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Evaluation of Mining Wastewater from the Shinca Creek Reused in Agriculture in a Rural Hamlet

Julián Pérez-Falcón[1], Hernan Ramirez-Asis[2*], Jesús Gerardo Vizcarra-Arana[3], Arnaldo Ruiz-Castro[1], Juan Roger Quiñonez-Poma[4], Edgard Brito-Gonzales[5]

[1] Faculty of Mining Engineering, Geology and Metallurgy, Universidad Nacional Santiago Antunez de Mayolo, Huaraz 02001, Perú
[2] Department of Administration, Universidad Nacional Santiago Antunez de Mayolo, Huaraz 02001, Perú
[3] Department of Marine Science, Universidad Nacional Santiago Antunez de Mayolo, Huaraz 02001, Perú
[4] Department of Agricultural, Universidad Nacional Santiago Antunez de Mayolo, Huaraz 02001, Perú
[5] Department of Economics, Universidad Nacional Santiago Antunez de Mayolo, Huaraz 02001, Perú

Corresponding Author Email: heramirez8@hotmail.com

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ABSTRACT

Abandoned mines and associated mine effluents, tailings ponds, and dumps pose a significant threat to human and environmental health and should be addressed as part of the environmental responsibilities of the mining industry. The objective of the study was to determine the extent to which the water of Quebrada Shinca (Peru) is contaminated with total metals and to outline possible applications in agriculture in the area. Water quality was monitored at three different times, using readings taken from seven environmental water monitoring points and three soil points, conducted in July, October 2022, and March 2023. The results are shown over the time intervals. The QISCA 03 (surface water) water flow is predicted to increase by 1603.04% from the reading taken in July 2022 to March 2023 and its values were below the Environmental Quality Standards for water (EQS), the QISCA 04 (mine effluent) flow reached (133.05%) and the values were (As=0.78, Cd=0.16, Cu=0.80, Zn=42.67) mg/l and for QISCA 07 (irrigation water) the flow increased by 92.42% and the values were (Cd=0.05, Mn=14.10, Pb=0.12 and Zn=13.94) mg/l in the same period.

1. INTRODUCTION

Currently, mining operations are required to conduct environmental and social impact assessments before becoming operational [1]. This is because technologies that enable the recovery and use of mineral resources are a vital aspect of modern mining development. Safe and effective closure of mining activities and waste management are also required by law in virtually all Latin American countries, and the latter often requires the provision of financial guarantees to ensure compliance. Because the mining industry did not always take into account the full mining cycle before stricter regulations were enacted, Mining Environmental Liabilities (MAPs) have accumulated in the form of mines without technical closure, tailings deposits, waste dumps and abandoned facilities [2]. The use of these MAPs has been linked to potential negative impacts on human and environmental health. Inventory and characterization are carried out to determine which sites pose a lesser or less significant hazard to human health and the environment and are therefore more likely to be suitable for reuse. In the Iberian Peninsula, metal mines have been discovered dating back to the Bronze Age. Records of mining deposits in Ibero-America date back several centuries. Mining in America had its greatest expansion during the 19th century [3]. Abandoned mines and the dumps, tailings dumps, dumps and tailings dump they produce must be treated to avoid a major threat to human and environmental health.

A sensitive and flexible method for separating and analyzing proteins, protein fragments, and peptides is reversed-phase high-performance liquid chromatography, or RP-HPLC. The mobile phase of an RP-HPLC system is polar, while the stationary phase is nonpolar. Separating, identifying, and quantifying semi-volatile and non-volatile chemicals in liquid samples is the goal of high-performance liquid chromatography(HPLC), a method of analytical chemistry [4]. Many different types of high molecular weight polyfunctional groups can be separated using high-performance liquid chromatography (HPLC), including macromolecules, ionic species, polymeric materials, labile natural compounds, and many more.

