Hot Springs of Damas, Quepos

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Introduction

The thermal source studied is located approximately in the Lambert coordinates 390.45 North, and 449.80 East, in the White River, about 400 meters toward the Northeast, before the intersection of the Blanco River with the Negro River (map).

Objectives:

- ✓ Analyze a sample of water taken in the field to identify their physical and chemical parameters.

- ✓ Make a flow capacity in the field to know the flow of this hot spring.

Methodology

In order to make this analysis, a sample of water was recollected in the field, taking their temperature and their degree of acidity in site for then be send to the AQYLASA laboratory, where was requested that they are made the pertinent tests to obtain the physical-chemical general parameters, besides sulfates and bacteriological analysis. Then these values were compared with the norms of drink capability of the CAPRE regional norm where Costa Rica is adscript and this way know if the water is drinkable and doesn't affect the human life. Beside also is made a classification of the thermal waters for their temperature and an explanation of their possible origin.

In the field a flow capacity of the hot spring was made to quantified their flow, using a recipient with a well-known volume, taking the required time then so that the recipient is filled.

Classification of the hot springs

Hot Springs

Most of the hot springs have an associate origin with the rains or precipitation, it has also been proven that the constituent chemical of the thermal waters were took of the minerals of the crossed rocks.

The thermal sources could be magmatic, that comes from the depths of the earth and that it contains metallic ions, or very radioactive, next to their high temperature. They could also be juvenile, that they are waters of resurgent sources of the underground circulation of infiltrated waters for cracks of the rocky layers or special porous lands, so are formed the geothermal water. Each type of thermal water depends on the depth and of the lands for which they cross and of the characteristics of the land where it arise.

Origin

In general form the origin of the thermal waters studied in Damas, Quepos could be described of the following way: the meteoric water infiltrates and in their underground flow is heated for the effect of the geothermic gradient or for any secondary source of heat that could be a magmatic body in way of cooling (figure 1).

The hot water is able to dissolve some components of the crossed rocks, load of mineral dissolved salts and return to the surface taking advantage of some zones of weakness of the bark how flaws or fractures (figure 1).

Classification of the thermo minerals waters

According to the temperature the thermal waters could classify like:

Classification	Temperature (°C)
Cold	less than 20°
Hypothermal	between 20 and 30°
Mesothermal	between 30 and 40°
Hyperthermal	More than 40°

The waters analyzed in the source Damas for their temperature of between 40 and 50°C is classified like Hyperthermal.

In the bottom table, they are observed the values of anions and cations that they were reported for the AQYILASA laboratory (see annexes):

Sample	**value**
pH	8.54
Color	0
Turbidity	1.22
Conductivity (ms)	3.15
Fenoftalein alkalinity (mg/ L)	12.0
Total alkalinity (mg/ L)	30.0
Carbonates (mg/ L)	24.0
Bicarbonates (mg/ L)	6.0
Total hardness (mg/ L)	567
Hardness of calcium (mg/ L)	554
Hardness of magnesium (mg/ L)	12.6
Calcium (mg/ L)	221.8
Magnesium (mg/ L)	3.0
Sulfatos (mg/ L)	0.9
Chlorides (mg/ L)	2.2
Total iron (mg/ L)	0.3
Sulfatos (mg/ L)	383

Next is an extract of the recommended norms by CAPRE (see annexes):

Parameter	Unit	Recommended Value	Maximum Acceptable Value
Color	Mg/ L	1	15
Turbidity	UNT	1	5
Chlorides		25	250
Conductivity	Us/cm	400	
Hardness	Mg/l	400	500
Sulfates	Mg/L	25	250
Calcium	Mg/L	100	
Magnesium	Mg/L	30	50
Iron	Mg/L	0.3	
Sulfures	Mg/L	0.05	

Analysis of the water sample of Damas, Quepos

The water source of Damas, Quepos presents high contents of sulfates, besides Calcium and Magnesium (table of Chemical Analysis reported by AQILASA), therefore is considered as **Sulfated calcic magnesic** (figure 2).

According to the table (Organoléptics Parameters) of the CAPRE regional norm (annexes) and the values reported in the chemical analysis, the parameters of **color**, and **turbidity** (0,0 mg/ L (pt-co) and 1.22 UNT respectively) are values considered as that they are below the maximum acceptable value, so there is no risk on the health of the customers.

According to the physical chemical parameters (table of the CAPRE regional norm) and the values reported in the analysis of laboratory, the parameters of **hardness**, **sulfates**, **calcium**, **conductivity**, and **temperature** (567, 383, 221.8 in mg/ L; 3.15 ms and 48ºC respectively) they don't adjust to the recommended values and they overcome the acceptable maximum, therefore risk for the health exists and they imply the taking of you work correctives, while the **Ph**, **magnesium** is considered as appropriate. The acidity (pH) depends on the concentration of the ions H^+ and OH^-. The pH of the pure water to 25°C is of 7.0.

