Section 4. Chemistry

https://doi.org/10.29013/AJT-22-1.2-18-23

Abiyeva Firuza Iskandarovna,
PhD student, National University of Uzbekistan
Nabiyev Abduraxim Abduxamidovich,
Doctor of Philosophy in Technical Sciences,
Assistant professor,
Tashkent Institute of Chemistry and Technology,
Smanova Zulayxo Asanaliyevna,
doctor of chemical sciences, professor,
National University of Uzbekistan
Ziyoyev Bayoniddin Tojimatovich,
Assistant, Tashkent Institute of Chemistry and Technology

ANALYSIS OF THE CHEMICAL COMPOSITION AND INFRARED-SPECTROSCOPIC ANALYSIS OF SODA WASTE OF KUNGIRAT

Abstract. We know that the processing of industrial waste and its conversion into finished products is one of the most important tasks for modern chemical technologists. The article states that the IR analysis and chemical composition of Disteller liquid were studied using modern methods. At the same time, the composition was studied and a scientific conclusion was made about the negative impact on the environment. The pH analysis of the distillery liquid was studied in three parts. The composition of the distillery liquid was studied for two seasons and a scientific conclusion was made.

Keywords: Distiller liquid, Soda, pH, Infrared spectroscopy, filtration, separation, chemical composition, waste.

Introduction. At the Kungrad soda plant in the northern part of the country, the processing of waste and its conversion into finished products is an important task today. The main purpose of our research is to study the chemical composition, physical and mechanical properties of soda distillery waste and to draw scientific conclusions on all its properties in order to turn it into a usable product. Soda powder is one of the most important products of the chemical industry, used in 50% in glass production, 25% in the chemical industry, 15% in the metallurgical industry, 10% in the pulp and paper industry and other industries. Today, more than 85% of world soda production is in China, the United States, Russia, Turkey and India. In 2010–2011, the growth of soda production was 6.2%, in 2012–2013 there was a decrease in production, which was 0.59%, but in 2018–2019 the growth of production was 0.2%. and production capacity reached 51.3 million tons [1]. There are currently four main methods of soda production in the industry: ammonia (Solve method), carbonation of natural soda raw materials, nepheline, and sodium hydroxide. Despite rapid growth in the 1970 s, soda production from natural soda raw materials is still one of the main methods of obtaining soda [2]. The raw material required for the production of soda by the ammonia method must be cheap, common (NaCl, $CaCO_3$). The reactions take place at low temperatures and near atmospheric pressure. The method is well studied, the technological processes are corrected and stable. The resulting soda is of high quality at a relatively low cost. While it has a number of key advantages, soda production by the ammonia method also has serious drawbacks. This is a significant consumption of energy resources and large specific capital investments required to create production. However, the main drawbacks of the Solvay method are the formation of large amounts of liquid waste, called distillation fluid, which indicates that the original natural raw material has not been used efficiently enough. Approximately 9–10 m^3 of distillation liquid is extracted from 1 ton of soda produced [3]. Currently, there is a problem of waste disposal in all countries that produce soda using this ammonia method. The new type of technology proposed for the processing of distilled liquid will prevent large-scale waste problems as well as environmental pollution. Wastewater, ie distilled liquid, is discharged into sludge reservoirs, water reservoirs located near existing production facilities. Accumulation of distillation fluid in mud ponds has a negative impact on increasing production capacity. Consequently, the elimination of waste by dumping mud ponds in a sedimentary state cannot solve the current environmental problem. Discharge of distillation fluid leads to the inevitable mineralization of natural reservoirs, significant changes in the biological state of water bodies. As a result, reservoir pollution can directly or indirectly affect humans, harming the interests of industrial water supply. The main task of improving the environmental safety of soda production is to develop a method of processing distilled liquid and return the treated water to the recycling process. Thus, the scientific and technical task is to recycle the main wastes of soda production with the increase in production volume [4]. It is of scientific and practical interest to convert distilled liquids from the wastewater of soda factories from recycled waste for the production of other types of products for poultry, fisheries and livestock into calcium and magnesium salts by converting them into carbonate and phosphate salts. The project capacity of the Kungrad soda plant is 100.000 tons per year.