Currently, many mining operations generate significant quantities of tailings or tailings from an open pit or cased mining deposits that have low concentrations of economically essential metals [5]. Due to the linear nature of the economy. There is a clear economic, social and environmental benefit in using hydrometallurgical processes to recover metals of economic interest from acid rock drainage rather than environmentally closing the tailings deposits themselves. It is also intended that the waste generated in these processes be reused in the closure of the tailing's deposits. In the rural hamlet of Quebrada Shinca, Ucru Independencia, Huaraz province, agriculture and livestock are the backbone of the local economy, so it is essential to make proper use of the most abundant natural resource in the area: water. An assessment of the situation in this area is necessary so that local residents can make an informed decision on whether or not to continue using mining effluents [6].

Studies have been conducted to strengthen this line of research: background on the use of hydrolyzed olive cake for the removal of heavy metals from acid mine effluents is provided below [7]. Two major problems of contemporary society inspired the present research. On the one hand, it sought ways to remove harmful metals from mine wastewater. On the other, it offered a new potential use for olive cake. First, Hydrolyzed olive cake and real wastewater were analyzed physiochemically, and their reactivity to different metals (manganese, chromium, copper, nickel, zinc, and lead) was examined [8, 9]. The hydrolyzed olive cake contained only 3.08% ash and 2.80% water-soluble chemicals. Lead (41.54 mg/g) was the element most retained, whereas manganese (3.57 mg/g) was the least. Adsorption tests were then conducted in water, adjusting the pH of the water to 6 to maximize its adsorption capacity. The results were promising compared to previous similar studies.

It notes that acid mine drainage (AMD) [10] is a global environmental problem that requires a comprehensive assessment of the current status of AMD treatment, reuse and resource recovery. Traditional methods of treatment and maintenance of AMD have included aggressive and passive treatments. Although various remediation strategies, including bioremediation, wetlands, permeable reactive barriers, and lime neutralization, exist to treat SAD, doing so is challenging due to the true long-term effects of SAD remediation. To understand why these issues have become the focus of the debate on sustainable approaches to treating SAD it is necessary to review the characteristics and implications of SAD, as well as remediation approaches at mine sites, new methods of water purification that allow for recycling and reusing existing water supplies. Creating and reusing water in AMD, and the use of membrane processes and other alternative treatment technologies. Precious metals, for example, cannot be selectively recovered by membrane methods. Water reuse and recovery will most likely be achieved through the use of an integrated approach of membranes and traditional treatment processes for sulphury acid, metals, and rare earth elements are all resources that can be used. Finally, the essay suggests developing resource reuse and recovery as an overall approach to sustainable WFD therapy, and draws attention to integrated technologies that require further study.

High pollution from abandoned mines and mining activities in the Dilala and Mpingiri rivers in the Democratic Republic of Congo: an impact assessment. According to toxic metals and rare earths (REE) are commonly found in abandoned mines and mining activities, affecting nearby environmental compartments and biota. Vacant mines, artisanal mining, and large-scale industrial mining all coexist in the African Copperbelt; this study analyzes sediments, and plant samples from riverbanks in the region. Sediments included the highest amounts of Cu, Co and Pb, with values of 137,252, 17,341 and 796 mg/kg/1, respectively, according to ICP-MS results. Per kilogram of soil, copper (175,859), cobalt (2,113) and lead (1,164) levels were determined. These figures also exceed soil remediation regulations and sediment restrictions established to safeguard aquatic life nationally and internationally. Phalaris Arundinaceous leaves presented the highest values of Cu, Co and Pb accumulation, with 34,061, 5050 and 230 mg/kg/1, respectively. These figures indicate that mining operations, in addition to natural contamination as background, contributed considerably to the contamination of the research sites. PREE concentrations were 2306, 733 and 3125 mg/kg/1 Specifically, in sediment, soil, and plant samples. The findings were shown on detailed and aesthetically pleasing maps. The aforementioned data were merged with satellite photos and other geographical data, permits for mining and hydrography. To disseminate the results and foster dialogue among many stakeholders, state-of-the-art online mapping technology will be used.

