FROM A DOG

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ABSTRACT

This article presented the results of a study on the impact of physicochemical factors on the biological activity of the SARS-CoV-2 coronavirus isolated from a dog in the Republic of Kazakhstan. The results indicated that storing the virus at a temperature of -70°C led to a decrease in viral activity, similar to the effect observed when stored at room temperature. Storage at +40°C resulted in complete inactivation of the virus. The study on the effect of various concentrations of ionic and non-ionic detergents revealed that exposure to the ionic detergent DOC at concentrations of 0.1% and 0.5% caused a decrease in viral activity, while no change was observed at a concentration of 0.01%. The detergent SDS, at concentrations of 0.01%, 0.1%, and 0.5%, reduced the biological activity of the virus from the initial titer (5.25 lg $TCID_{50}/cm^3$) to 4.00 lg TCID50/cm³. Similarly, the use of non-ionic detergents, Triton X-100 and Tween-20, led to a reduction in viral activity from the initial titer to 4.50 lg TCID50/cm³.

The effect of pH in acidic, neutral, and alkaline environments on the biological activity of the virus was also studied. A decrease in viral activity was observed at acidic and alkaline pH levels, whereas a neutral pH environment had no impact on viral activity.

Keywords: coronavirus infection, physicochemical properties, biological activity.physico-chemical factors, isolation from the virus, virus resistance, coronavirus infection, virus resistance, biological activity.

INTRODUCTION

Coronaviruses (CoV) are a family of viruses that include 43 types of RNA-containing viruses, such as severe acute respiratory syndrome coronavirus (SARS-CoV), Middle East respiratory syndrome coronavirus (MERS-CoV), bat SARS-like CoV, among others, that infect mammals, including humans, birds, and amphibians [1]. To date, seven types of human coronaviruses from the Coronaviridae family are known, including three associated with severe acute respiratory syndromes (SARS-CoV, MERS-CoV, and SARS-CoV-2) and four types of coronaviruses (HCoV) that primarily cause mild colds. According to researchers from various countries, all four types of HCoV circulate in the human population year-round and have seasonal peaks in incidence [1,2].

The coronavirus disease 2019 (COVID-19) pandemic has placed an unprecedented burden on healthcare systems worldwide, leading to a global crisis. Coronaviruses can infect humans as well as several animal species [1-3]. When infected, coronaviruses can cause a spectrum of illnesses, ranging from mild acute respiratory infections to severe acute respiratory syndrome [3, 4].

During the replication process, coronaviruses can induce genetic variability through spontaneous mutations, although their mutation rate is relatively low compared to other RNA viruses, such as the influenza A virus and HIV [4].

Despite the extensive research conducted globally on the immunobiological properties of the SARS-CoV-2 virus, the virus's physicochemical properties have not been studied as extensively.

This paper presents the results of a study examining the influence of physical and chemical factors on the biological activity of the SARS-CoV-2 virus isolate from Kazakhstan.

MATERIALS AND METHODS

Samples

Virus. The study used the *SARS-CoV-2/Canis lupus familiaris/KAZ/CCoV_Almaty_KZ_2022* coronavirus isolate (ID: PP898122) isolated from a dog with a biological activity of 5.25 lg $TCID_{50}/cm^3$. The virus was grown in a Vero cells and isolated by blind passaging for at least three generations [5].

Determination of the biological activity of virus-containing material by titration

The infectious activity of the virus was determined by titration [6] in a Vero cell culture grown in a 96-well culture microplate. Serial 10-fold dilutions of the virus stock from 10^{-1} to 10^{-8} were prepared in DMEM supplemented with 2% FBS, 100 U/ml penicillin and 100 µg/ml streptomycin, and 100 µl of the diluted virus was added to each well. The cells were incubated at 37 °C in an atmosphere of 5% CO_2 for 7 days, and a cytopathic effect was assessed using an inverted microscope. The virus titer was calculated using the Reed-Muench formula and expressed as lg TCID50/cm3 [5, 7].