Object and method. IR analysis and chemical composition of distiller liquid are studied by modern methods. At the same time, the composition was studied and a scientific conclusion was made about the negative impact on the environment. The pH analysis of the distillery liquid was studied in three parts. The composition of the distillery liquid was studied for two seasons and a scientific conclusion was made. For the study, we used Japanese IR-Fourier spectrometer, Shimadzu IRAffinity-1, high-efficiency energy-dispersed X-ray fluorescent spectrometer – Japan, Rigaku NEX CG EDXRF and Kungirad soda Distiller liquid (filtrate), Kungirad soda distillate liquid sediment, Kungirad soil soaked in distillate liquid.

Table 1. – Quantitative analysis of distiller liquid

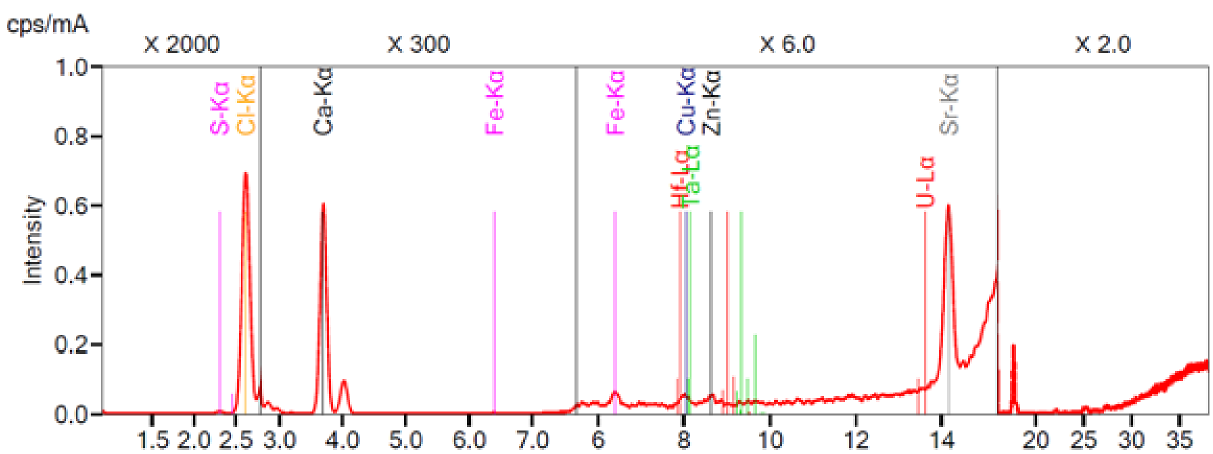
№		The result obtained
1.	General alkalinity	0.6 mg* ekv/dm^3
2.	General salinity	1605.53 mg/dm^3
3.	Solids	1.5 mg/dm^3
4.	Hydrogen indicator	12.04
5.	Temperature	21°S

№	Mass concentration of components	The result obtained
1.	Calcium (Ca^{2+})	3.0 mg* ekv/dm^3
2.	Magnesium (Mg^{2+})	Not available
3.	Sodium (Na^+)	485.07 mg/dm^3
4.	Iron (Fe^{2+})	0.10 mg/dm^3
5.	Sulfates (SO_4^{2-})	662.81 mg/dm^3
6.	Chlorides (Cl^-)	366.15 mg/dm^3

