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جامعة المرقب

العدد التاسع عشر
يوليو 2021م

هيئة تحرير
مجلة التربوي

- المجلة ترحب بما يرد عليها من أبحاث وعلى استعداد لنشرها بعد التحكيم .
 - المجلة تحترم كل الاحترام آراء المحكمين وتعمل بمقتضاها .
 - كافة الآراء والأفكار المنشورة تعبر عن آراء أصحابها ولا تتحمل المجلة تبعاتها .
 - يتحمل الباحث مسؤولية الأمانة العلمية وهو المسؤول عما ينشر له .
 - البحوث المقدمة للنشر لا ترد لأصحابها نشرت أو لم تنشر .
- (حقوق الطبع محفوظة للكلية)



ضوابط النشر:

- يشترط في البحوث العلمية المقدمة للنشر أن يراعى فيها ما يأتي :
- أصول البحث العلمي وقواعده .
 - ألا تكون المادة العلمية قد سبق نشرها أو كانت جزءا من رسالة علمية .
 - يرفق بالبحث تزكية لغوية وفق أنموذج معد .
 - تعدل البحوث المقبولة وتصحح وفق ما يراه المحكمون .
 - التزام الباحث بالضوابط التي وضعتها المجلة من عدد الصفحات ، ونوع الخط ورقمه ، والفترات الزمنية الممنوحة للتعديل ، وما يستجد من ضوابط تضعها المجلة مستقبلا .

تنبيهات :

- للمجلة الحق في تعديل البحث أو طلب تعديله أو رفضه .
- يخضع البحث في النشر لأولويات المجلة وسياستها .
- البحوث المنشورة تعبر عن وجهة نظر أصحابها ، ولا تعبر عن وجهة نظر المجلة .

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Comparison of Different Indicators for Groundwater Contamination by Seawater Intrusion on the Khoms city, Libya

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الملخص

ثم اختيار عدد عشرة عينات من الشرق الي الغرب في اتجاه المجاور للبحر وعدد تسعة ابار من الشمال الي الجنوب في اتجاه عمودي من البحر لعدد من ابار المياه الجوفية بمنطقة الخمس الواقعة بالشمال الغربي من ليبيا وتم اخذ العينات لمدة ثلاثة اشهر متتالية من نفس البئر وخضعت للتحاليل الفيزيائية والكيميائية

وعند مقارنة النتائج المتحصل عليها من عينات المأخوذة باتجاه الشرق الي الغرب باتجاه المجاور للبحر مع نتائج الشمال الي الجنوب باتجاه عمودي من البحر لوحظ بان المتغيرات الكيميائية التي تتضمن الحموضة والاملاح الكلية الذائبة والكلوريد والكبريتات والبيكربونات والنترات والصدويوم والبوتاسيوم والماغنيسيوم والكالسيوم تتميز بارتفاع لبعض الكاتيونات والانيونات وخصوصا في الابار القريبة من البحر في الاتجاه المجاور للبحر.

ABSTRACT

Ten wells were chosen in east-west trend and nine wells were chosen in north south of ground water well samples at AL- Khoms region north west of libya. . Water sampling was done on a monthly basis for three months starting from April till June. The study covered the average analysis of physical and chemical parameters.

When the present result are comprised east-west trend with the vertical trend, number of ten ground water samples at the east-west trend and nine ground water samples at the nor-west trend were analyzed for th eir chemical characteristics including pH, total dissolved solids (TDS), chloride, sulphate, bicarbonate,nitrate, sodium, potassium, magnesium and calcium content. High concentrations of some cations and anions were observed specialty in wells near the sea at the east-west trend. An over-reliance on ground water to meet an ever-increasing water demand has resulted in an excessive depletion of the fresh ground water stock and the situation is being exacerbated by seawater intrusion.

KEYWORDS: Libya, ground water, seawater, intrusion, salinity.



INTRODUCTION

Sea water intrusion into coastal aquifers leads to impairment of the quality of the fresh water aquifers. The extent of saline water intrusion is influenced by nature of geological settings, hydraulic gradient, rate of groundwater withdrawal and its recharge [1-3].

The intrusion of seawater to groundwater system has recently emerged as a serious problem damaging ground water systems, in Libya. This problem is triggered by the compulsive consumption of ground water in domestic, agricultural, and industrial applications, [4-7]. Seawater intrusion (or salt-water intrusion) is the underground flow of seawater into freshwater wells and aquifers. Seawater intrusion is limited to aquifers where groundwater and seawater are in hydraulic continuity. Freshwater has lower density than Seawater and floats on top of it. The interface between the two bulks is not distinctive boarder; it is a mixture of fresh and salt water (saline water). The shape of the interface is established by the hydrodynamic balance along the contact plan. This interface has an inclination towards land and its toe intersects with the bottom of the aquifer [8-11].

MATERIALS AND METHODS

Study Area:

This work was carried out at khoms district which has 20 km coastal stretch on the south shoreline of the Mediterranean sea, It is bounded by Wadi Libda from the northwest, and Wadi Kaam from southeast and googase region from southeast. Ten wells were chosen in east-west trend and nine wells were chosen in north-south trend The wells between latitudes 32o 22` and 32o 37` N and longitudes 14o 11` and 14o 26` E. Water sampling was done on a monthly basis for three months starting from April till June 2012. To monitor the existing study, we obtain map of the area under investigation. Fig(1) shows the area that covered by our study, which was obtained from Google.



Fig(1):Map of the area under consideration.



Experimental work:

Fifty seven groundwater samples were collected from 19 wells, water was sampled on a monthly basis, during three months starting from April till June. 57 samples were taken from Khoms city from different sits, the pH were measured for Water samples using pH-meter type HANNA model HI8014, and electric conductivity E C values were measured using E C meter model 4520. The total dissolved solids (TDS) were weighted after sample evaporation. Chloride, carbonate, sulphate bicarbonate, calcium and magnesium were determined according to Adams[1990], while sodium and potassium were measured by using flame photometer type JENWAY model PFP7, Phosphide ion were measured by UV Visible Spectrophotometer from varian Company, USA, at wavelength 400nm using Planck detector.