If one accepts [11], metal flocculation caused by mining operations has traditionally affected freshwater ecosystems. It is assumed that riparian vertebrates and macroinvertebrates are taken up by sequestration, despite the possibility of metal flocs having smothering effects. Studies have not differentiated between the effects of metal toxicity and the smothering effects of metal flocs. Worldwide, people are concerned about the ecological impact of mining [12]. We compared information from exposed and unexposed areas to determine whether the predominant cause of biotic damage is asphyxiation by metal flocs or metal poisoning. Test sites had lower macroinvertebrate abundance compared to reference sites if those invertebrates' exhibited traits associated with vulnerability to fine sediments, such as exposed gills. Differences in macroinvertebrate characteristics across results were more indicative of smothering and metal flocs than metal toxicity at test sites [13, 14]. Current regulations only consider the effects of metal pollution on aquatic organisms. However, our findings reveal that the choking effect of metal flocs can have devastating effects on living things.

Both groundwater chemistry and the potential impact on human health were studied in the mining area of East Singh hum. According to Singh et al. [15], the objective of their research was to analyze the hadrochemical elements of groundwater in the mining area of East Singh hum district to determine the amount to which people are exposed to heavy metals and the health problems associated with such exposure. Hadrochemical testing of the groundwater indicated that Na, K and Ca constitute the majority of the cations present, while HCO3, F and Cl ions form the bulk of the p aniconic block. Humans are responsible for the introduction of these metals into the environment through mining and mineral processing operations. Cr was determined to be more hazardous to the population than As, Cd or Pb in terms of both hazard quotient (HQ) and chronic daily intake (CDI). Because of their ability to accumulate in the human body and induce a wide variety of ailments, heavy metals were also determined to have an extremely high hazard index (HI) (> 1).

It developed a plan to improve waste disposal in artisanal gold mines in Napo-Ecuador [16]. Some of the negative effects of artisanal alluvial gold mining practiced in our country are the clearing of primary forests for mining, the development of communities without sanitation services and the production of effluents, atmospheric emissions and polluting solid waste. In light of this, we gathered information from direct observation, interviews and surveys, and used it to develop a SWOT analysis matrix, as well as some supporting tables and bar charts. A series of reform proposals were prepared and presented after determining that the existing waste management system in an artisanal gold mining company in Napo, Ecuador, was ineffective. Metrics and indicators were also developed to track progress in implementing these reforms. According to the schedule below, the suggested modifications would take about 12 months to implement and cost about $13,495.

It states that mining companies have made their water use more public as part of an effort to improve corporate transparency and responsible water management in the mining sector [17]. However, there have not been many attempts to collect and examine these reports. To address this problem, we have collected 7962 data points from 408 mining company reports and arranged them in accordance with mining industry water accounting. There is still potential for improvement in practices for reporting data, such as making sure that all relevant water flows are included and that any flows that don't exist are accounted for (such as spills) are clear. The quality of reporting has increased considerably in recent years. Preliminary analysis of the data shows significant variation in water withdrawals, water use efficiency and emissions across mining operations. The overall interactions of water resources in mining require further studies to determine the effect of mine-specific components, such as ore treatment processes and the climate of the area [18].

Biological treatment systems, coagulation-flocculation, and traditional filtration are just a few of the wastewater treatment methods that have been developed and used in this area. Current discharge or reuse regulations are also being met by upgrading existing technology. Membrane technology is one of the most rapidly developing methods for treating wastewater at the time. The benefits of membrane technology in treating water and wastewater have led to its rapid expansion over the last 20 years. A lot of hope for membrane technology in wastewater treatment comes from the fact that it drastically cuts down on equipment size, energy consumption, and startup costs. The promise of little or no chemical consumption, environmental friendliness, and easy accessibility makes membrane technology a promising candidate to close the sustainability and economic gap [19, 20]. To rephrase, high-performance liquid chromatography (HPLC) has lately been shown to be the preferred technology for treating wastewater. Even though the high-performance liquid chromatography (HPLC) technique has been around for a while, there is still potential for advancements in terms of efficiency, energy consumption, permeate quality, space requirements, and knowledge needed to handle the diverse and complicated wastes. One of the major issues in the process is the decrease of membrane fouling, which is why modules and membrane components are always being updated to enhance this. Many wastewater treatment facilities are also actively investigating, developing, and implementing hybrid approaches that combine multiple processes, either inherently or in conjunction with additional technologies like coagulation or adsorption.

