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THINK ABOUT OF PROPERTIES (P, Ρ, T) Of "KHACHMAZ" GEOTHERMAL WATER OF KHACHMAZ REGION

M. M. BASHIROV
Baku Engineering University, Hasan Aliyev str., 120, Khirdalan, AZ0102, Azerbaijan
mbashirov@beu.edu.az

N. D. NABIYEV
Baku Engineering University, Hasan Aliyev str., 120, Khirdalan, AZ0101, Azerbaijan
nnabiyev@beu.edu.az

N. S. RZAYEV
Baku Engineering University, Hasan Aliyev str., 120, Khirdalan, AZ0102, Azerbaijan
nrzayev@beu.edu.az

A. M. NAMAZOVA
Technical Humanitarian Lisey, Azerbaijan, Baku, Nasimi r, 20 January str.60, AZ 1102
aytan_namazova@yahoo.com

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ABSTRACT

The test research facility, in which the properties of warm water "Khachmaz" (p,ρ,T) in Khachmaz area, Examined was Azerbaijan which has air conditioning and a constant temperature of T=293.15 K.Data from various sources were compared with the re sults obtained for the watery arrangement of water, toluene, and NaCl (m=2.9666 1 mol·kg-1). The gotten comes about are displayed graphically within the figures. In article, the reliance of the thickness of Khachmaz warm water of the Khachmaz locale of Azerbaijan on the temperature of ρ/(kg · m-3) was measured within the high-precision temperature extend T = (278.15-468.15) in a tubular densimeter 5000M Anton-Paar DSA. Utilizing exploratory values at chosen temperatures, expository connections of warm water were set up. The gotten values are depicted by numerical conditions.

Presentation

Global initiatives are underway to decrease atmospheric carbon dioxide emissions. Significant measures are being implemented nationwide to address this issue. The Ministry of Industry and Energy was designated as the coordinator for executing the "State Program on the use of alternative and renewable energy sources in the Republic of Azerbaijan," as per the Presidential Decree dated October 21, 2004 1. This program outlines key strategies for harnessing the country's most efficient energy sources, including wind power, geothermal waters, solar energy, mountain rivers, water channels, and hydropower [1].

The republic's thermal water distribution zone, encompassing the entire Mesozoic layer, features both regional fractures and tectonically disturbed rock zones with complex, steeply falling crack systems. Water velocity is highest in primary drainage channels, where heat transfer to surrounding rocks is minimal, resulting in maximum water temperature. This phenomenon is also observed in highly fractured zones, as evidenced by geothermal source outputs in erosion depressions at the intersection of major suture zones [2].

The discharge zone's hydrogeological characteristics for thermal waters are directly influenced by rock fracturing and the nature of water-bearing formations. The prevalence and abundance of gryphons in natural outcrops indicate well-developed rifts.

This region's geothermal energy resources are particularly valuable. The area's diverse chemical composition, therapeutic properties, and favorable geographical location provide an excellent foundation for medical applications and extensive use across various sectors of the national economy [2,3].

1. The issue explanation and arrangement

The "Khachmaz" geothermal energy resource in this Azerbaijan's region underwent density measurements at atmospheric pressure using the DMA 5000M device, achieving 0.01% accuracy (superior to high-pressure measurements). This instrument enables precise measurements up to 363.15 K. The chemical composition of the Khachmaz thermal waters was analyzed using an IRIS Intrepid II Optical Emission Geomotograph with inductively coupled plasma atomic emission spectrometer 3,4. Results indicate that sodium (Na) is the predominant chemical element, comprising approximately 72.41 to 90.12% of all chemical substances in the "Khachmaz" thermal water of the Khachmaz region in Azerbaijan [3].

3. Dialog of the investigate work and it`s comes about:

The figures below demonstrate that the discrepancy between the newly acquired density measurements and previously published data falls within the estimated margin of error for this apparatus. Water that underwent double distillation was procured from various laboratory sources. Sodium chloride, methanol, and additional chemicals were acquired from the German company Merck. The outcomes consistently exhibited minimal variations and remained in close proximity to one another. This consistency serves as evidence of the high precision achieved by the newly developed experimental equipment. [3,4].