Purification and concentration of the virus by centrifugation

The virus was centrifuged at 400,000 g in a Himac FN-150 ultracentrifuge for 30 min. The pellet was then resuspended in 0.05% phosphate buffer [8].

Effect of different temperatures on the virus. The purified virus was incubated at -70°C, +22°C, and +40°C.

Effect of pH environment on the virus. After purification, the virus pellets were resuspended in buffer solutions with dif-

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ferent pH values: 5.0–5.3, 7.0–7.2, and 8.8–9.0.

Study of the effect of chemical factors on the biological activity of coronavirus. The virus-containing suspension was treated with ionic detergents: sodium dodecyl sulfate (SDS), sodium deoxycholate (DOC), Tween-20 and Triton X-100. The detergent was added to the virus-containing suspension at a concentration of 0.5%, 0.1%, and 0.01%. The mixture was incubated for 30 minutes at 37°C with constant shaking. It was then freed from the detergent by centrifugation at 400,000 g in a Himac FN-150 ultracentrifuge for 30 minutes. The sediment was resuspended in 0.05 M phosphate buffer and used to determine biological activity in Vero cell culture.

The data were processed using the GraphPad Prism 8 software package and subjected to statistical analysis using the Student's t-test, with significance considered at $p < 0.05$

RESULTS

Currently, there are studies on the influence of physical and chemical factors on the properties of coronavirus [5]. Despite the in-depth analysis of the immunobiological properties of the virus conducted in many countries, the physicochemical properties of coronavirus have not been sufficiently studied. As a result of circulation in the environment, the virus is exposed to various physical factors, such as high/low temperature, acidity of the environment, exposure to UV rays, etc. Along with this, chemical effects on the virus can affect its activity. The subject of our study was the effect of some of these factors on the virus. The data obtained can be used to develop means and methods for disinfection and virus inactivation.

The virus was precipitated by centrifugation, and the virus sediment was resuspended in 0.05 M PBS with a pH between 5.0 and 9.0.

It should be noted that the biological activity of the Kazakhstan coronavirus isolate at pH values within 7.0-7.2 remains at the same level as the initial titer, and within 5.0-5.3, a slight decrease in virus activity is observed. When the environment is alkalized (pH 8.8-9.0), a significant reduction in the virus's biological activity titer is observed (Table 1).

When studying the effect of low temperature (-70°C) on the virus's biological activity, it was found that during the observation period, no significant changes in biological activity were observed. However, when incubating the viral material at room temperature, a slight decrease in the virus's biological activity was observed. Further research showed that incubation of the viral material at elevated temperatures (+40 °C) leads to complete inactivation of the virus (Table 2).

Further work was carried out to study the effects of chemical factors on the biological activity of the coronavirus. In

Table 1. Study of the effect of pH on the biological activity of a virus-containing coronavirus suspension

Name of material	Initial titer	Physical factors		
		Biological activity ($lgTCD_{50}/cm^3$) at pH values in acidic, neutral and alkaline environments		
		pH=5.0-5.3	pH=7.0-7.2	pH=8.8-9.0
Coronavirus isolate	5.25 lg $TCID_{50}/cm^3$	5.08±0.14	5.25±0.08	4.42±0.14

Table 2. Study the effect of various temperature indicators on the biological activity of the virus-containing coronavirus suspension

Name of material	Initial titer	Results of the impact of different temperatures on the virus		
Coronavirus isolate	5.25 lg $TCID_{50}/cm^3$	The effect of subzero temperatures on the biological activity of the virus ($lgTCID_{50}/cm^3$)		
		at -70°C for 3 days	at -70°C for 6 days	at -70°C for 9 days
		5.25±0.08	5.08±0.14	5.00±0.00
		The effect of room temperature on the biological activity of the virus ($lgTCID_{50}/cm^3$)		
		at +22°C for 3 days	at +22°C for 6 days	at +22°C for 9 days
		4.50±0.14	4.00±0.08	3.25±0.08
		The effect of elevated temperatures on the biological activity of the virus ($lgTCID_{50}/cm^3$)		
		at +40°C for 3 days	at +40°C for 6 days	at +40°C for 9 days
		1.50 ±0.00	0.0 ±0.00	0.0 ±0.00