Finally, we examined the impact of the mining industry on the water cycle using data from Fernandez [21]. Water has many functions in mining: it is both an environmental resource to be protected and an essential resource to be used both inside and outside the mine. It can also be a nuisance to be avoided, reduced, or rectified. When considering the sustainability of water resource management over time, water footprint and water footprint are two excellent global metrics to consider. Their investigation is useful in ways that go beyond the results of a standard audit of a company's water management procedures.

These factors motivated us to investigate the status of Quebrada Shinca's mining effluents and to make recommendations on how to clean them up so they can be reused in agriculture.

2. METHODOLOGY

Santa Rosa de Ucru, in the province of Huaraz and the district of Independencia, is where the investigation is being carried out. The headwaters of Shinca Creek are located about 8 km west of the El Milagro neighborhood of Huaraz, along the asphalt road that formerly led to the old Santo Toribio Mine. Water quality was monitored by installing environmental reference stations [22]. The full extent of the project can be seen in these sections. The numerous monitoring points are detailed below.

Regarding the study site, the Santo Toribio Mine ceased operations more than 10 years ago but left a sequel of mine tailings that damaged the tributaries along 30 kilometers. According to Table 1, the sampling plan was carried out during one year at seven different points along the Shinca Creek, the data collection procedures were by 400 ml pipettes for periods of 45 days over a year.

Table 1. Water sampling points

Environmental	Station Description Component	UTM Coordinates	North East
	QISCA 01: Quebrada Rupashca	8948725.59	215686.65
	QISCA 02: Quebrada Chacuapayacunan	8948901.32	215694.11
	QISCA 03: Quebrada Shinca	8949083.94	216206.56
	QISCA 04: Ojo de Agua Canchapampa (mining effluent)	8949874.00	216210.00
	WATER		
	QISCA 05: Quebrada Shinca (Qisca 03 + Qisca 04)	8949327.80	216361.58
	QISCA 06: Quebrada Shecshus.	8949188.00	217559.00
	QISCA 07: Irrigation canal (Qisca 05 + Qisca 06)	8949185.00	217641.00
SOIL	**S1:** Sector Mesapampa **S2:** Sector Pacuash	8948974.00 8948564.00	218210.00 218777.00
	S3: Sector Santa Rosa	8948486.00	219083.00

Source: Prepared by the author (2024)

2.1 Coordinates in universal transverse mercator projection system (UTM)

For points QISCA 01, QISCA 02, QISCA 03, QISCA 05, QISCA 06 and QISCA 07, they are evaluated with the values established in Supreme Decree 003-2017-MINAM in Table 2. It verifies that water meets the Environmental Quality Standards, in Category 3: Vegetable Irrigation and Animal Drinking, of the parameters for Unrestricted Vegetable Irrigation [23], which are:

Table 2. Reference standards according to the Water ECA

Parameter	Unit	Value
PHYSICAL - CHEMICAL		
Oils and Fats	mg/l	5
Chemical Oxygen Demand (COD)	mg/l	40
Fluorides	mg/l	1
INORGANICS		
Aluminum (Al)	mg/l	5
Arsenic (As)	mg/l	0.1
Barium (Ba)	mg/l	0.7
Beryllium (Be)	mg/l	0.1
Boron (B)	mg/l	1.00
Cadmium (Cd)	mg/l	0.01
Copper (Cu)	mg/l	0.2
Cobalt (Co)	mg/l	0.05
Total Chromium (Cr)	mg/l	0.1
Iron (Fe)	mg/l	5
Lithium (Li)	mg/l	2.5
Magnesium (Mg)	mg/l	-
Manganese (Mn)	mg/l	0.2
Mercury (Hg)	mg/l	0.01
Nickel (Ni)	mg/l	0.2
Lead (Pb)	mg/l	0.05
Selenium (Se)	mg/l	0.02
Zinc (Zn)	mg/l	2
MICROBIOLOGICAL AND PARASITOLOGICAL		
Thermotolerant Coliforms	NMP/100 ml	1000
Escherichia coli	NMP/100 ml	1000
Helminth eggs	Huevos/L	1

Source: Supreme Decree 004-2017-MINAM, in Category

2.2 Vegetable Irrigation and animal drinking - Sub category D1: Vegetable irrigation unrestricted irrigation

In addition, the opinion of 73 residents was taken into account, who were interviewed so that they could express their concerns about the level of water contamination and its possible agricultural uses after an artisanal treatment to reuse water with levels below the permissible limits.