RESULTS AND DISCUSSION:

- Statistical analysis of wells samples three months at the vertical trend and the horizontal trend.

Table (1): Results of wells samples three months at the vertical trend and the horizontal trend

Sample collection period months at the vertical trend and the horizontal trend									
		the horizontal trend				the vertical trend			
TEST	Unit	Average	Std.Deviation ±	Minimum	Maximum	Average	Std.Deviation ±	Minimum	Maximum
TDS	ppm	4229	1692.2	2222	8975	2709	854.74	1425	4788
Cl ⁻	ppm	1465.2	695.8	701.5	3305.1	744.2	388.1	46	1753.7
SO ₄ ²⁻	ppm	1018.8	494.7	408.7	2304.5	607.8	222.26	232	1225.4
HCO ₃ ⁻	ppm	393.6	119.3	235.5	756.4	286.4	35.4	252	351.4
Na ⁺	ppm	909.1	421.2	424.2	2110.8	566.8	244.9	32	1133
K ⁺	ppm	19.19	8.5	7.9	51.6	12.5	3.9	5.8	21.2
TH		1586	802	842	3780	925	193.9	654	1330
Mg ²⁺	ppm	246.8	167.7	81.9	674.6	113.4	42.4	49.9	204.8
Ca ²⁺	ppm	184.7	21.1	131.4	213.3	189.8	15.15	152.4	222.9
pH	----	7.4	0.23	6.9	7.8	7.7	0.271	7.19	8.18
P ₃ ⁻	ppm	0.791	0.792	0.019	2.926	1.29	3.49	0.013	14.26
PO ₄ ³⁻	ppm	2.4	2.5	0.05	8.9	3.9	8.9	0.2	43.7
Salinity	ppm	3.4	1.43	1.7	6.6	2.1	0.79	1.1	3.8
E.C	ms/cm	6009	2508.9	1260	12070	4064	1273.57	2530	7000

*All concentrations are measured in ppm, pH unit, electrical conductivity in μ S/cm



Total dissolved solids

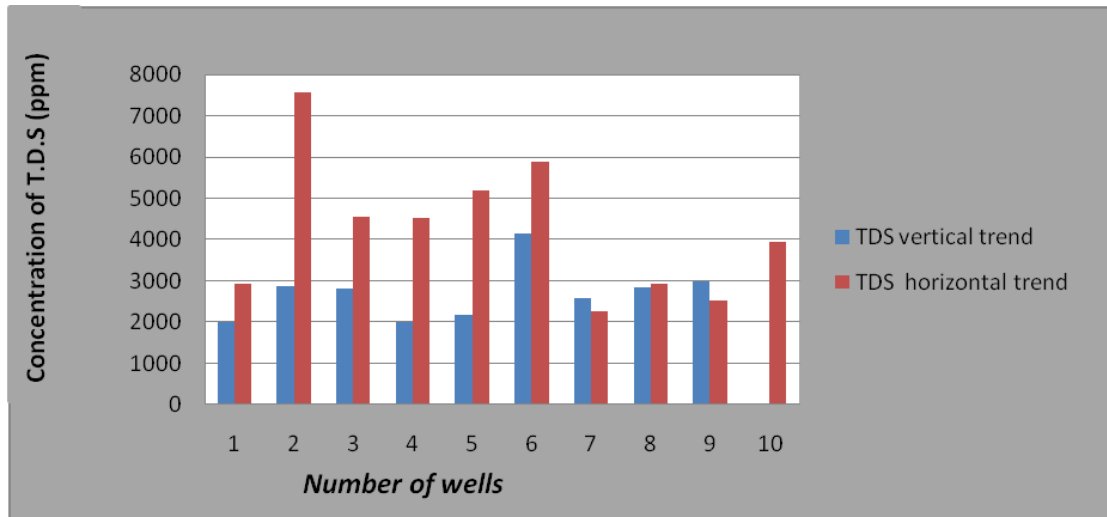


Fig (2): Shows T.D.S values for all water samples

Figure 28 shows the TDS value in the area's ground water. TDS concentration varied between (8975-2222)ppm landward of the study area in vertical trend, (4788-1592)ppm, near the Mediterranean Sea in horizontal trend and The concentration of TDS content indicates a gradual decrease in TDS concentration landward.

Comparing the horizontal trend TDS values with the vertical trend TDS values, TDS content increased significantly through the horizontal trend (4788-1592)ppm. This could be attributed to seawater intrusion that is triggered by the increased consumption of ground water and near the Mediterranean Sea in horizontal trend.

