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Assessment and remediation of contaminated elements in varied car wash stations across Al-dour city utilizing pomegranate peels, with comparative analysis against nickel nanoparticles

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Abstract: study to evaluate the contamination caused by the car wash plants' tainted effluents. Three stations are located in different parts of the city of Al-dour provided liquid waste, which is then brought directly to the lab for examination and testing of various contaminated samples. Al, Ca, Fe, Zn, Mn, and Cu are some of the primary constituents in raw water that are investigated prior to treatment. The study of the untreated raw water has produced results that are higher than the World Health Organization's acceptable limits (pollution levels) and the standard values of Iraqi water regulations for every quality that is examined.

Three different processing powders are used to treat the unprocessed water samples from the three car wash stations: TAMARI(T3) kernel powder, pomegranate peel powder(T2), and nickel nano powder (T1). The powders are applied in five different concentrations at five different levels and the results are compared to a controlled treatment that involved applying one treatment per station. Following treatment, analyses are conducted, and the findings indicate that for the three selected vehicle wash facilities, nickel nano powder at concentrations of 250 and 200 ppm has the highest removal values of the characteristics under study (Al, Ca, Fe, Zn, Mn, and Cu). Although the removal of nano nickel from pomegranate peels and date cores is not as great as expected, it is still considerably better than the controled coefficients, which have showed the highest levels of removal.



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Keywords: (Shell of pomegranate, nickel Nanoparticles, Date pits

1. Introduction

The world's recent drought crisis has been brought on by poor rainfall, changing climatic conditions, low river water levels, and an increase in the rate of population growth, particularly in the Arab world and Iraq. According to international reports, the disparity among these factors has led to growing gaps between the demands for water and its sources and stock, and it is anticipated that these gaps will widen in the upcoming decades due to unfulfilled strategic projects that have aimed at addressing water scarcity and the absence of quick treatment solutions [1] and [2]. Although Iraq has a reasonable amount of water compared to the other nations, there is still an urgent need to supply water sources that encourage water consumption in all aspects of life. A shortage of surface and groundwater resources is quite possible[3] and [4].

Due to the release of large amounts of human and industrial waste into rivers and the lack of law enforcement to regulate these practices, the percentage of pollution in rivers has increased significantly and dangerously in recent times. One of the main sources of pollution in rivers is the sewage and industrial waste found in cities, which is highly toxic and harmful chemical, biological, and physical substances that are difficult to decompose. These wastes enter rivers and groundwater through public drainage networks or seep into the ground. Water from residences, hotels, hospitals, restaurants, and water used for road and vehicle wash stations is among these pollutants. Additionally, car wash facilities are thought to be one of the main causes of water pollution [5].

The number of cars has increased significantly in recent years due to the noticed rising in industrial activity, city expansion, and population density. As a result, this has led to a need for multi functioned service stations of all kinds, including car washes, to meet the growing demand from car owners seeking high-quality auto care. In the city of Samara, there are now over 70 stations spread throughout the city, none of which is neither authorized to operate nor had a pre-existing specialized raw water treatment unit. Therefore, there are not dedicated to supply the public health treatment standards.The primary source of effluent from vehicle washes is the usage of chemicals like

As one of the solutions offered to provide quantities that enhance life-supporting water sources, nanotechnology is one of the new and emerging methods for treating industrial wastewater because it is low-cost, environmental friend, and uses materials of natural origin. Compared to the traditional methods, nanotechnology is used as a way to reduce and remove the sources of basic pollution from water [5]. The purpose of this study is to investigate the issue of contaminated water from car wash facilities located in various parts of the city of Samara that is dumped straight into rivers without any treatment and to implement novel solutions to lessen the harmful effects of this contaminated water.

Earlier within this decade, the study of nanoparticles has flourish due to their effective applicationd in many aspects as opto-electronic devices, clinical settings, and the medical field. Specially as the areas of diagnosis, optical switching, drug delivery, and More specifically, silver-based nanocancer treatment [6, 7]. materials that have been made of noble metals. Also, Ag NPs' prominent surface plasmon resonance is the cause this of (SPR) phenomenon [8, 9, 10]. controlled The and methodical changes in geometry of nanomaterial are made possible by the coupling of pharmaceutical advancements with SPR, which is a sensitive function of the nanocomposite structure [11, 12].

2. Materials and Methods

2.1. Devices and tools used in this study

	Origin	
	English	
1	Particale Size Analyser	
2	(Sartorius) Balance Sensitive Electrical	Germany
3	Jar Test	
4	Atomic Absorption Spectro	

Tuble (1) Devices unta tools used to work in this rescure	Table	(1)) –Devices	and to	ools	used	to	work	in	this	researc	h
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2.2 processed materials

2.2.1 pomegranate peel powder

-Pomegranate peels are, collected from local markets, dusted, washed with distilled water. Then, they are dried under laboratory conditions with continuous stirring until reaching the complete dehydration. After a week, the dry crusts are ground with an electric mixer and the powder is kept in clean and sterile glass bottles. Finally, an adhesive is fixed on them, on which the sample information is recorded for subsequent uses.