3. RESULTS

Table 3. Results of water quality analysis Qisca 07

PARAMETERS ACCORDING TO D.S. 004-2017-MINAM					
Category 3: Irrigation of vegetables and animal drinking water D1: Irrigation of vegetables (Unrestricted irrigation).					
Sampling Point	QISCA 07				
Name	Irrigation Canal (Qisca 05 + Qisca 06)				
Coordinates	8949185.00N 217641.00E				
Altitude Date of measurement	3701 m.a.s.l. 07/10/2022 10/23/2022 03/05/2023				
Start time			12:27 pm	7:49 am	13:20 h
End time			12:42 pm	8:30 am	13:40 h
Flow rate m3/sec			**0.0130**	**0.0072**	**0.012**
Flow Lt/sec			**12.97**	**7.21**	**11.99**
Monitoring Date			**07/10/2022**	**10/23/2022**	**03/05/2023**
Parameter	**Unit**		**Value**		
PHYSICAL - CHEMICAL					
Oils and Fats	mg/l	5	<0.5	2.53	<0.5
Chemical Oxygen Demand (COD)	mg/l	40	13.3	<10.0	<10.0
Fluorides	mg/l	1	0.46	0.48	0.16
INORGANICS					
Aluminum (Al)	mg/l	5	4.305	4.417	2.699
Arsenic (As)	mg/l	0.1	0.0562	0.0047	0.0479
Beryllium (Be)	mg/l	0.1	0.00039	0.00070	<0.00021
Barium (Ba)	mg/l	0.7	<0.0023	0.0101	0.0276
Boron (B)	mg/l	1.00	0.0036	0.0120	0.0027
Cadmium (Cd)	mg/l	0.01	**0.0481**	**0.0799**	**0.0145**
Copper (Cu)	mg/l	0.2	0.1326	0.1865	0.0722
Cobalt (Co)	mg/l	0.05	0.0104	0.0152	0.0043
Total Chromium (Cr)	mg/l	0.1	<0.0005	<0.0005	<0.0005
Iron (Fe)	mg/l	5	**6.4650**	1.4750	4.2000
Lithium (Li)	mg/l	2.5	0.021	0.029	0.004
Lead (Pb)	mg/l	0.05	**0.0761**	**0.0930**	**0.1777**
Manganese (Mn)	mg/l	0.2	**18.3120**	**>20**	**3.9849**
Mercury (Hg)	mg/l	0.01	<0.0010	<0.0010	<0.0010
Nickel (Ni)	mg/l	0.2	0.0051	0.0100	0.0020
Selenium (Se)	mg/l	0.02	0.005	0.011	<0.004
Zinc (Zn)	mg/l	2	**16.4840**	**21.7789**	**3.5484**
MICROBIOLOGICAL AND PARASITOLOGICAL					
Helminth eggs	Eggs/L	1	<1	<1	<1

Source: Laboratory Servicios Analíticos Generales S.A.C Test Reports N° 164090, 166853 and 171352.

For station QISCA 01: From Table 3, the sampling in different periods, the water flow at point QISCA 01. It can be deduced that in the month of March 2023 increased by 582.33%, with respect to the flow measured in the month of July 2022. In addition, the physicochemical parameters, such as Oils and Fats, COD, Fluorides; continue to report values below the Water Quality Standards (C3D1). Also, the biological parameters such as Helminth eggs present concentrations below the norms set out in the Water ECA (C3-D1) and the concentrations of total metals present values below the limits established by the ECA (C3-D1).

For station QISCA 02: From the sampling in different periods, the water flow at point QISCA 02, and it can be deduced that in the month of March 2023 increased by

1294.59%, with respect to the flow measured in the month of July 2022. Likewise, the physicochemical parameters, such as Oils and Fats, Total Cyanide, BOD, Fluorides; continue to report values below the Water Quality Standards (C3-D1). In addition, the biological parameters such as Helminth Eggs present concentrations below the norms set out in the Water ECA (C3-D1). Similarly, the concentrations of total metals present values below the limits established by the ECA (C3-D1).