Chloride Ion

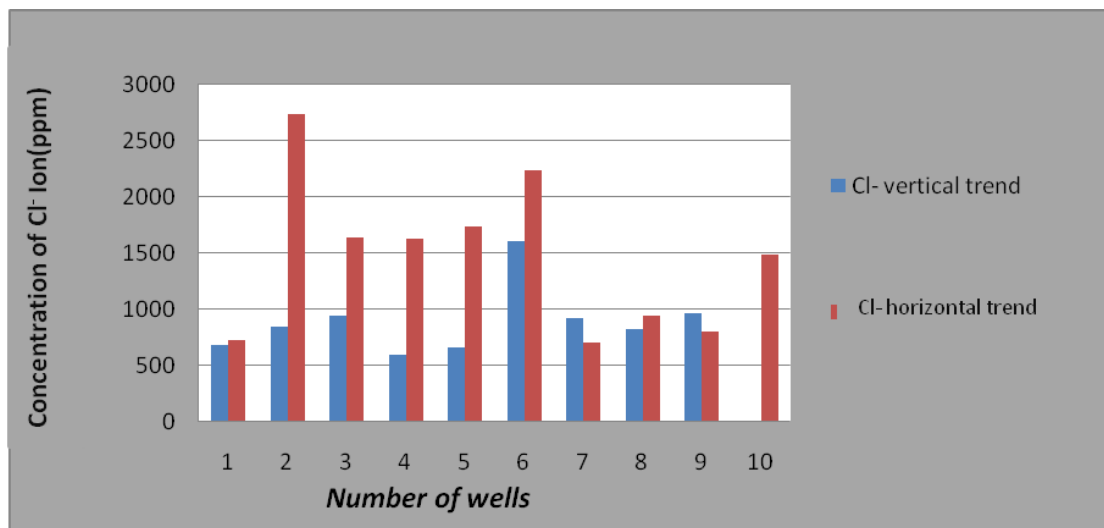


Fig (3): Shows Chloride ion concentration for all water samples Shows



The variation of chloride content is represented in Figure 29 It has a similar profile to that of TDS. It shows that, chloride concentration varies between (3305.1-701.5) ppm landward of the study area in vertical trend and (1753.7-50.9)ppm near the Mediterranean Sea in the horizontal trend. The horizontal trend chloride value (3305.1-701.5)ppm is much higher than the vertical trend chloride value (1753.7-50.9)ppm . Which due to wells located far from coast and depth of the study area in the vertical trend.

Sulphate Ion

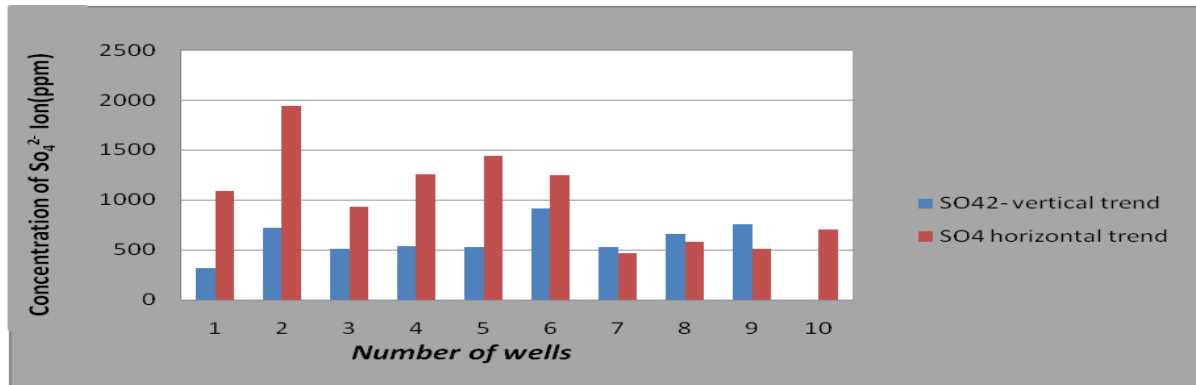


Fig (4): Shows Sulphate ion Concentration for all water samples

Sulphate constitutes the second predominant anion after chloride and varies in content between (2304.5-408.7) ppm near the Mediterranean Sea in the horizontal trend . and (1225.4-257.4)ppm landward in vertical trend of the study area (Table3 & Fig 30). sulphate enrichment is associated with TDS rise. The The horizontal trend sulphate content (2304.5-408.7) ppm is much higher than the vertical trend sulphate content(1225.4-257.4)ppm.

Bicarbonate Ion

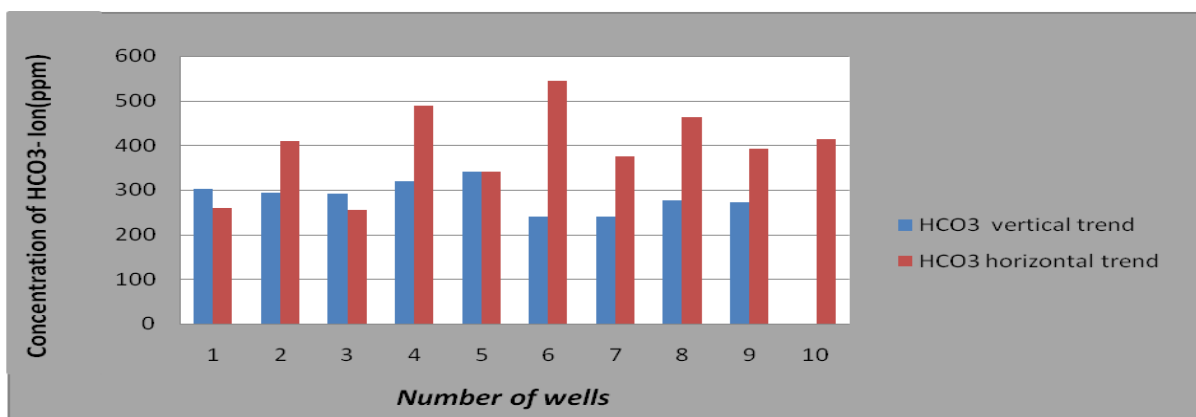


Fig (5): Shows Bicarbonate ion concentration for all water samples

The studied water wells show low contents of bicarbonate and lack carbonate ion. Bicarbonate concentration ranges between (756.4-235.5)ppm at the horizontal trend of the study area and (351.4-229.4)ppm at the vertical trend (Table 3 & Fig 31). The higher value of bicarbonate content at the horizontal trend of the study area may be attributed to local calcareous water bearing sediments.