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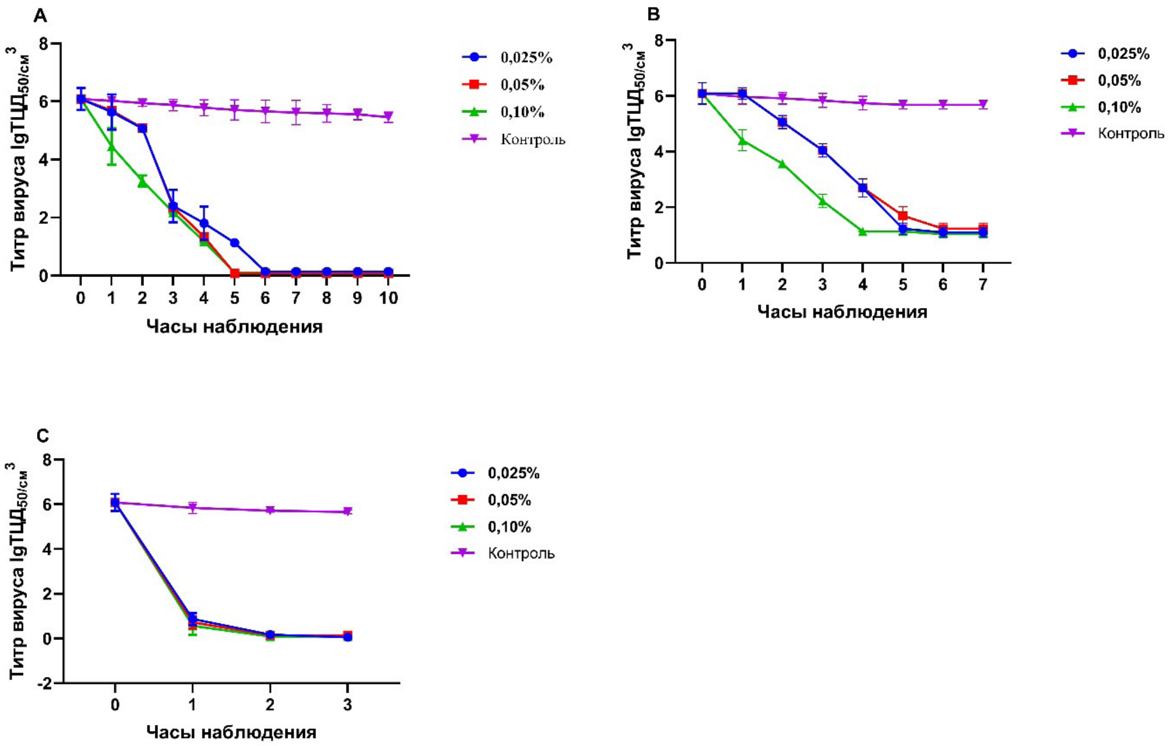

Figure 1. Analysis of the effect of formaldehyde on biological activity at different temperature conditions and inactivator concentrations compared with the control.

A - incubation at 4°C; B - incubation at 22°C; C - incubation at 37°C

Table 3. Effect of detergents on biological activity

Name of material	Initial titer	Biological activity ($lgTCID_{50}/cm^3$) after treatment with detergents											
		DOC			SDS			Triton X-100			TWIN-20		
Coronavirus isolate	5,25 lg $TCID_{50}/cm^3$	0.5%	0.1%	0.01%	0.5%	0.1%	0.01%	0.5%	0.1%	0.01%	0.5%	0.1%	0.01%
		4.00	4.75	5.25	4.00	4.50	5.25	4.50	4.75	5.25	4.50	5.00	5.25

this case, the rate of virus inactivation under the influence of formaldehyde in different concentrations (0.025%, 0.05% and 0.1%) at temperatures of 4°C, 22°C and 37°C was assessed.