2.2.2 date kernel powder

The date cores are collected from local varieties available in the markets. The cores of the dates are separated from its fruits and washed thoroughly with distilled water. The washed cores are transferred to the laboratory and left with continuous stirring until drying. The cores are ground with a mill after being cleaned well and made sure that they are free of any powdery residues. Then, store the powder in clean, sterile glass jars and fix the adhesive on them without the sample information for subsequent uses.

2.2.3 nano nickel powder

The powder uses the processed silver nanomaterials from the American company US Research Nanomaterials Inc and is manufactured according to the corresponding industrial specifications of nanotechnology.

2.2.4 preparation of concentrates for powders

For pomegranate peels, date cores, and silver powder, concentrations of PPM Powder Solutions weight/Volume (1 mg = 1 ppm) are created. A preliminary experiment is then conducted using the Jar Test equipment to ascertain the ideal effective concentrations for use in processing.

2.2.5 collection of samples.

-The first, haphazard set of information is provided to around 70 car wash locations in the city of Al-dour. These locations are relied on river's water and water purification facilities for the purpose of irrigation and drinking. Three locations have been designated for the collection of samples by car wash facilities; two of them are located on the riverbank and discharge the untreated water directly into the river, while the third one is located in the city center and releases untreated waste into the groundwater. Following their collection in designated basins to gather the station's water and complete washing the automobiles while keeping them stagnant to make sure they do, raw water samples are taken from car wash stations. They are kept in the refrigerator for the second day for the purpose of subsequent transactions and tests. The test is carried out by placing one liter of water from each car wash station in the rollers of the jar test device. Then the silver nanoparticle, date kernel powder and pomegranate peel powder are added according to the concentrations approved in the experiment. Afterthat, the rollers are placed in the said Tester and then the solutions are mixed for 30 minutes separately according to the parameters of the experiment. For the first five minutes, they are at a speed of 100 cycles per minute to homogenize the treated material with water. Afterthat, from the sixth minute the speed is increased to 300 cycles per minute to mix the treated material with water in. Finally, the resrarchers complete the 24 minutes at a speed of 50 revolutions per minute. Figure.1 shows the procedure of the eperiment.



Fig.1 neighbor test equipment

2.3 Factors and design of the experiment

The experiment includs two factors: the first factor includs three types of processing powders such as: silver nanopowder (T1), pomegranate peel powder (T2) and date kernel powder(T3), while the second factor includes the concentration of five levels as illustrated :(250, 200, 150, 100 and 50) ppm for each treatment, which are given codes from C1 To C5, respectively. The final combination has showed 15 resulting transactions between species and concentrations, in addition to the three controlled transactions with a transaction for each station. Table (3.3) illustrats the analysis of three times repetitions for each test and for all samples to reduce the experimental error when collecting samples.

2.4 Statistical analysis

-The results are statistically analyzed for all the qualities that have been studied in the two experiments of the study by using a ready-made statistical analysis system (SPSS, V23) under the Windows operating system, and a complete randomized design is used (R.C.D) according to ?[13]. the arithmetic averages of the transactions are compared according to the Duncan Test at a probability level (0.05)

3. Results

3.1 The study includ two main phases:

The first stage involves analyzing untreated raw sewage from car wash stations to determine the extent of its pollution compared to ordinary water. The second stage examines the efficiency of removing pollutants from wastewater using the treatment methods employed in the study..

3.2. Characteristics of raw car wash water (first stage)

The analysis's findings regarding the washing plants' raw wastewater are presented in Table (1) When car wash facility effluent is compared to control water. The high concentrations of Ca, Mg, Na, and W all have showed values above allowable limits. High elements in wastewater can be attributed to variations in chemical composition depending on the source of pollutants in wastewater. These findings align with a study by [14]. That has found that wastewater quality varies from site to site and that chemical composition varies depending on the effluent source. Table 2, indicates a noteworthy rise in the amount of heavy metals that is found in untreated wastewater .

-The multiple chemical composition of pollutants in car wash wastewater such as detergents and dust fats and residues of small car parts volatile as a result of washing, which led to their high content [15].