Sodium Ion

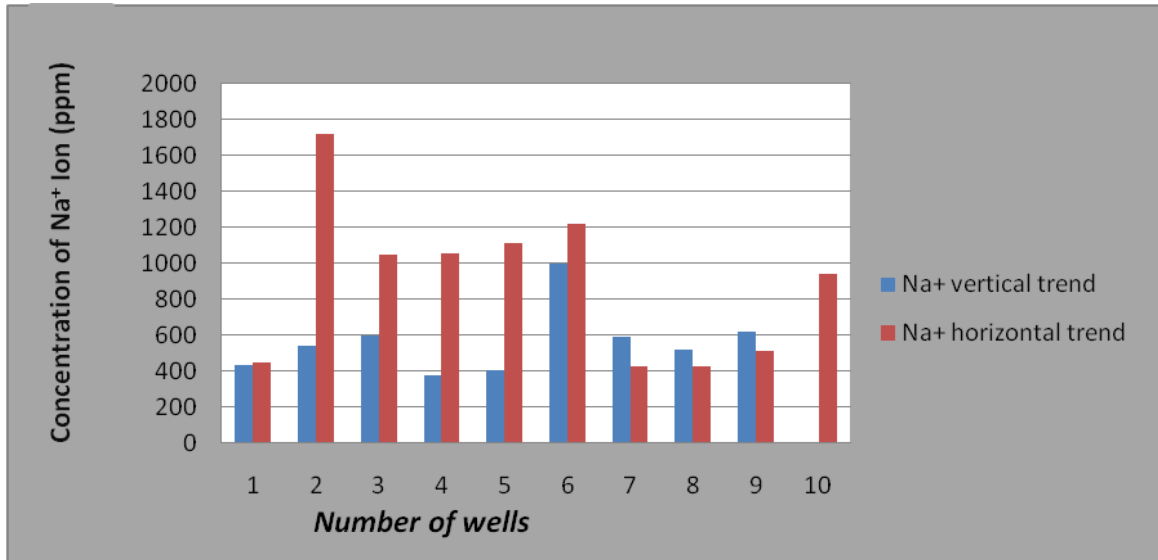


Fig (6): Shows Na⁺ values for all water samples

Sodium concentration ranges between (2110.8-424.2)ppm near the Mediterranean Sea in the horizontal trend and (1133-30.8)ppm at the vertical trend of the study area (Table 3 & Fig 32). figure of sodium content shows a gradual decrease landward (Fig 32). The horizontal trend sodium content is higher than the vertical trend (1133-30.8)ppm. which is wells located far from coast and depth at the vertical trend of the study area.

Potassium Ion

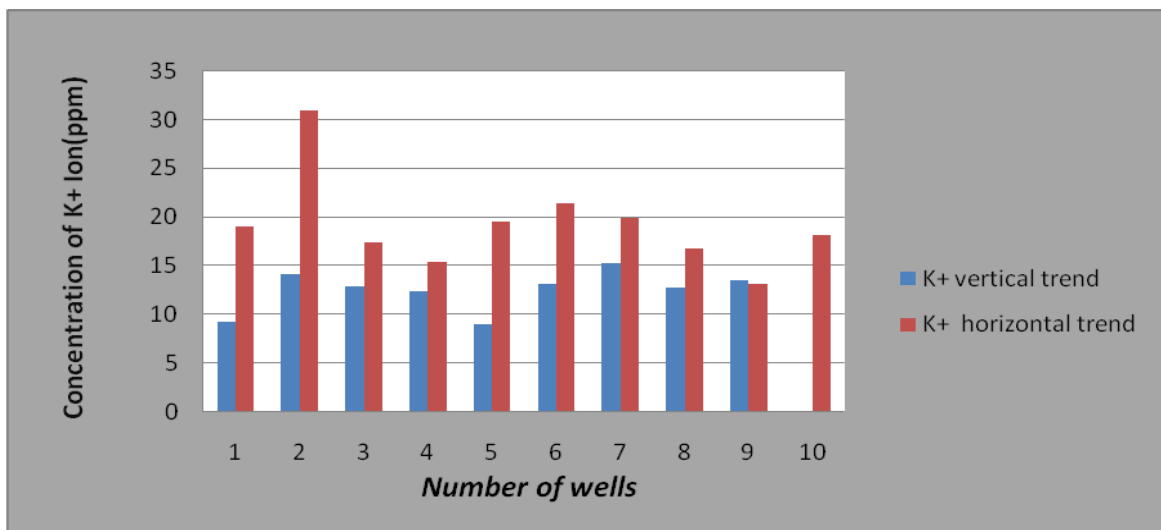


Fig (7): Shows Concentration Potassium Ion for all water samples

Potassium content is generally lower than that of sodium. The potassium content ranges between (51.6-7.9)ppm30.93 ppm near the Mediterranean Sea at the horizontal trend and



(21.2-5.8)ppm at the vertical trend of the study area (Table 3 & Fig 33). Generally, potassium content is rather similar to that of sodium content (Figs 32 and 33) .

Magnesium Ion

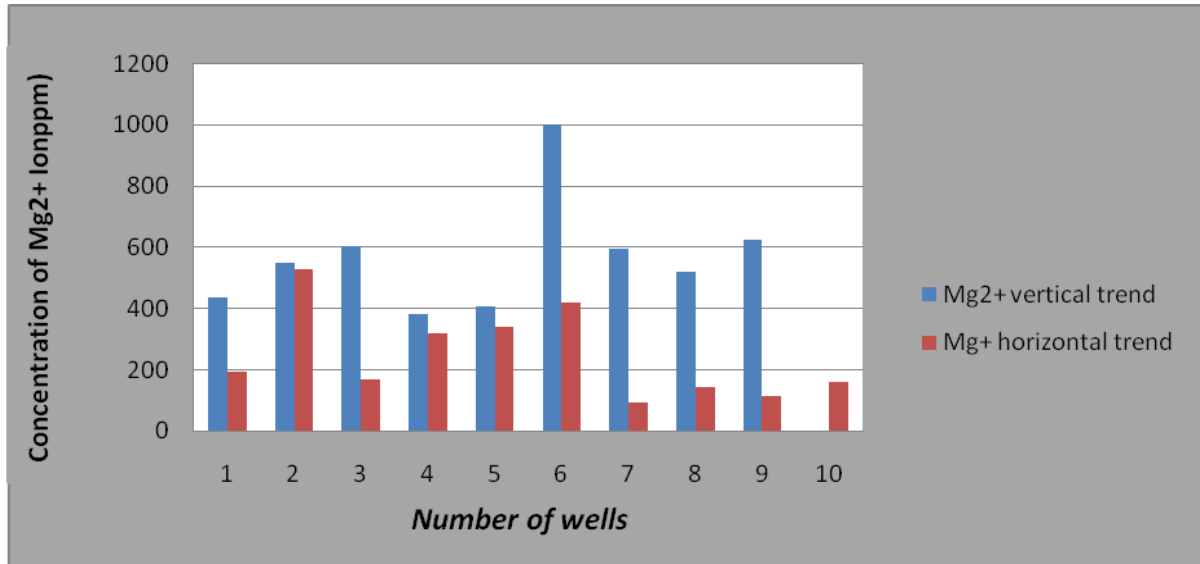


Fig (8): Shows Concentration of Mg⁺² ion for all water samples Shows

Magnesium content varies between (674.6-81.9)ppm near the Mediterranean Sea at the horizontal trend and (204.8-49.9) ppm at the vertical trend of the study area (Table 3 & Fig 34).