The Figure 1 illustrates the rate of virus inactivation under the influence of formaldehyde at different concentrations and temperatures. At a final formaldehyde concentration of 0.05% and 0.10%, and a temperature of 37°C, the virus rapidly loses infectivity in cell cultures, with significant inactivation observed after just 1 hour. At room temperature (22°C), the virus begins to lose infectivity starting from the 3rd hour of exposure to the tested formaldehyde concentrations.

In contrast, at 4°C, virus inactivation by formaldehyde occurs much more slowly compared to 22°C and 37°C. Treatment with 0.1% and 0.05% formaldehyde solutions at 4°C leads to a complete loss of viral infectivity for cell cultures after 5 and 6 hours of exposure, respectively. By the 7th hour of observation, the virus has entirely lost its residual infectivity.

Thus, it was established that formaldehyde's effectiveness depends on the ambient temperature and the concentration of the inactivator. The most pronounced decrease in the virus's biological activity is observed at high temperatures (37°C). At room temperature (22°C), formaldehyde is less effective. At low temperatures (4°C), more time is required to achieve similar results.

Next, detergents, such as DOC, SDS, Triton X-100, and Tween-20, were added to the viral material at concentrations of 0.01%, 0.1%, and 0.5% (v/v). The mixture was incubated for 30 min at 37°C with constant shaking. The detergent was precipitated by centrifugation. The sediment was resuspended in 0.05 M PBS and used to determine the biological activity in the Vero cell culture.

The data in Table 3 indicate that the viral material is sensitive to the action of detergents. Under the influence of the ionic detergent DOC in concentrations of 0.1% and 0.5%, a decrease in viral activity can be observed, and in 0.01% concentrations, no change in viral activity is observed. Using the detergent SDS in concentrations of 0.01%, 0.1% and 0.5%, a decrease in the biological activity of the virus from the initial titer (5.25 lg $TCID_{50}/cm^3$) to 4.00 lg $TCID_{50}/cm^3$ is noticeable. Also, using the non-ionic detergents Triton X-100 and Tween-20, a decrease in viral activity from the initial titer to 4.50 lg $TCID_{50}/cm^3$ can be observed.

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DISCUSSION

According to the literature, the new coronavirus infection, SARS-CoV-2, is no longer an extreme event in society's life and is gradually becoming a dangerous infection for which it is necessary to plan and implement anti-epidemic measures [9].

Emergency measures (medicines, immunobiological drugs, and diagnostic test systems) to contain the spread of coronavirus infection helped to avoid a global collapse during the exponential growth of the incidence rate [10-15].

In recent years, virology has focused on studying the molecular genetic properties of pathogens of viral infections, and the study of the physicochemical and biological properties of viruses remains poorly understood. Thus, many of the main virological questions remain unanswered despite the studies of biological and physicochemical properties. Despite the abundance of scientific information, there is a lack of information on the physicochemical properties of coronavirus infection, mainly related to their resistance to various environmental factors (pH, temperature, ultraviolet, chemicals), which does not provide confidence in the effectiveness of veterinary and sanitary measures.

Studying the pathogen's resistance to various manipulations during which it is exposed to multiple physicochemical factors is very important. Edward Patterson carried out similar work on the SARS-CoV-2 inactivation method for subsequent biological analyses, which found that Triton X-100 in concentrations of 0.5% completely inactivates the virus. In our studies, Triton X-100 was used in 0.01%, 0.1% and 0.5% concentrations. According to our data, this detergent reduces the activity of the virus from the initial titer (5.25 lg $TCID_{50}/cm^3$) to 4.50 lg $TCID_{50}/cm^3$, but complete inactivation of the virus did not occur. These same studies showed that when the virus was exposed to the detergent Tween-20, a decrease in the biological activity of the virus was observed; we obtained similar results. [16-19].