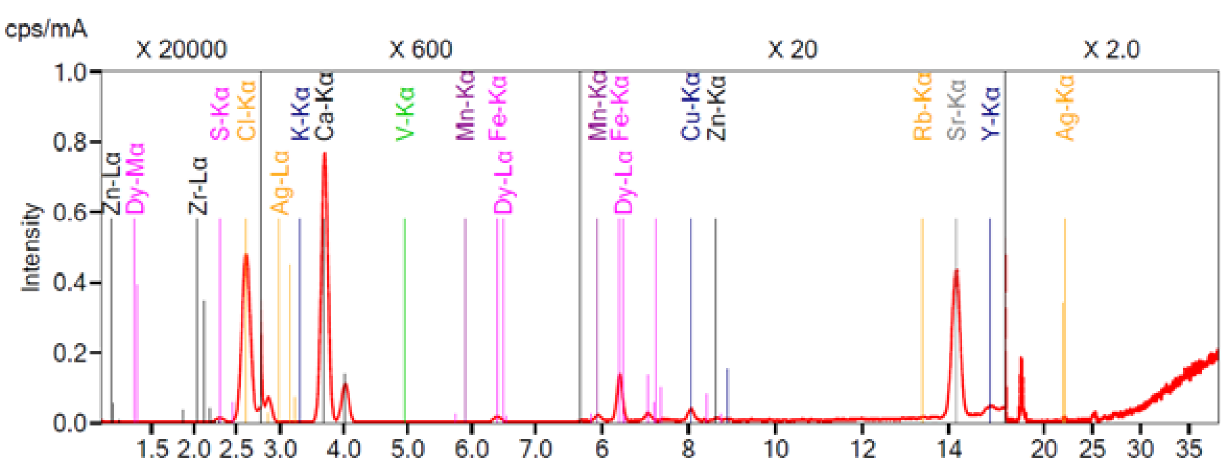
Table 2. – Elemental analysis of distiller liquid: (from dispersed X-ray fluorescent spectrometry – Japan, Rigaku NEX CG EDXRF)

№	Components	Chemical composition							
		Cl	SO_3	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO
1.	Distiller liquid (filtrate) mg/cm^2	90300	4260	–	55600	–	36.6	6.48	6.01
2.	Kungirad precipitation of soda distillation liquid	36.8	4.40	0.0317	32.5	0.0182	0.0969	0.0084	0.0013
3.	Kungirad soil moistened with distilled liquid	2.03	0.830	0.0327	59.5	0.0149	0.154	0.0020	0.0019

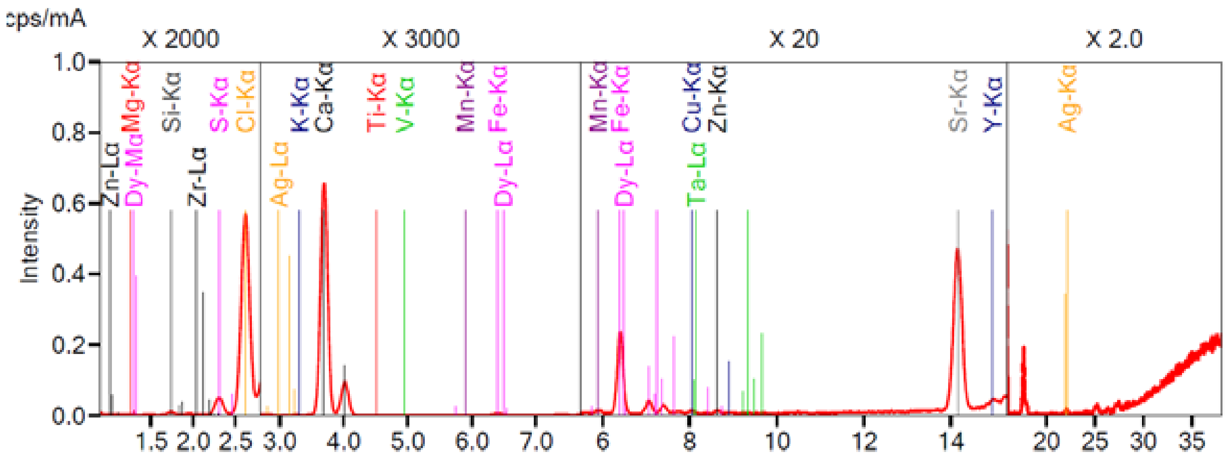
№	Components	Chemical composition						
		Rb_2O	SrO	Ag_2O	SiO_2	TiO_2	MgO	V_2O_5
1.	Distiller liquid (filtrate) mg/cm^2	–	19.3	0.0013	–	–	–	–
2.	Kungirad precipitation of soda distillation liquid	0.0005	0.0168	0.0012	–	–	–	0.0019
3.	Kungirad soil moistened with distilled liquid	–	0.0155	–	0.686	0.0139	0.944	0.0029