Calcium Ion

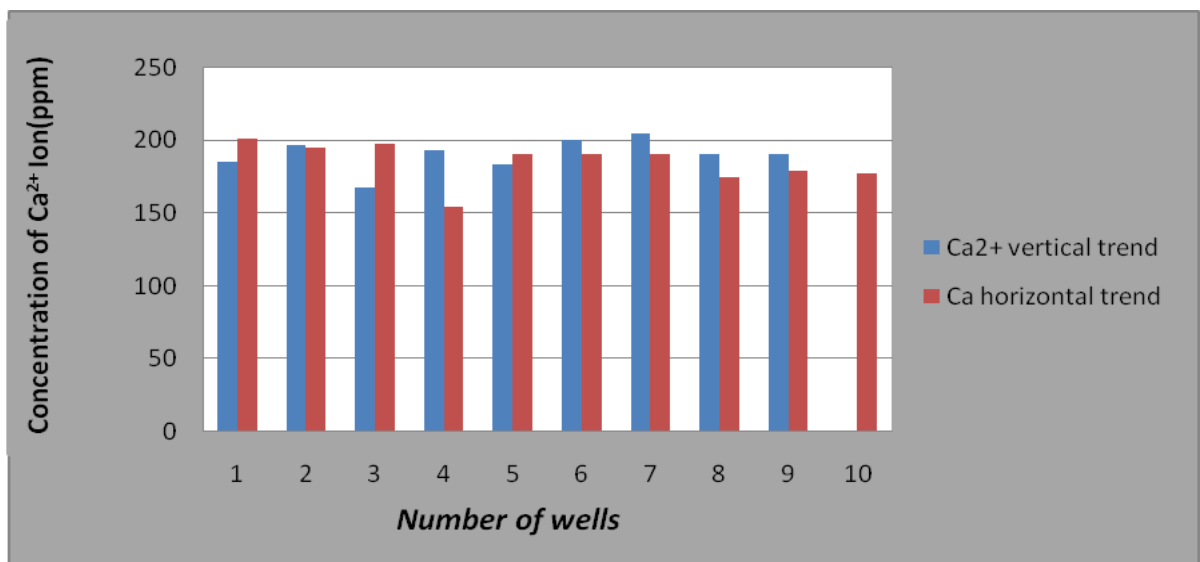


Fig (9): Shows Calcium ion concentration for all water samples Shows

Calcium content varies between (213.3-131.4)ppm near the Mediterranean Sea at the horizontal trend and (222.9-152.4)ppm at the vertical trend of the study area Table (3). The figure of calcium content shows decrease in calcium content toward the Mediterranean Sea



Fig (35). This may give an indication about its source mainly from the land. The high values of calcium may be related to the lithology of water-bearing sediments and surface calcareous materials which is dominant along the study area.

Acidity and basity of samples (PH-Value)

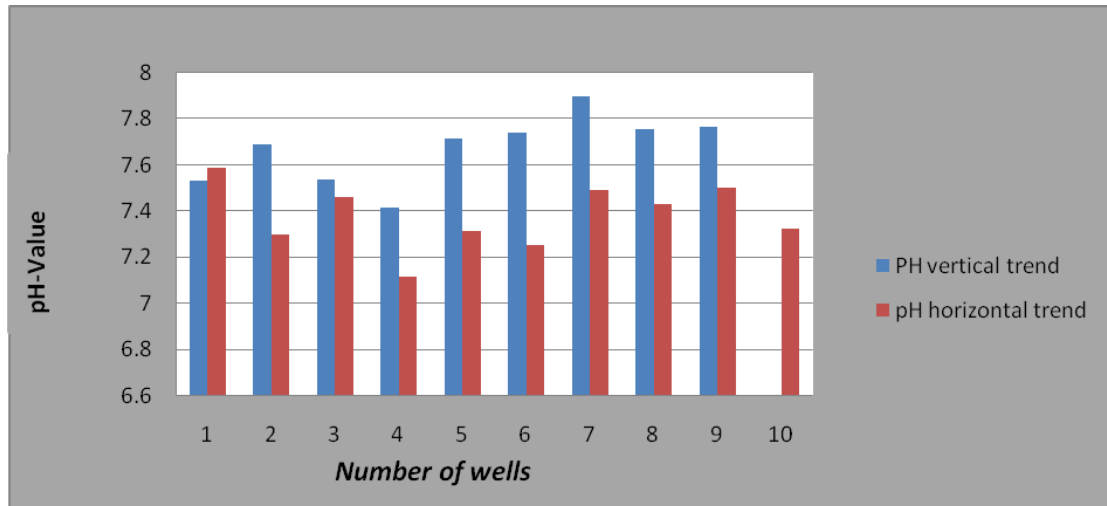


Fig (10): Fig (3.1.4): Shows pH values for all water samples

The pH values of the collected samples range between 7.8-6.9 at the horizontal trend and 8.18-7.19 at the vertical trend of the study area (Table 3). The pH values across the study area Fig 36 indicate that, the ground water is dominantly alkaline and becomes acidic near the Mediterranean Sea at the horizontal trend. This may give indication that, the TDS is not the single factor affecting the pH value of the studied ground water and may be attributed to the recharging of the ground water by rainfall, which is relatively high in the study area.