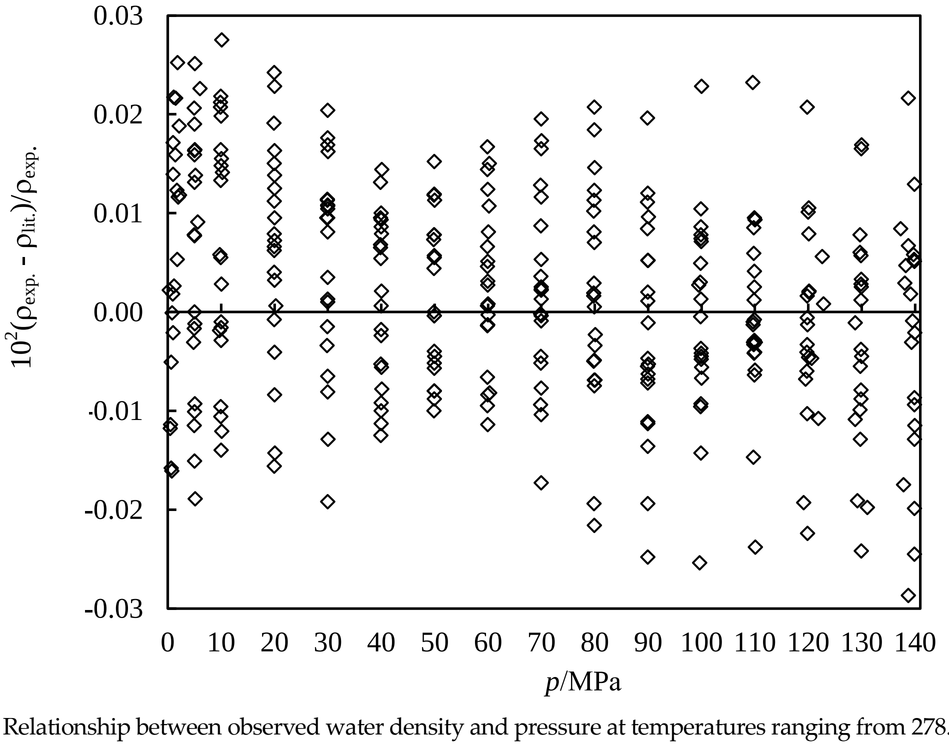

Fig1. Relationship between observed water density and pressure at temperatures ranging from 278.15 K to 468.15 K, and its deviation from IAPWS 95 3 reference data.

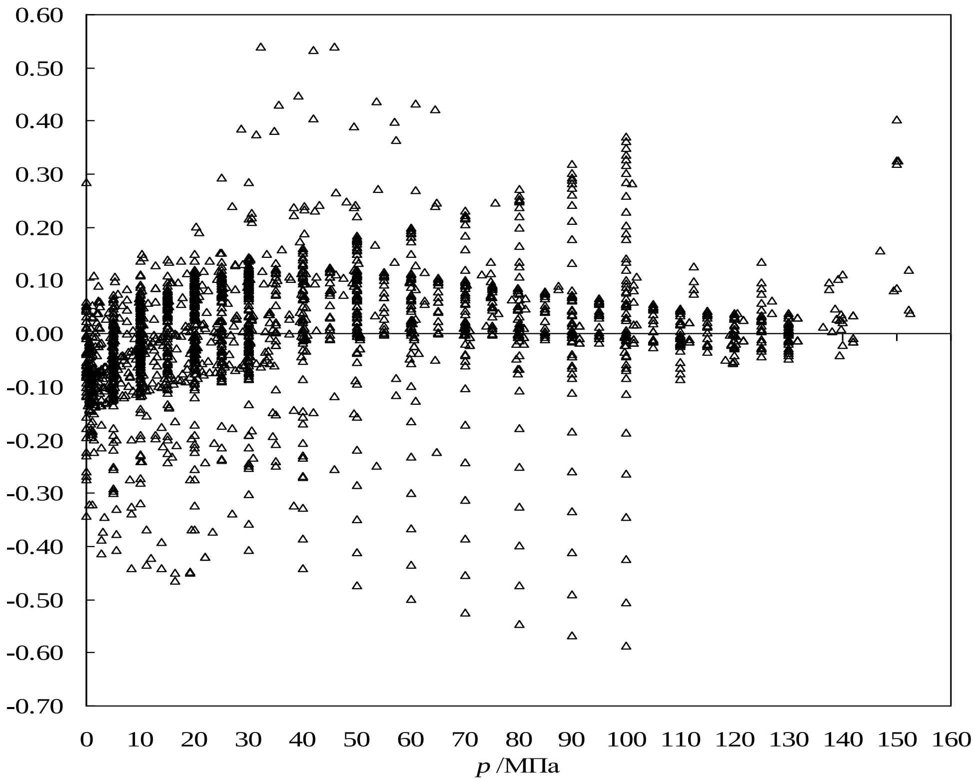

Fig. 2. Dependence of the measured density of toluene at temperature T = (278.15-468.15) K and its difference with data from various literature (data up to 2000) on pressure.