A



B



C

Figure 1. Element analysis: A – Distiller liquid (filtrate); B – Kungirad precipitation of soda distillation liquid; C – Kungirad soil moistened with distilled liquid

From the analysis of elemental analysis it can be seen (Table 1 and Figure 1), when the soda plant wastewater is studied in two parts (liquid and sediment): the liquid part contains Cl^-, Ca^{+2}, Fe^{+3}, We can observe a large amount of SO_4^{2-} ions and Cl^-, Ca^{+2} ions in the sediment. Along with the study of distillery liquid, when studying the chemical composition of the soil of the waste liquid discharge, it is possible to see a strong rate of salinity in the ground due to the abundance of Ca^{+2} ions, pH = 12.04. This has a negative impact on the agrochemical properties of the soil. The reduction of microorganisms in the soil leads to an increase in the hygroscopicity of the soil where the liquid is discharged

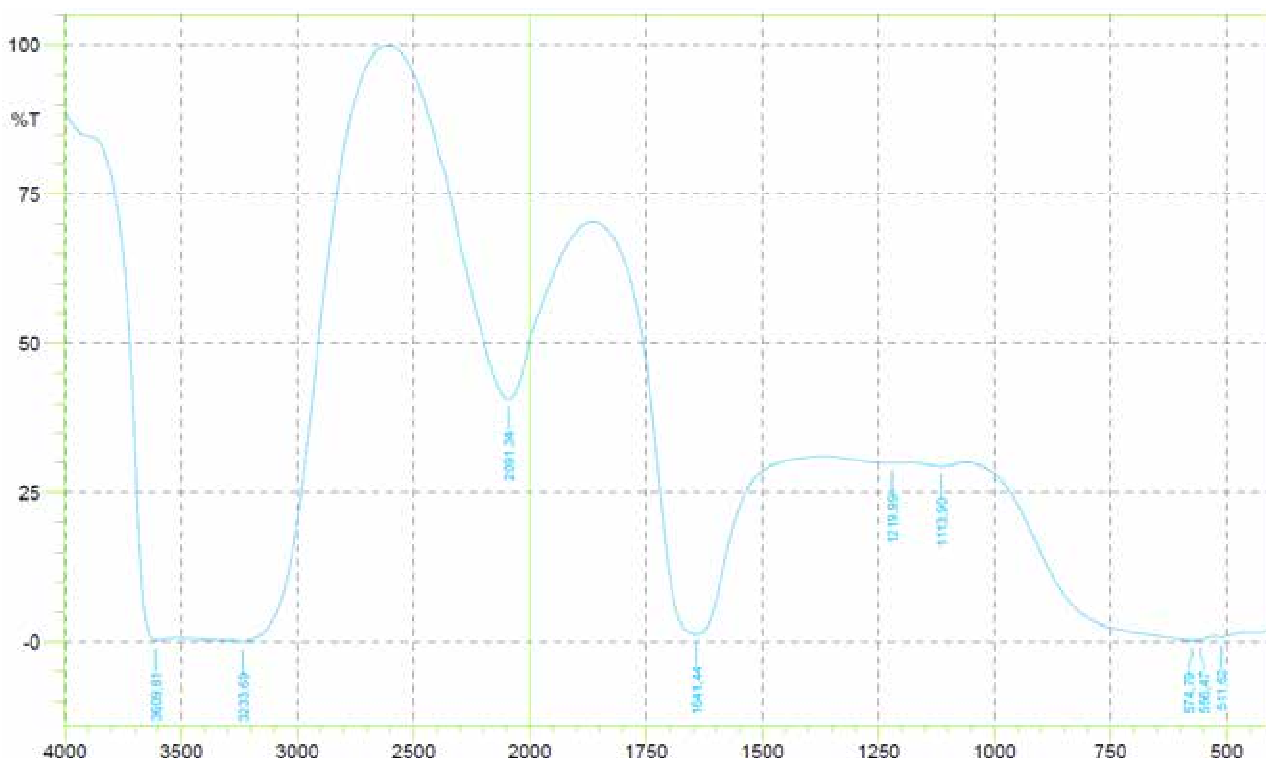


Figure 2. In the IR spectroscopic analysis of the filtrate part of the Disteller liquid, OH-ions in the 3609.81cm $^{-1}$ area, NH bonds in the 3233.88cm $^{-1}$ area, Ca $^{+2}$ ion in the 1210cm $^{-1}$ area, Fe in the 1113.90cm $^{-1}$ area $^{+3}$ ions and sulfate ions can be observed in the area of 574.7–511.62 cm $^{-1}$