Electrical Conductivity(EC)

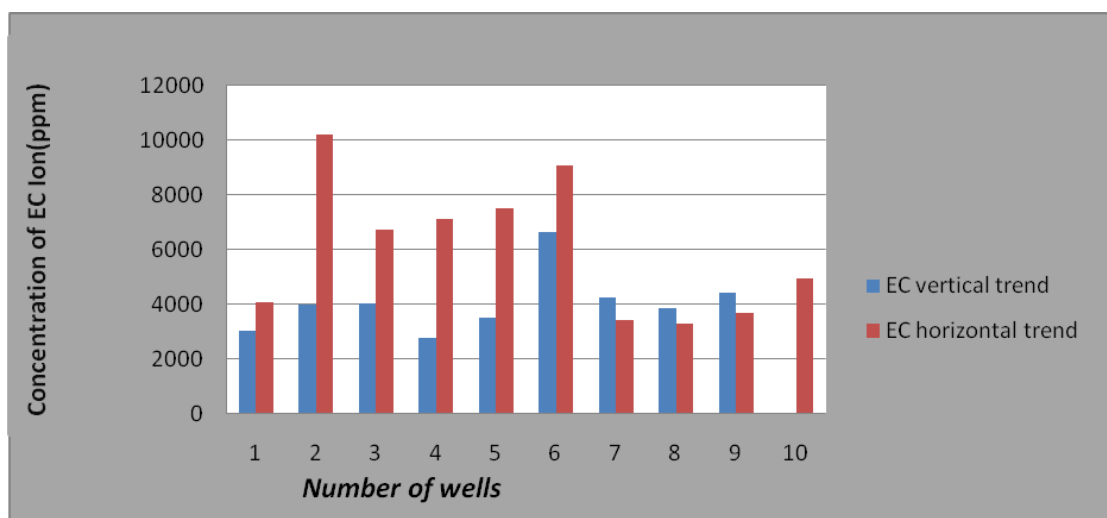


Fig (11): Shows EC values for all water samples



E.C values are listed in table 3 and their values across the study area is shown in Fig 37. The ground water show high E.C values ranging between (12070-1260) $\mu\text{S}/\text{cm}$, near the Mediterranean Sea at the horizontal trend, and (7000-2530) $\mu\text{S}/\text{cm}$ at the vertical trend of the study area.

Phosphide ion

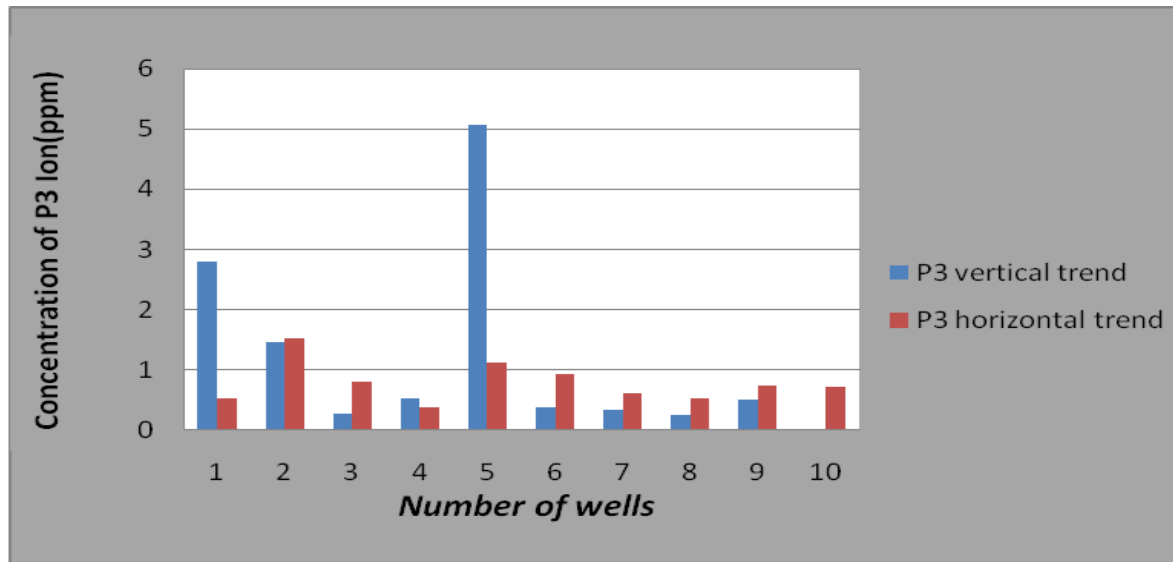


Fig (12): Phosphide ion content varies between (2.926-0.019)ppm near the Mediterranean Sea at the horizontal trend and (14.26-0.013)ppm at the vertical trend of the study area (Table 3 & Fig 38).