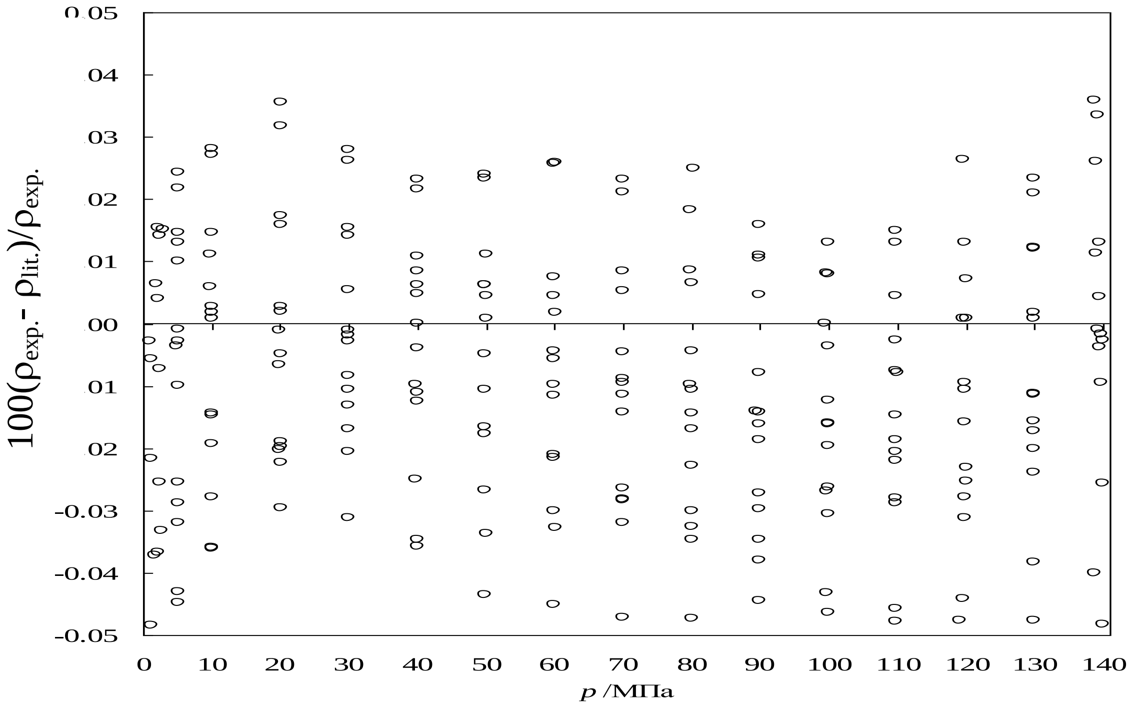

Fig. 3. Dependence of the measured density of an aqueous solution of NaCl (M=2.96661 mol·kg1) at temperature T= (278.15-468.15) K on pressure and differences with data from various literature (data up to 2000).

When calculating each agreement state's dependences (p, ϱ, and T), it was looked for to form as moo weight values as conceivable in arrange to get profoundly precise thickness values utilizing graphical extrapolation at barometrical weight, which were compared with the values of thickness measured on the DMA 4500 gadget. The information gotten by these diverse strategies are in great understanding inside ±0.02%. Each isotherm test was performed with weight interims of around 5 MPa. Investigates for all examined objects were conducted at temperatures beginning from T=(278.15÷373.15) K and weights up to p=40 MPa. The gotten test parameters (p, ϱ, T) are given in table1. [3, 4].

Table 1. Test values of the thickness of warm water "Khachmaz" in Khachmaz area, Azerbaijan at different weights and temperatures