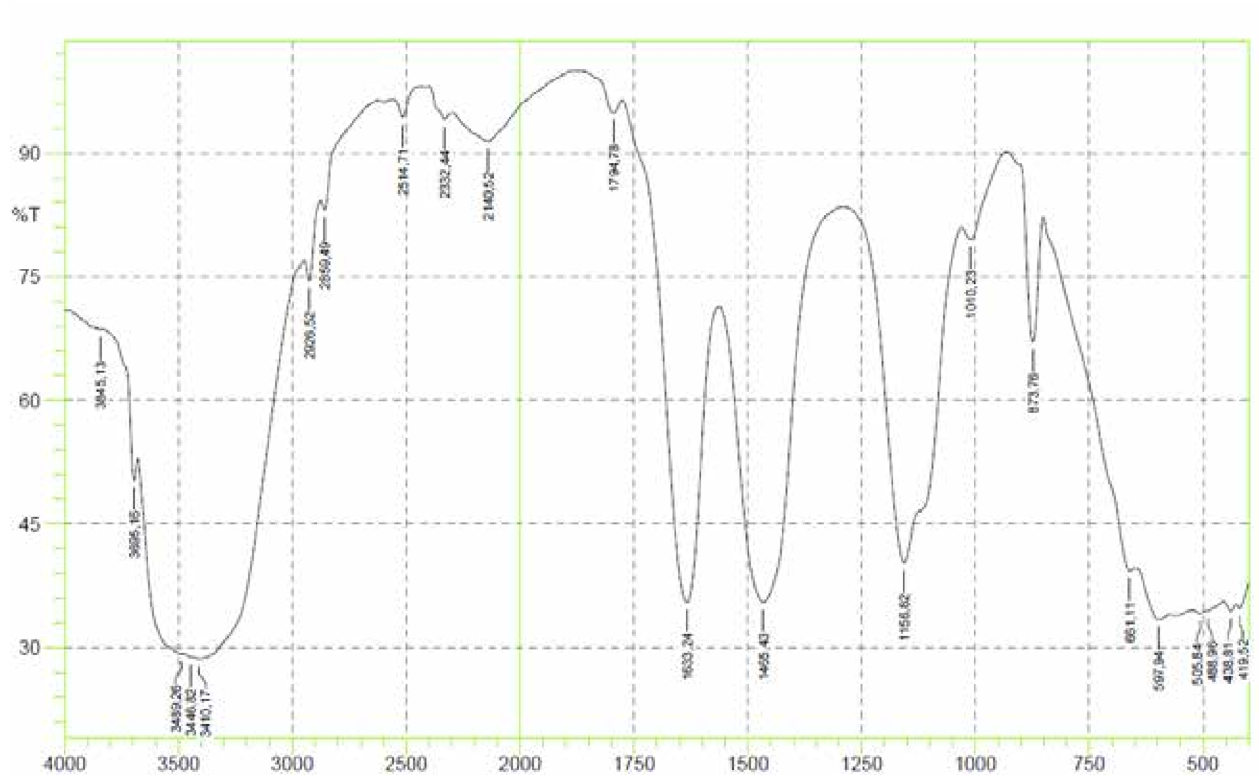


Figure 3. In the IR spectroscopic analysis of the sedimentary part of the distiller liquid, OH^- ions in the area 3489.26–3410,17 cm^{-1}, Cl – ions in the area 2926.52cm^{-1}, Ca^{+2} ion in the area 1010.23cm^{-1} and 419, The AgCl molecule can be observed in the area of 52 cm^{-1}