Phosphate ion

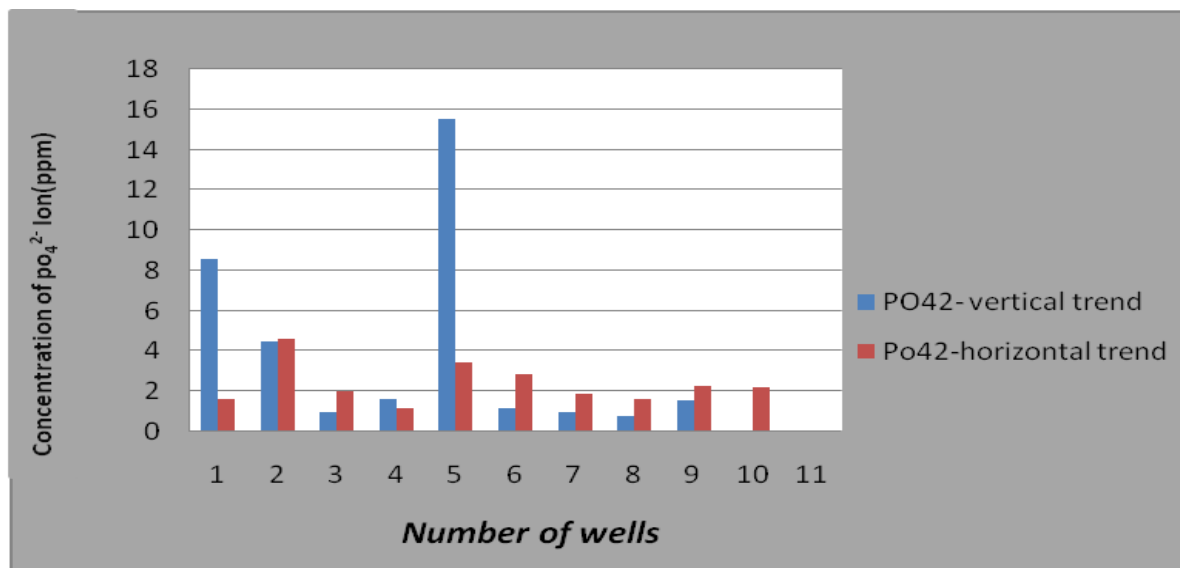


Fig (13): Phosphate ion content varies between (8.9-0.05)ppm near the Mediterranean Sea at the horizontal trend and (43.7-0.2)ppm at the vertical trend of the study area (Table 3 & Fig 39). Since it is calculated from P_3^- .



salinity

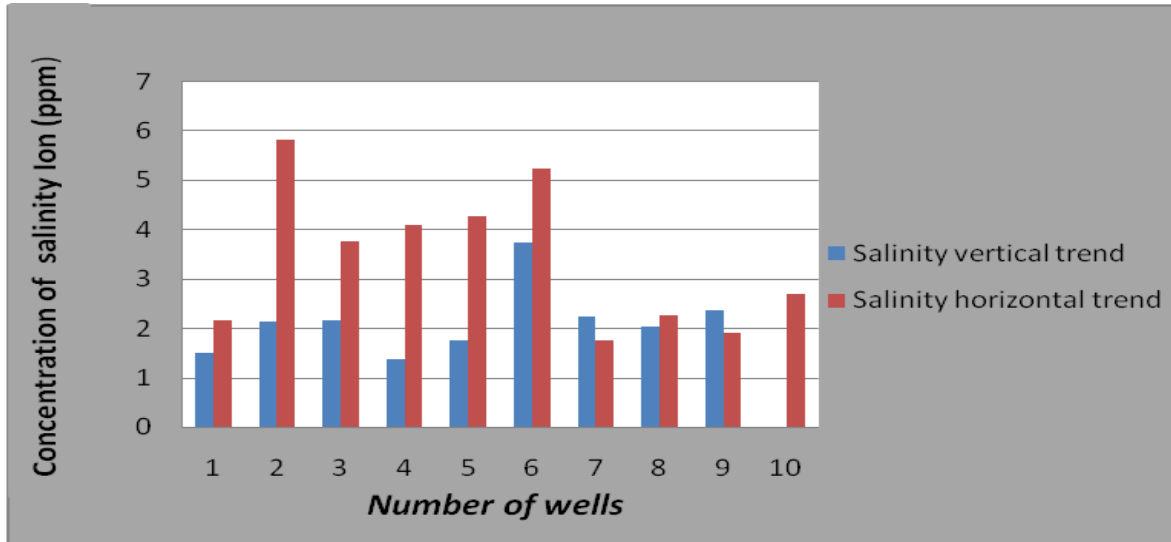


Figure 14: PO_4^{3-} value showed also an increasing trend during the whole period of observation at the horizontal trend of the study area.

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الفهرس

الصفحة	اسم الباحث	عنوان البحث	ر.ت
1-23	يونس يوسف أبونايجي	وضع الضاهر موضع الضمير ودلالته على المعنى عند المفسرين	1
24-51	محمد خليفة صالح خليفة محمود الجداوي	دراسة استقصائية حول مساهمة تقنية المعلومات والاتصالات في نشر ثقافة الشفافية ومحاربة الفساد	2
52-70	Ebtisam Ali Haribash	An Interactive GUESS Method for Solving Nonlinear Constrained Multi-Objective Optimization Problem	3
71-105	احمد علي الهادي الحويج احمد محمد سليم معوال	العوامل الخمسة الكبرى للشخصية وعلاقتها بالذكاء الوجداني لدى طلبة مرحلة التعليم الثانوي	4
106-135	محمد عبد السلام دخيل	في المجتمع الليبي التحضر وانعكاساته على الحياة الاجتماعية "دراسة ميدانية في مدينة الخمس"	5
136-158	سالم فرج زويبيك	الاستعارة التهكمية في القرآن الكريم	6
159-173	أسماء جمعة القلعي	دور الرياضات العملية الصوفية في تهذيب السلوك	7
174-183	S. M. Amsheri N. A. Abouthferah	On Coefficient Bounds for Certain Classes of Analytic Functions	8
184-191	N. S. Abdanabi	Fibrewise Separation axioms in Fibrewise Topological Group	9
192-211	Samah Taleb Mohammed	Investigating Writing Errors Made by Third Year Students at the Faculty of Education El-Mergib University	10
212-221	Omar Ali Aleyan Eissa Husen Muftah AL remali	SOLVE NONLINEAR HEAT EQUATION BY ADOMIAN DECOMPOSITION METHOD [ADM]	11
222-233	حسن احمد قرقد عبدالباسط محمد قريصة مصطفى الطويل	قياس تركيز بعض العناصر الثقيلة في المياه الجوفية لمدينة مصراته	12
234-244	ربيعة عبد الله الشبير عائشة أحمد عامر عبير مصطفى الهصيك	تعادم الدوال الكروية المناظرة لقيم ذاتية على سطح الكرة	13
245-255	Khadiga Ali Arwini Entisar Othman Laghah	λ -Generalizations And g - Generalizations	14