For station QISCA 03: From the sampling in different periods, the water flow at point QISCA 03, it can be deduced that in March 2023 it increased by 1603.04%, with respect to the flow measured in July 2022. Similarly, the physicochemical parameters, such as Oils and Fats, Total Cyanide, BOD, and Fluorides; continue to report values below the Water Quality Standards (C3-D1). Also, the biological parameters such as Helminth Eggs present concentrations below the norms set out in the Water ECA (C3-D1). Likewise, the concentrations of total metals show values below the limits established by the ECA (C3-D1).

For station QISCA 04: At station QISCA 04, there are values of Arsenic and Zinc, which persist since the first sampling; these values are above the MPL of D.S. 010-2010-MINAM. In addition, in the last monitoring, Cadmium, Copper and Lead appear at this point, with values above the LMP of D.S. 010-2010-MINAM.

For QISCA 05 station: From sampling in different periods, the water flow at QISCA 05 point in March 2023 increased by 799.01%, compared to the flow measured in July 2022. In this sense, the physicochemical and bacteriological parameters reported values below the Water Quality Standards. On the other hand, the concentrations of total metals show values below the limits established by the ECA (C3-D1), with the exception of Manganese, which exceeds the limits established by the ECA (C3-D1). Likewise, arsenic, cadmium, lead, and zinc concentrations decreased in the third sampling, with respect to the initial sampling.

For station QISCA 06: From sampling in Table 4, in different periods, the water flow at point QISCA 06 in March 2023 increased by 329.14% with respect to the flow measured in July 2022. Likewise, the physicochemical and bacteriological parameters reported values below the Water Quality Standards. Similarly, the concentrations of total metals show values below the limits established by the ECA (C3-D1), with the exception of Manganese, which shows values that persist and exceed the limits established by the ECA (C3-D1). For station QISCA 07: From Table 4, sampling in different periods, the water flow at point QISCA 07 in March 2023 increased by 92.42% with respect to the flow measured in July 2022. In this sense, the physicochemical and bacteriological parameters reported values below the Water Quality Standards. In addition, the concentrations of total metals show values below the limits established by the ECA (C3-D1), with the exception of Cadmium, Manganese, Lead and Zinc, which persist and exceed the limits established by the ECA (C3-D1).

Table 4. Quality results for S3- Santa Rosa Sector

Land Use						
				Sampling Points		
Industrial/ Extractive				S 3		
Parameters in Land SANTA ROSA mg/kg PS						
Sampling date			07/10/2022	10/23/2022	03/05/2023	
	M.D.L.	**Units**	**Report 1**	**Report 2**	**Report 3**	**Results**
		Metals				
Silver (Ag)	0.06	mg/kg	<0.06	<0.06	<0.06	-0.06
Aluminum (Al)	1.4	mg/kg	4488.5	5695.8	5562.8	5249.03
Arsenic (As)	0.17	mg/kg	134.34	180.10	134.28	149.57
Boron (B)	0.2	mg/kg	<0.2	<0.2	<0.2	-0.20
Barium (Ba)	0.23	mg/kg	113.48	222.75	124.05	153.43
Beryllium (Be)	0.021	mg/kg	0.600	0.589	0.344	0.51
Calcium (Ca)	2.4	mg/kg	12685.3	18481.6	8073.8	13080.23
Cadmium (Cd)	0.03	mg/kg	4.12	6.92	6.18	5.74
Cerium (Ce)	0.3	mg/kg	55.4	53.1	60.3	56.27
Cobalt (Co)	0.05	mg/kg	10.32	9.46	11.13	10.30
Chromium (Cr)	0.05	mg/kg	3.46	3.61	3.33	3.47
Copper (Cu)	0.07	mg/kg	20.48	17.87	22.74	20.36
Iron (Fe)	0.24	mg/kg	33166.26	28159.34	34576.17	31967.26
Mercury (Hg)	0.1	mg/kg	<0.10	<0.10	<0.10	-0.10
Potassium (k)	3.5	mg/kg	1307.8	1277.8	1408.8	1331.47
Lithium (Li)	0.3	mg/kg	8.6	11.0	7.2	8.93
Magnesium (Mg)	3.7	mg/kg	1703.1	2329.4	2156.4	2062.97
Manganese (Mn)	0.08	mg/kg	1973.39	2264.54	2193.19	2143.71
Molybdenum (Mo)	0.14	mg/kg	1.50	1.89	1.54	1.64
Sodium (Na)	3.9	mg/kg	39.6	49.5	47.0	45.37
Nickel (Ni)	0.06	mg/kg	4.21	5.48	4.26	4.65
Phosphorus (p)	0.3	mg/kg	1323.5	983.0	1519.5	1275.33
Lead (Pb)	0.08	mg/kg	55.23	71.42	57.16	61.27
Antimony (Sb)	0.22	mg/kg	3.32	7.84	4.62	5.26
Selenium (Se)	0.4	mg/kg	<0.4	<0.4	<0.4	-0.40
Tin (Sn)	0.1	mg/kg	0.67	0.75	0.26	0.56
Strontium (Sr)	0.07	mg/kg	45.56	42.12	29.41	39.03
Titanium (Ti)	0.03	mg/kg	5.98	6.90	6.13	6.34
Thallium (Tl)	0.4	mg/kg	1.5	0.5	1.2	1.07
Vanadium (V)	0.05	mg/kg	28.52	28.44	26.80	27.92
Zinc (Zn)	0.23	mg/kg	154.13	230.54	186.38	190.35