The **Iron** parameter (0.30mg/ L) are inside the maximum acceptable value of the table (Parameters for Substances not wanted) of the CAPRE regional norm; there is no risk on the health of the customers, but the content of sulfurs is above the maximum acceptable value for what it is necessary to take correctives measures in order to diminish their content.

The content of total coliforms and fecal (less than 2/ 100ml) it is a value adapted in the bacteriological parameters of the CAPRE regional norm; is no risk on the health (see annexes).

Conclusions

The water sample in the thermal source located in the property of the Hot Springs Hotel in Damas Quepos is classified like Hiperthermal (between 40 and 50°C).

The water of Damas, Quepos is classified like **Sulfated calcic magnesic** for their chemical composition (figure 2).

According to the CAPRE regional norm (annexes) the parameters of color, turbidity, and iron is not inside the recommended value but if inside the maximum acceptable value, so, there is no risk on the health of the customers.

The values of pH, magnesium and iron are inside the recommended value.

The parameters of hardness, sulfates, calcium, conductivity, and temperature doesn't adjust to the recommended values and overcomes the acceptable maxima, therefore risk for the health exists and they imply the taking of you work correctives.

The same as the content of sulfurous is above the maximum acceptable value for what it is necessary to take measured correctives in order to diminish their content.

The content of total and fecal coliforms (less than 2/ 100ml) it is a value adapted in the bacteriological parameters of the CAPRE regional norm; don’t affect the heath.

The caudal capacity carried out ends of the month of April of the year 2001, gave 0.27 liters per second like a result.

Recommendations

After studying the results of the analysis of the AQYLASA laboratory to a sample of water of the thermal source located in the property of the Hot Springs Hotel in the Lambert coordinates 390.45 North, and 449.8

This is recommended:

Because the analysis gave concentrations of certain chemical elements and parameters physiques that are outside of the CAPRE regional norm in their document of 1994 like result: "Norms of Quality of the water for Human consumption," it is necessary return to sample the water of this thermal source in order to check the quality of this, keeping in mind the security for the human health.

As is well known the good results that give the treatments of thermal waters for certain illnesses or likings of the human beings how they are: Chronic inflammatory rheumatisms, chronic degenerative Rheumatisms Rheumatisms (sciatic, another) metabolic Rheumatisms (drop, another) Sequels of traumatisms, recoveries chronic affections of the apparatus breathing Affections of the skin (eczemas, dermatitis) and another. However it is necessary to keep in mind, that if the favorable indications are important, with but reason is it the contraindications. Because, given the exciting character and stimulant of these waters, it’s not always advisable their use in sharp phases, or buds of some illnesses, like: Gastric ulcers, Cardiopatics, severe Hypertension, Nefritis, asthmatic processes in crisis, Tuberculosis, Different types of tumors and cancer.

In the case that the interested agree in sample the waters, it must should take the necessary cares for the sample of the waters and their quick analysis for later study the possible correctives solutions.

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Annexes

Conversion of mg/ L to meq/ L for the triangle CO3=+ HCO3-; Cl- y SO4=

According to data of the sample of Damas, Quepos

Cl^- = 2.2 mg / L * 0.02821 = 0.06 meq / L

$SO_4^=$ = 383 mg / L * 0.02082 = 7.97 meq / L

$CO_3^=$ = 24 mg / L * 0.03333 = 0.80 meq / L

HCO_3^- = 6.0 mg / L * 0.01639 = 0.10 meq / L

Total = 8.93 meq / L

Calculation of percentages

Cl^- = 0.06 / 8.93 * 100 = 0.70 %

$SO_4^=$ = 7.97 / 8.93 * 100 = 89.3 %

$CO_3^=$ = 0.80 / 8.93 * 100 = 9.0 %

HCO_3^- = 0.10 / 8.93 * 100 = 1.1 %

$CO_3^=$ + HCO_3^- = 10%

Conversion of mg/ L to meq/ L for triangle CO3=+ HCO3-; Ca+2 + Mg+2 y SO4=

$SO_4^=$ = 383 mg / L * 0.02082 = 7.97 meq / L

Ca^{+2} = 221.8 mg / L * 0.04990 = 11.1 meq / L

Mg^{+2} = 3.0 mg / L * 0.08226 = 0.25 meq / L

Ca^{+2} + Mg^{+2} = 11.35 meq / L

$CO_3^=$ = 24 mg / L * 0.03333 = 0.80 meq / L

HCO_3^- = 6.0 mg / L * 0.01639 = 0.10 meq / L

Total = 20.22 meq / L

Calculation of percentages

$SO_4^=$ = 7.97 / 20.22 * 100 = 39.4 %

Ca^{+2} + Mg^{+2} = 11.35 / 20.22 * 100 = 56.1%

$CO_3^=$ + HCO_3^- = 0.9 / 20.22 * 100 = 4.5%