256-284	خيري عبدالسلام حسين كليب عبدالسلام بشير اشتيوي بشير ناصر مختار كصارة	Impact of Information Technology on Supply Chain management	15
285-294	Salem H. Almadhun, Salem M. Aldeep, Aimen M. Rmis, Khairia Abdulsalam Amer	Examination of 4G (LTE) Wireless Network	16
295-317	نور الدين سالم فريوع	التجربة الجمالية لدى موريس ميرلوبوتي	17
318-326	ليلى منصور عطية الغويج هدى على التقبي	Effect cinnamon plant on liver of rats treated with trichloroethylene	18
327-338	Fuzi Mohamed Fartas Naser Ramdan Amaizah Ramdan Ali Aldomani Husamaldin Abdualmawla Gahit	Qualitative Analysis of Aliphatic Organic Compounds in Atmospheric Particulates and their Possible Sources using Gas Chromatography Mass Spectrometry	19
339-346	E. G. Sabra A. H. EL- Rifae	Parametric Tension on the Differential Equation	20
347-353	Amna Mohamed Abdelgader Ahmed	Totally Semi-open Functions in Topological Spaces	21
354-376	زينب إمام أبو راس حواء بشير بالنور	كتاب الخصائص لابن جني دراسة بعض مواضع الحذف من ت"392" المسمى: باب في شجاعة العربية	22
377-386	لطيفة محمد الدالي	Least-Squares Line	23
387-397	نادية محمد الدالي ايمان احمد اخميرة	THEORETICAL RESEARCH ON AI TECHNOLOGIES FOR LEARNING SYSEM	24
398-409	Ibrahim A. Saleh Tarek M. Fayez Mustafah M. A. Ahmad	Influence of annealing and Hydrogen content on structural and optoelectronic properties of Nano-multilayers of a-Si:H/a-Ge: H used in Solar Cells	25
410-421	أسماء محمد الحبشي	The learners' preferences of oral corrective feedback techniques	26
422-459	أمينة محمد العكاشي ربيعة عثمان عبد الجليل عفاف محمد بالحاج فتحية علي جعفر	التقدير الإيجابي المسبق لفاعلية الذات ودوره في التغلب على مصادر الضغوط النفسية " دراسة تحليلية "	27



460-481	Aisha Mohammed Ageal Najat Mohammed Jaber	English Pronunciation problems Encountered by Libyan University Students at Faculty of Education, Elmergib University	28
482-499	الحسين سليم محسن	The Morphological Analysis of the Quranic Texts	29
500-507	Ghada Al-Hussayn Mohsen	Cultural Content in Foreign Language Learning and Teaching	30
508-523	HASSAN M. ALI Mostafa M Ali	The relationship between <i>slyA</i> DNA binding transcriptional activator gene and <i>Escherichia coli</i> fimbriae and related with biofilm formation	31
524-533	Musbah A. M. F. Abduljalil	Molecular fossil characteristics of crude oils from Libyan oilfields in the Zalla Trough	32
534-542	سعدون شهبوب محمد	تلوث المياه الجوفية بالنترات بمنطقة كعام، شمال غرب ليبيا	33
543-552	Naima M. Alsharif Mahmoud M. Buazzi	Analysis of Genetic Diversity of <i>Escherichia Coli</i> Isolates Using RAPD PCR Technique	34
553-560	Hisham mohammed alnaib alshareef aisha mohammed elfagaeh aisha omran alghawash abdualaziz ibrahim lawej safa albashir hussain kaka	The Emergence of Virtual Learning in Libya during Coronavirus Pandemic	35
561-574	Abdualaziz Ibrahim Lawej Rabea Mansur Milad Mohamed Abduljalil Aghnayah Hamza Aabeed Khalafllaa ³	ATTITUDES OF TEACHERS AND STUDENTS TOWARDS USING MOTHER TONGUE IN EFL CLASSROOMS IN SIRTE	36
575-592	صالحة التومي الدروقي أمال محمد سالم أبوسته	دافع الانجاز وعلاقته بالرضا الوظيفي لدى معلمي مرحلة التعليم الأساسي "ببلدية ترهونة"	37
593-609	آمنة سالم عبد القادر قدورة نجية علي جبريل انبية	الإرشاد النفسي ودوره في مواجهة بعض المشكلات الأخرية الراهنة	38
610-629	Hanan B. Abousittash, Z. M. H. Kheiralla Betiha M.A.	Effect Mesoporous silica silver nanoparticles on antibacterial agent Gram- negative <i>Pseudomonas aeruginosa</i> and Gram-positive <i>Staphylococcus aureus</i>	39
630-652	حنان عمر بشير الرمالي	برنامج التربية العملية وتطويره	40
653-672	Abdualla Mohamed Dhaw	Towards Teaching CAT tools in Libyan Universities	41



673-700	عثمان علي أميمن سليمة رمضان الكوت زهرة عثمان البرق	سبل إعادة أعمار وتأهيل سكان المدن المدمرة بالحرب ومعوقات المصالحة الوطنية في المجتمع الليبي: مقارنة نفس-اجتماعية	42
701-711	Abdulrhman Mohamed Egnebr	Comparison of Different Indicators for Groundwater Contamination by Seawater Intrusion on the Khoms city, Libya	43
712-734	Elhadi A. A. Maree Abdualah Ibrahim Sultan Khaled A. Alurffi	Hilbert Space and Applications	44
735-759	معتوق علي عون عمار محمد الزليطني عرفات المهدي قرينات	الموارد الطبيعية اللازمة لتحقيق التنمية الاقتصادية بشمال غرب ليبيا وسبل تحقيق الاستدامة	45
760-787	سهام رجب العطوي هدى المبروك موسى	الخلج وعلاقته بمفهوم الذات لدى تلاميذ الشق الثاني بمرحلة التعليم الاساسي بمنطقة جنزور	46
788-820	هنية عبدالسلام بالوص زهرة المهدي أبو راس	الصلابة النفسية ودورها الوقائي في مواجهة الضغوط النفسية	47
821-847	عبد الحميد مفتاح أبو النور محي الدين علي المبروك	ودوره في الحد من التمر التوجيه التربوي والإرشاد النفسي المدرسي	48
848	الفهرس		52