Source: Laboratory Servicios Analíticos Generales S.A.C. Test reports N° 164090, 166853 and 171352. M.D.L.

- In the results of the water monitoring stations, it can be seen that all the parameters analyzed are in accordance with the ECS (soil).
- In the case of sampling point S1, Molybdenum (Mo), Silver (Ag), Mercury (Hg) are below the limits and the other elements are above the soil quality standards.
- For the case of sampling point S2, Thallium (Tl), Boron (B), Mercury (Hg), Silver (Ag), Selenium (Se) are below the limits and the other elements are above the soil quality standards.
- In the case of sampling point S3, Mercury (Hg), Silver (Ag), Selenium (Se) are below the limits and the other elements are above the soil quality standards.
- For a better understanding of what is described above, the graphs with the values of the parameters that are above the environmental quality standards are presented.

In addition, 73 neighbors of Shinca Creek were interviewed, and it was revealed that their major concerns were as follows: Lead in drinking water is neurotoxic; high concentrations are deadly. Sequelae, such as intellectual disability or behavioral problems, can occur in children recovering from severe lead poisoning. There is growing evidence that arsenic in drinking water poses a serious health danger of numerous cancers, including lung and skin cancers. Multiple forms of cancer have been related to arsenic exposure, but especially skin, lung and bladder cancers.

4. DISCUSSION

Arsenic in water can cause a variety of health problems, including those listed below. Thickening and discoloration of the skin. Symptoms include bloating, gas, nausea and diarrhea. Diseases affecting the pancreas, nervous system, immune system, liver and lungs. The inhabitants knew that drinking water contaminated with arsenic could be dangerous, so they helped clean up mining waste in the Shinca River - Peru [24, 25]. The frequency of macroinvertebrates with exposed gills and other traits suggesting sensitivity to fine sediments was lower at test sites compared to reference sites, corroborating the findings of Metal smothering and metal flocs, rather than metal toxicity, were responsible for the observed changes in macroinvertebrate populations at the different test sites. The impacts of metal pollution on living organisms are the only ones currently considered in regulations [26, 27]. However, our results show that the asphyxiating impact of metal flocs can have extremely harmful consequences for living beings.

The chemical dynamics of these metals and their mobility between water and soil resources are affected by climate, the water dynamics of the Shinca Creek reservoir system, and chemical inputs created by mining operations in the sub-basin and upstream of Shinca Creek. Therefore, lead can be introduced into drinking water through corrosion of lead-containing mining pipes, especially in locations with very acidic waters or waters with low mineral concentrations, which accelerate corrosion of pipes and fittings. According to Zamora et al. [28], UF can be used to treat wastewater if combined with pretreatment. Evaluation of domestic wastewater treatment by direct ultrafiltration with a submerged hollow fiber rotating module. This thesis proposes a pretreatment system that includes a screening chamber, a desander and an Imhoff tank. writes in his master thesis Wastewater Reuse that the results of BOD, COD and SS of the treated water are good, which is very advantageous to carry out a reuse project. beneficial in the context of golf course irrigation. This thesis achieves similar satisfactory and excellent results for reuse in irrigation. A comparable evaluation of the feasibility of membrane bioreactors for wastewater treatment in Colombia was performed.