Table 2 specifications of untreated raw waste water for car wash plants Iraqi effluent standards for disposal to water

	Unit of	Waste	General used	** Iraqi		
Measurements	measurem ent	St.3	St.2	St.1	water measurements	Water
						S
Са	mg/L	19.1	18.00	20.00	40	30
Mg	mg/L	12.3	13.50	13.00	60	40
Na	mg/L	422	395	401	200	150
AI	mg/L	7.33	7.44	7.47	5	1
Cu	mg/L	1.77	1.66	1.57	0.4	0.05
Zn	mg/L	30	25	28	3	0.5
Mn	mg/L	17	16	14	0.3	0.2
Fe	mg/L	38	35	32	5	3

bodies

3.3 Removal of contaminated elements Macro and Micro Elements

3.3.1 Aluminum element Al

Table 3 shows that there are significant differences between the types of materials are used in raw water treatment and control treatment . The silver powder treatment gives the highest average decrease in aluminum concentration for all stations, with decreases of 7.054, 6.994, and 7.350. The lowest clearance was observed with pomegranate peel powder, which amounted to 8.026, 7.926, and 7.382 for all stations. This treatment also is differed significantly from the control treatment, which yielded values of 7.24, 7.89, and 7.77 for stations ST1, ST2, and ST3, respectively, when compared with the average values of other treatments and the control treatment.

Table 3 shows how the removal of elemental concentration from the raw water of three car wash stations that are located in various parts of the city of Al-dour are affected by varying amounts of nickel nanomaterial, powders, pomegranate peels, and date cores.

	Туре	CONC.	ppm	Mean				
Stations		250	200	150	100	50	Туре	control
	nickel	8.15	7.18	7	6.68	6.11	7.10a	
S 1	Pit	7.10	7.10	7.00	6.55	6.00	7.07b	7.77d
	Shell of pomegranate	7.7	7.6	7.35	7.06	7.36	7.03c	
M.C.St ₁		7.20a	7.31 b	b 7.32	c 7.51	c 7.53		
	nickel	7	6.80	6.70	6.60	6.90	6.99a	7.89d
S2	Pit	6.90	7.30	7.40	7.333	7.55	7.34b	
	Shell of pomegranate	7.8	7.71	7.52	8	8.6	7.99c	
M.C.St ₂		7.22a	7.22b	7.23b	c7.52	d7.99		
	nickel	7.54	7.15	7.31	7.23	7.32	7.34a	
S3	Pit	6.16	16.16	7.33	7.90	7.50	7.35a	7.24d
	Shell of pomegranate	7.4	7.8	7.9	7.12	7.93	7.39b	
M.C.St ₃		7.27a	7.28a	7.29b	7.40c	7.61d		

-The results of the analysis indicate that there are also significant differences between the concentrations used for the controlled treatment. It is noted that the highest clearance rate is recorded with a concentration of 250 ppm in all treated samples at all stations by recording average values of up to 7.20 , 7.22 , 7.27 for terminals St1, ST2 and ST3, respectively. The concentrations of 200ppm and 150ppm have reached a higher rate than the concentrations of 100ppm and 50ppm of Al. Also, they are different from the controlled treatment , which is recorded the highest averages of Al concentration 7.77 , 7.89, 7.24 for the three stations sequentially .

					CON	C. ppm	Mean	
Stations	Туре	250	200	150	100	50	of Type	control
	nickel	1.80	2.21	2.45	2.42	3.41	a 2.45	
S1	Pit	2.21	2.25	2.31	2.99	3.45	b 2.64	4.17d
	Shell of pomegranate	3.20	3.15	3.26	3.05	3.52	c 3.23	
M.C.Stı		2.40a	2.53a	2.67b	2.87b	3.46c		
	nickel	2.22	2.11	2.65	2.98	3.35	2.66a	
S2	Pit	2.15	2.29	2.55	2.90	3.43	2.66a	4.88c
	Shell of pomegranate	2.50	2.51	3.2	3.10	3.33	2.92b	
M.C.St ₂		2.29a	2.30a	2.8b	2.99c	3.37d		
	nickel	2.69	2.5	3.4	3.45	3.19	3.04a	
S3	Pit	2.75	2.8	2.95	3.30	3.27	3.01 a	4.36c
	Shell of pomegranate	2.70	3.30	3.85	3.1	3.11	3.21b	
M.C.St ₃		2.71a	2.86b	3.4c	3.28c	3.19d		

significant differences between the treatment and control coefficients, such as the nickel powder treatment excelled in recording the lowest concentration of element Ca in the treated water samples of the first station and recorded an average of 2.45. As for the second and third stations, there is no significant difference between the nickel and pomegranate peel treatments in reducing the concentration of the CA element, which differes significantly from the treatment of date nuclei and the control coefficient, the latter of which recordes the highest concentration rates as 4.17, 4.88 and 4.36 for the three stations, respectively.

The results of table 2 also shows that there are significant differences between the transactions, as they recorde a decrease in the concentration of CCA with an increase in concentration in general. The highest clearance rate is recorded with the concentrations of 250 ppm and 200 ppm in the St1 and ST2 stations with average values of 2.43, 2.55 and 2.33, 2.32, respectively. In contrast, it in turn differes from the control transaction, which recordes the highest values for CCA.