$\frac{p}{MPa}$	$\frac{\rho}{kg \cdot m^3}$	$\frac{T}{K}$	$\frac{p}{MPa}$	$\frac{\rho}{kg \cdot m^3}$	$\frac{T}{K}$
0.624	1004.04	278.15	1.160	989.32	328.02
5.004	1006.21	278.15	5.024	990.99	328.04
10.023	1008.65	278.16	10.079	993.00	328.17
15.012	1011.05	278.15	15.576	995.38	328.18
20.035	1013.43	278.14	19.985	997.22	328.19
25.036	1015.76	278.15	25.527	999.61	328.17
30.054	1018.07	278.15	30.023	1001.50	328.14
35.124	1020.37	278.14	35.513	1003.58	328.12
40.021	1022.56	278.15	39.978	1005.37	328.06
0.539	1002.59	288.14	0.846	981.22	343.15
5.006	1004.66	288.16	5.097	983.06	343.16
9.855	1006.87	288.17	9.967	985.17	343.14
15.151	1009.25	288.17	15.525	987.55	343.15
20.064	1011.43	288.17	20.000	989.45	343.15
25.121	1013.64	288.16	25.586	991.82	343.14
30.103	1015.79	288.16	30.045	993.68	343.16
35.111	1017.92	288.16	35.514	995.98	343.15
40.145	1020.04	288.15	40.050	997.87	343.15
1.025	1000.15	298.27	0.846	974.29	354.24
5.079	1002.02	298.22	5.097	976.23	354.25
9.818	1004.22	298.22	9.967	978.33	354.27
15.593	1006.61	298.17	15.525	980.63	354.27
20.018	1008.46	298.13	20.000	982.58	354.27
25.104	1010.69	298.13	25.586	984.92	354.27
30.155	1012.85	298.12	30.045	986.83	354.28
35.089	1014.82	298.13	35.514	989.17	354.27
40.040	1016.88	298.13	40.050	991.07	354.27
0.898	995.52	313.08	1.626	962.02	372.90
4.995	997.25	313.10	5.059	963.59	372.90
9.972	999.20	313.15	10.042	965.73	372.96
15.563	1001.65	313.17	15.525	968.08	372.97
20.008	1003.42	313.20	20.014	970.00	372.99
25.534	1005.80	313.18	25.596	972.31	373.00
30.057	1007.65	313.19	30.001	974.44	372.90
35.586	1009.82	313.17	35.576	976.79	372.91
39.970	1011.52	313.15	40.013	978.53	372.92

Isotherms are plotted in p-ϱ arranges within the weight extend of 0,1-40 MPa (Figure 4).

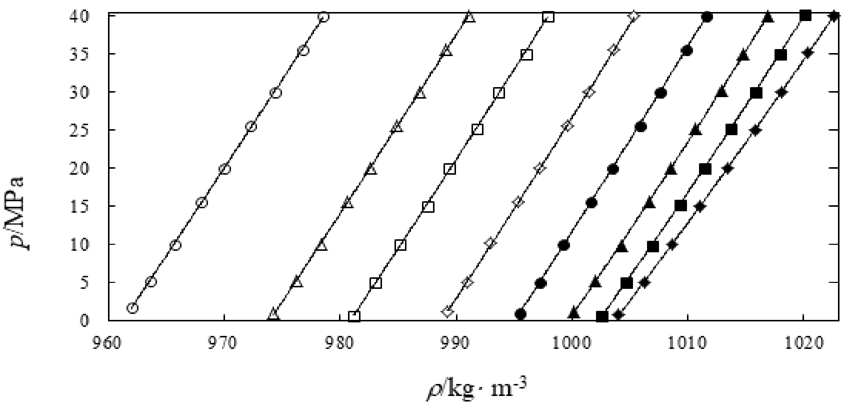

Fig. 4. Reliance of weight (p) on thickness (ϱ) of warm water "Khachmaz" in the same locale, Azerbaijan, calculated agreeing to equations1-2: ♦, 278,15 K; ■, 288,16 K; ▲, 298,17 K; •, 313,18 K; ◊, 328,18 K;□, 343,15 K; Δ, 354,27 K; ○, 372,96 K.

The DMA of the thermal water under study was measured with a 5000M density meter. The mentioned device makes it possible to carry out measurements at temperatures up to T = 363.15 K. The results obtained are recorded using the following formulas [5]:

$$p = A\rho^2 + B\rho^8 + C\rho^{12} \qquad (1)$$

The use of the Akhundov-Imanov formula of Azerbaijani scientists reduces the measurement error to $\Delta\varrho/\varrho=\pm(0.002\div0.004)\%$. The coefficients A(T), B(T) and C(T) depend polynomially on temperature:

$$A(T) = \sum_{i=1}^{3} a_i T^i,\ B(T) = \sum_{i=0}^{2} b_i T^i,\ C(T) = \sum_{i=0}^{2} c_i T^i \qquad (2)$$

The values of the coefficients a_{ij}, b_{ij} və c_{ij} in equation (2) are given in table 2.

Table 2.

a_1= -3.9409326	b_0= 8245.9457814	c_0= -6498.34719856
a_2= 0.028469201	b_1= -55.5978423	c_1= 44.49657812795
a_3= -0. 3472496358·10^{-4}	b_2= 0.043887215947	c_2= -0.06724687932

Condition (1) enables it possible to type in down the experimental values of the dependency on warm water "Khachmaz" (p, ϱ, T) with a normal blunder of 0.006%, taking into account the n umbers of the integrals A(T), B(T) and C(T).

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