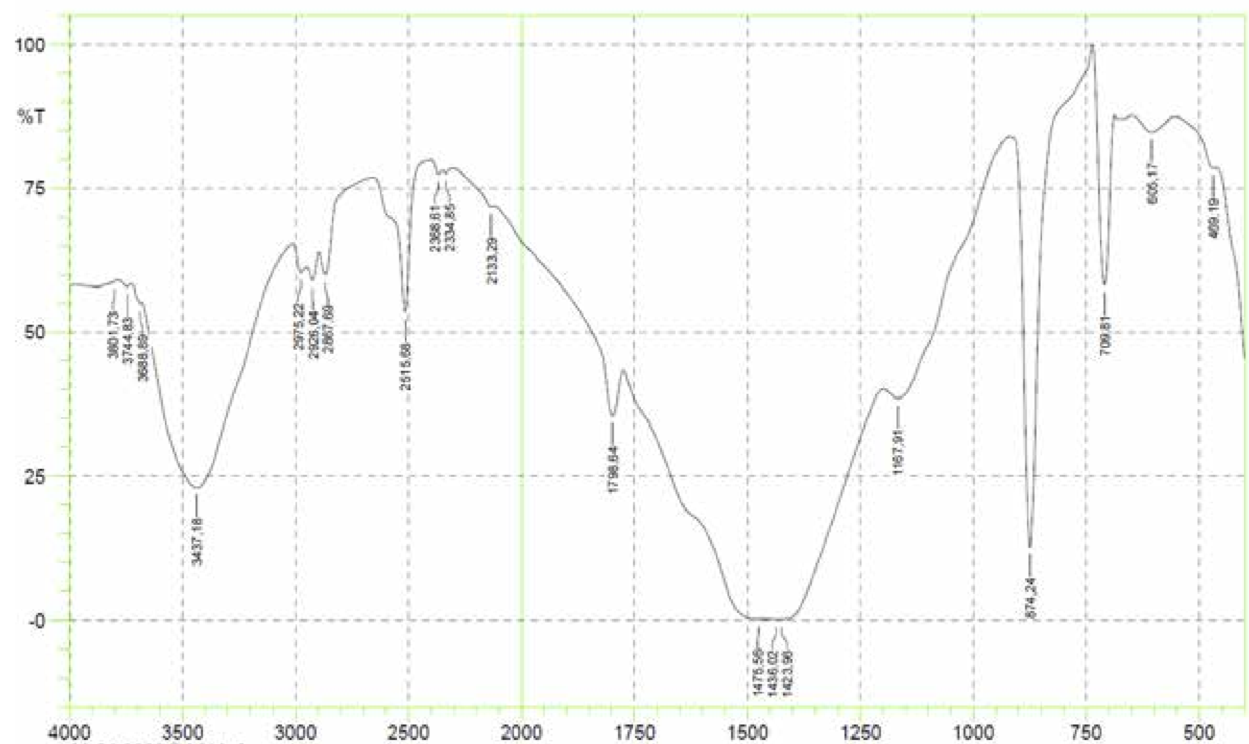


Figure 4. Analysis of infrared spectroscopic analysis: A – Distiller liquid (filtrate); B – Kungirad precipitation of soda distillation liquid; C – Kungirad soil moistened with distilled liquid

Conclusion. The composition of the distillery liquid was studied for two seasons. As a result of the study, the following scientific conclusions were made: The purpose of recycling soda plant waste is to maintain the ecological condition of the plant area in a positive state. Exploring the chemical basis of wastewater by proposing methods of recycling the finished product state.

References:

1. United States Department of the Interior U. S. Geological survey. 2014. Minerals Yearbook. Soda Ash [Advance Release]. By Wallace P. Bolen. November, 2015.– P. 70.1–70.9.
2. Conference materials «WORLD SODA ASH»: Riviera: 2007.– 272 c.
3. Tkach G. A., Shaporev V. P., Titov V. M. Production of soda using low-waste technology.– Kharkov: XGPU, 1998.– 429 p.
4. Abdieva F. I., & Nabiev A. A. Study of the chemical composition of liquid waste from the production of soda ASH. Conference Zone,2022. – P. 256–258. Retrieved from: URL: http://www.conferencezone.org/index.php/cz/article/view/403