The study of the influence of physicochemical factors on the properties of coronavirus infection is relevant and of not only theoretical but also practical importance for the selection of relevant strains for the production of diagnostic and prophylactic agents and for the development of measures to combat this infection.

CONCLUSION

This work studied the effects of physical and chemical factors on the biological activity of the SARS-CoV-2 virus isolate isolated in the Republic of Kazakhstan.

The obtained data are of current value to the scientific community and have theoretical and practical significance in the fight against coronavirus infection.

FUNDING

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REFERENCES

1. Killerby M.E., Biggs H.M., Haynes R.M., Dahl D., Mustaquim S.I. Human coronavirus circulation in the United States 2014-2017// J. Clin Virol. – 2018. – №101. – P. 52-56.

2. Al-Khannaq M.N., Takebe Y., Pang Y.K., Oong X.Y., Tee K.K., Ng K.T. Diversity and Evolutionary Histories of Human Coronaviruses NL63 and 229E Associated with Acute Upper Respiratory Tract Symptoms in Kuala Lumpur, Malaysia// J. Trop Med Hyg. – 2016. – №94. - P.1058–64.

3. Fuentealba N.A., More G., Bravi M.E. First detection and molecular analysis of SARS-CoV-2 from a naturally infected cat from Argentina// J. Vet Microbiol. – 2021. – №260. – P. 109-179.

4. Bloom J.D., Beichman A.C., Neher R.A., Harris K. Evolution of the SARS-CoV-2 mutational spectrum// J. bioRxiv – 2022. – № 21. – P.11-19.

5. Zhugunissov K., Kerimbayev A., Kopeev S., Myrzakhmetova B., Tuyskanova Nakhanov M., Khairullin A., Orynbayev M., Abduraimov Ye., Kassenov M., Zakarya K., Kutumbetov L. SARS-CoV-2 virus: isolation, growth, thermostability, inactivation and passages// J. Experimental Biology. – 2022– №1. – P. 73-89.

6. Wurtz N., Penant G., Jardot P., Duclos N., Scola B.L. Culture of SARS-CoV-2 in a panel of laboratory cell lines, permissivity, and differences in growth profile// European Journal of Clinical Microbiology & Infectious Diseases. – 2021. – №40. – P. 477-484.

7. Reed L.J., Muench H.A. Simple Method of Estimating Fifty Per Cent Endpoints// The American Journal of Hygiene. – 1938. – №27. – P. 493-497.

8. Liebermann H., Tews G. Conditions for virus purification and concentration by means of differential centrifugation // J. Arch Exp Vet. – 1982. – № 36. – P. 923-32.

9. Sabgayda T.P., Zubko A.V. Do cold temperatures affect the spread of the new coronavirus infection? Social'nye aspekty zdorov'a naselenia//Social aspects of population health. - – 2021. – №67. – 1 p.

10. Kasilingam D., Prabhakaran S.P., Rajendran D.K., Rajagopal V., Santhosh K.T., Soundararaj A. Exploring the growth of COVID-19 cases using exponential modelling across 42 countries and predicting signs of early containment using machine learning// J. Trans. Emerg. Dis. – 2021. № 68. – P. 1001-1018.

11. Nurpeisova A., Khairullin B., Abitaev R., Shorayeva K., Jekebekov K., Kalimolda E., Kerimbayev A., Akylbayeva K., Abay Z., Myrzakhmetova B., Nakhanov A., Absatova Z., Nurabayev S., Orynbayev M., Assanzhanova N., Abeuov K., Kutumbetov L., Kassenov M., Abduraimov Y., Zakarya K. Safety and immunogenicity of the first Kazakh inactivated vaccine for COVID-19// J. Hum Vaccin Immunother. – 2022. – №18. – P. 4-12.