3.3.3 Iron element Fe

As for the concentration of the Iron element in all stations, it is significantly affected by the variety of treatment and decreased using the treatment of nickel powder in all samples collected from the stations. As indicated in Table 3, and the treatment of nickel powder gives the lowest averages for the concentration of the Fe element in the treated water samples, reaching 6.54, 8.29, 9.24 for stations St1, St2, St3 sequentially . The rest of the transactions such as (pomegranate peels and date cores) indicate significant differences among themselves in terms of the effect with the highest averages of the values of the treatment with silver nanopowder. In contrast , they record a significant difference from the control treatment.

Stations	Type	CONC.	ppm	Mean of	control			
Stations	1992	250	200	150	100	50	Туре	control
	nickel	6.25	6.50	6.71	6.30	6.21	6.39a	
S1	Pit	6.75	6.70	6.85	7.55	7.12	6.99b	9.9c
	Shell of pomegranate	6.75	7.5	7.27	9.3	10.15	8.19c	
M.C.St ₁		a 6.58	b 6.9	b 6.94	7.71c	7.82d		
S2	nickel	7.90	7.88	8.60	8.15	8.21	8.14a	
	Pit	9.29	8.85	9.27	8.35	9.59	9.07b	10.5c
	Shell of pomegranate	9.90	11.55	10.79	10.25	12.77	11.05c	
M.C.St ₂		a 9.03	9.42b	9.55b	8.91c	d10.19		
S3	nickel	9.06	9.75	9.15	9.4	9.1	9.29b	10.8c
	Pit	8.95	9.1	9.45	9.88	9.98	9.47b	10.00
	Shell of pomegranate	10.75	10.35	11.82	12.40	14.9	12.04c	
M.C.St ₃		9.58a	9.73a	10.14b	10.56c	11.32d		

-Table 5 shows how various amounts of date cores, powders, pomegranate peels, and nickel nanomaterial affected the elimination of the FE element from the raw water of three car wash stations located around the city of Al-dour.

3.3.4 Manganese element Mn

-The results of the statistical analysis in Table 3-4 show that there are significant differences in reducing the concentrations of the MN element for the type of substance and its concentrations for all transactions. Which illustrats a difference between them from the control transaction .The transaction using nickel powder has recorded averages of 0.130, 0.030. 0.031 while the Mn averages in the control transaction are 2, 1, 0.75 respectively.

Table 6 the effect of different concentrations of nickel nanomaterial, powders, pomegranate peels and date cores on the removal of the element mn from the raw water of three car wash stations in different locations of the city of Aldour.

		CONC.	ppm	Mean				
Stations	Туре	250	200	150	100	50	of	control
		250	200	150	100	50	Туре	
	nickel	0.12	0.13	0.16	0.17	0.19	0.154 a	
S1	Pit	0.12	0.14	0.17	0.19	0.20	0.164 b	2d
	Shell of pomegranat e	0.13	0.15	0.18	0.19	0.20	0.170 c	
M.C.St ₁		a 0.132	b 0.14	c0.17	d0.183	e 0.19		
	nickel	0.02	0.03	0.05	0.06	0.08	0.048 a	
S2	Pit	0.03	0.05	0.06	0.08	0.09	0.062 b	1 d
	Shell of pomegranat e	0.04	0.06	0.07	0.08	0.09	0.068 c	
M.C.St ₂		a0.03	0.046b	c0.06	d 0.073	e0.086		
S 3	nickel	0.01	0.02	0.04	0.06	0.08	0.042 a	0.75d
S3	Pit	0.05	0.06	0.08	0.10	0.12	0.082 b	

	Shell of pomegranat e	0.08	0.10	0.11	0.13	0.15	0.114c	
M.C.St ₃		0.046a	0.06b	0.076c	0.096d	0.116e		

The use of different concentrations of substances has shown significant differences among them. The concentration of 250 ppm using nickel powder provides the highest reduction percentage, with significant differences from the powders of date kernels and pomegranate. The removal of the element Mn reached 0.130, 0.030, and 0.031 for the three stations, respectively, while the control treatment recorded the highest rates of the element Mn, as shown in the table above.

5. Conclusions

Wastewater from car wash stations in random areas contains pollution levels that exceed the limits allowed by the World Health Organization and Iraqi standards, thus being a major source of pollution for Rivers and groundwater in the city of Samarra . The treatment using natural vegetable powders and nickel nanopowder has proven its effectiveness in water treatment and has reduced the percentage of pollution, making it suitable for use . The materials that are used in the treatment recorded a good removal rate and the treatment methods are cheap, easy to use, available and with little damage to the environment and can be an alternative to chemical and physical products that are manufactured and used in the current hazardous treatments that affect the human environment, its negatives and behavior .

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