Shinca Creek is home to a diverse range of businesses, including agriculture (primarily cattle, pig and poultry farming), manufacturing (primarily in the form of machinery and equipment) and services (primarily in the form of energy production, chemicals, footwear manufacturing and explosives R&D). A checklist was used to characterize the components that produce a potential influence once the resource quality and anthropogenic dynamics have been diagnosed, which will allow for future assessment of impacts on the Shinca-Peru stream. The main physicochemical parameters influenced by the activities in the research region on the water resource are the depletion of dissolved oxygen, the increase in chemical oxygen demand and cadmium and other heavy metals being present, lead, among others [29-31]. Organic matter, cation exchange capacity, cadmium and lead have been shown to have the greatest impacts, all of which are small to moderate in terms of their impact on the soil's ability to function as a resource. Cadmium and lead concentrations in sediments also change, as does the electrical conductivity of sediments. Soil is affected by a wide range of human activities, such as metallurgy and processing, chemical production, agricultural activities, electric power generation and distribution, and the exploitation of metallic and non-metallic natural resources [32-34].

The findings will be utilized to carry out comparable investigations in other rivers in Peru, including the Ticapampa and Huánuco mining tailings. In order to have access to water for farming, it is critical to restore the rivers. On the other side, we can utilize this information to better allocate funds to organizations working to combat water contamination, which will lead to more effective tactics for both human and agricultural usage.

Due to financial constraints, the study was unable to process all of the samples collected for the sampling method. Similarly, the supplier who conducted the analysis took an excessive amount of time to provide the results, limiting the study's ability to accurately determine mineral or other harmful substance levels. Lastly, the results can only be applied to comparable scenarios because the case study technique is scenario specific. Therefore, the results cannot be generalized.

5. CONCLUSIONS

In the results of the water monitoring stations at QISCA 01, QISCA 02 and QISCA 03, it can be seen that all the parameters analysed are in accordance with the ECAs for surface water. In the case of sampling point QISCA 04, which is a mining effluent, the values of (As=0.78, Cd=0.16, Cu=0.80, Zn=42.67) mg/l are above the limits established by D.S. 010-2010-MINAM. However, in the case of sampling point QISCA 05 (a mixture of surface water and mining effluent), the values (Cd=0.02Mn, Fe=10.51, Mn=11.60 and Zn=8.83) mg/l are above the ECA of the water. Furthermore, for the case of sampling point QISCA 06 (surface water), the Mn=4.26 mg/l is above the ECA of the water. Finally, for the case of sampling point QISCA 07 the water mixture is (Qisca 05 + Qisca 06) whose values are (Cd=0.05, Mn=14.10, Pb=0.12 and Zn=13. 94) mg/l, which are above the ECA of the water and are used by the inhabitants of the village of Ucru, for the cultivation of corn, potatoes, wheat, barley, avocado, alfalfa and vegetables, thus ignoring the quality of water used in these crops and other daily activities; It is, therefore, essential to carry out water treatment by active and/or passive methods in order to avoid the contamination of bread products and avoid the risk of generating any disease in the community members of the area and in any case eliminate the use of water from QISCA 04 and store surface water from QISCA 01, QISCA 02, QISCA 03 and QISCA 06 in reservoirs that can supply the 64 users of the irrigation committee who directly use them for agriculture and other activities for technician irrigation.

Communities, territorial entities, groups and companies play a role in protecting Shinca-Peru Creek, but more could be done to improve the quality of natural resources in the area. The longterm dangers of metals mobility from one resource to another are illustrated by the dynamics of these contaminants over time, with fluctuations in concentration driven by climatic behavior, resource use, own discharges, and upstream areas of the Shinca-Peru Creek.

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