12. Zhugunissov K., Zakarya K., Khairullin B., Orynbayev M., Abduraimov Ye., Kassenov M., Sultankulova K., Kerimbayev A., Nurabayev S., Myrzakhmetova B., Nakhanov A., Nurpeisova A., Chervyakova O., Assanzhanova N., Bu-

DOI: 10.11134/btp.3.2024.21

rashev Y., Mambetaliyev M., Azanbekova M., Kopeyev S., Kozhabergenov N., Issabek A., Tuyskanova M., Kutumbetov L. Development of the Inactivated QazCovid-in Vaccine: Protective Efficacy of the Vaccine in Syrian Hamsters// J. Front Microbiol. – 2021. – №12. – P. 20-43.

13. Khairullin B., Zakarya K., Orynbayev M., Abduraimov Y., Kassenov M., Sarsenbayeva G., Sultankulova K., Chervyakova O., Myrzakhmetova B., Nakhanov A., Nurpeisova A., Zhugunissov K., Assanzhanova N., Nurabayev S., Kerimbayev A., Yershebulov Z., Burashev Y., Kulmagambetov I., Davlyatshin T., Sergeeva M., Buzitskaya Z., Stukova M., Kutumbetov L. Efficacy and safety of an inactivated whole-virion vaccine against COVID-19, QazCovid-in®, in healthy adults: A multicentre, randomised, single-blind, placebo-controlled phase 3 clinical trial with a 6-month follow-up// J. E.Clinical.Medicine. – 2022. – №50. – P. 15-26.

14. Jekebekov K.K., Nurpeisova A.S., Abay Z.S., Shorayeva K.A., Absatova Z.S., Abitayev R.T., Kalimolda E.Zh., Moldagulova S.U., Assanzhanova N.N., Omurtay A.D., Shayakhmetov Y.A., Sadikaliyeva S.O., Barakbayev K.B., Kassenov M.M., Zakarya K.D., Abduraimov Y.O. Safety Assessment: a Comparative Analysis of Quantitative Content of Bacterial Endotoxins and Evaluation of Pyrogenicity of the Kazakhstan Vaccine QazCovid-in® against COVID-19//J. Bull Exp Biol Med. – 2024. – №176. – P. 452-456.

15. Shorayeva K., Nakhanov A., Nurpeisova A., Chervyakova O., Jekebekov K., Abay Z., Assanzhanova N., Sadikaliyeva S., Kalimolda E., Terebay A., Moldagulova S., Absatova Z., Tulendibayev A., Kopeyev S., Nakhanova G., Issabek A., Nurabayev S., Kerimbayev A., Kutumbetov L., Abduraimov Y., Kassenov M., Orynbayev M., Zakarya K. Pre-Clinical Safety and Immunogenicity Study of a Coronavirus Protein-Based Subunit Vaccine for COVID-19// Vaccines. – 2023. – №11. – P. 1771.

16. Li L., Li X., Guo Z., Wang Z., Zhang K., Li C., Wang C., Zhang S. Influence of Storage Conditions on SARSCoV-2 Nucleic Acid Detection in Throat Swabs// The Journal of infectious diseases. – 2020. – №222. – P. 203–205.

17. Garrett A., Meei-Li Huang P., Keith R V., Alexander J. Greninger Stability of SARS-CoV-2 in Phosphate-Buffered Saline for Molecular Detection// J. of Clin. Microbiol. – 2020. – № 58. – P. 4-20.

18. Aboubakr H. A., Sharafeldin T.A., Goyal S. M. Stability of SARS-CoV-2 and other coronaviruses in the environment and on common touch surfaces and the influence of climatic conditions: A review// J. Transboundary emerg dis. – 2021. – №68. – P. 296-312.

19. Patterson E.I., Prince T., Anderson E.R., Casas-Sanchez A., Smith S.L., Cansado-Utrilla C., Solomon T., Griffiths M.J., Acosta-Serrano Á., Turtle L., Hughes G.L. Methods of Inactivation of SARS-CoV-2 for Downstream Biological Assays// J. Infect Dis. – 2020. – №9. – P.1462-1467.

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ФИЗИКАЛЫҚ-ХИМИЯЛЫҚ ФАКТОРЛАРДЫҢ ИТТЕН ОҚШАУЛАНҒАН SARS-COV-2 ҚОЗДЫРҒЫШЫНА ӘСЕРІ

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ТҮЙІН

Бұл мақалада Қазақстан Республикасының аумағында иттен бөлінген SARS-CoV-2 коронавирусының биологиялық белсенділігіне физика-химиялық факторлардың әсерін зерттеу нәтижелері келтірілген. Нәтижелер вирусты – 70ºС температурада сақтау бөлме температурасында сақтау сияқты вирус белсенділігінің төмендеуіне әкелетінін көрсетті. +40 ºС температурада сақтау вирустың толық инактивациясына әкеледі. Әр түрлі әсерлерді зерттеу иондық және иондық емес жуғыш заттардың концентрациясы 0,1% және 0,5% концентрациясында ДОХ иондық жуғыш заттың әсерінен вирус белсенділігінің төмендеуін байқауға болатынын көрсетті, ал 0,01% концентрацияда вирус белсенділігінің өзгеруі байқалмайды. 0,01%, 0,1% және 0,5% концентрациясындағы ДСН жуғыш зат вирустың биологиялық белсенділігінің бастапқы титр (5,25 lg $ТЦД_{50}$/$см^3$) 4,00 lg $ТЦД_{50}$/$см^3$дейін төмендеуіне әкелді. Сондай-ақ, Тритон Х-100 және TWIN-20 иондық емес жуғыш заттарды қолдану арқылы вирустың белсенділігінің бастапқы титрден 4,50 lg $ТЦД_{50}$/$см^3$ дейін төмендегенін байқауға болады.

Қышқыл, бейтарап және сілтілі ортадағы рН-ның вирустың биологиялық белсенділігіне әсері зерттелді. Қышқыл және сілтілі ортаның рН-да вирус белсенділігінің төмендеуі байқалады, өйткені бейтарап ортаның рН-ы вирустың белсенділігіне әсер етпейді.

Түйінді сөздер: физика-химиялық факторлар, вирустан оқшаулау, вирустың тұрақтылығы, коронавирустық инфекция, вирустың тұрақтылығы, биологиялық белсенділік.

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ВЛИЯНИЕ ФИЗИКО-ХИМИЧЕСКИХ ФАКТОРОВ НА ИЗОЛЯТ SARS-COV-2, ВЫДЕЛЕННОГО ОТ СОБАКИ

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АБСТРАКТ

В данной статье приведены результаты изучения воздействия физико – химических факторов на биологическую активность коронавируса SARS-CoV-2, выделенного от собаки на территории Республики Казахстан. Результаты показали, что хранение вируса при температуре – 70ºС приводит к снижению активности вируса также, как и хранение при комнатной температуре. Хранение при температуре + 40ºС приводит к полной инактивации вируса. Изучение влияния различных концентраций ионных и не ионных детергентов показало, что под воздействием ионного детергента ДОХ в концентрациях 0,1% и 0,5% можно заметить снижение активности вируса, а в 0,01% концентрациях изменение активности вируса не наблюдается. Детергент ДСН в концентрациях 0,01%, 0,1% и 0,5% приводил к снижению биологической активности вируса от исходного титра (5,25 lg $ТЦД_{50}$/$см^3$) до 4,00 lg $ТЦД_{50}$/$см^3$. А также с использованием не ионных детергентов Тритон Х-100 и Твин-20 можно заметить снижение активности вируса от исходного титра до 4,50 lg $ТЦД_{50}$/$см^3$.

Изучено влияние рН кислой, нейтральной и щелочных сред на биологическую активность вируса. При рН кислой и щелочных средах заметны снижение активности вируса, тогда как нейтральная рН среда не оказывает никакого влияния на активность вируса.

Ключевые слова: физико – химические факторы, изолят из вируса, устойчивость вируса, коронавирусная инфекция, стабильность вируса, биологическая активность.