



Evaluation of laterite as a filter media to remove arsenic from groundwater

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Abstract: Arsenic in drinking water has a chronic effect on humans and thus is a global health issue. Most people of Pakistan use groundwater for drinking, and consequently, prone to As toxicity. The objective of this study was to evaluate laterite as an adsorbent media for As removal, and subsequent preparation of a low-cost As filter. Laterite was tested for As adsorption capacity through batch sorption experiments and fitting to the Langmuir model. Two identical filters were prepared using variable particle size of laterite and substrate material ratios (sand, activated carbon, and brick chips). Arsenic contaminated water was poured daily and collected at the bottom for analysis. The water samples were analyzed for As using an atomic absorption spectrophotometer coupled with a hydride generation assembly. Other water quality parameters *viz.*, electrical conductivity (*EC*), pH, chloride, total suspended solids (*TSS*), total dissolved salts (*TDS*), nitrate, calcium, magnesium, sodium, potassium, carbonate, bicarbonate and sulfate contents were also tested. Filter 1 had an As removal efficiency from 83 to 93 %, while Filter 2 had 67 to 85 % removal efficiency. Most of the water quality parameters remained under the WHO recommended limits indicating no harmful addition to the filtered water by substrates. It appears that laterite may serve as an economical option for As removal from contaminated groundwater.

Keywords: arsenic adsorption; Langmuir isotherm; low-cost adsorbent; drinking water treatment.

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INTRODUCTION

Water pollution is one of the major threats people are facing all around the world. The World Health Organization (WHO) reported 768 million people had no access to safe drinking water, which ultimately causes widespread diseases in many areas of the world.¹ According to worldwide ranking of drinking water quality, Pakistan came 80th of 122 countries. Groundwater contamination is one of the major problems caused by both natural and anthropogenic activities. In developing countries, such as Pakistan, chemicals used in agriculture and inappropriate industrial and municipal waste disposal are of major public health concerns.

Arsenic ranks 20th in the earth crust metalloid ranking, about 12th in the human body and 14th in seawater.² Arsenic causes serious environmental and health issues throughout the world³ and especially countries such as India, Bangladesh, China and Nepal have higher reported incidence.⁴ Shallow groundwater of many Asian (Pakistan, Bangladesh, Vietnam, Thailand, Mongolia, China and India), European (Germany and Hungary), South American (Argentina and Chile) and North American countries (USA, Canada and Mexico) have As contamination. Arsenic contamination is widely reported in many parts of Pakistan. A collaborative study between the Public Health Engineering Department of Pakistan and UNICEF revealed the alarming situation of As-enriched groundwater throughout the Indus alluvial basin. Ironically, an As concentration as high as 906 $\mu\text{g L}^{-1}$ has been reported for the district Muzaffargarh in Southern Punjab.⁵ The results of the monitoring program indicated that many areas of Punjab and Sindh province have As contaminated groundwater that is being used as drinking water.^{6,7} The rural community of these areas uses naturally As contaminated groundwater for drinking purposes.⁸ Due to the relative mobility of As over a wide range of redox conditions, it can appear simultaneously in soil and water. In reduced conditions, As is relatively more mobile and form oxyanions that are harmful even at $\mu\text{g L}^{-1}$ levels. Overall, As occurs in four oxidation states -3, 0, +3, +5, and of these oxidation states, +3 and +5 are most prevalent in aqueous environments.⁹ It was reported that both organic and inorganic forms of As can exist in natural waters, whereby the inorganic forms (arsenate As(V) and arsenite As(III)) are more toxic than the organic forms.

In the environment, natural and anthropogenic sources are the two major pathways of As release. The terrestrial amount of As is 1.5–3 mg kg^{-1} .¹⁰ Currently, different electronic devices contain As and on their disposal and recycling process release As into the environment. In addition, industrial activities result in As contamination.¹¹ Several anthropogenic activities cause increases in the As concentrations in groundwater and surface waters. These include power plants running on oil and coal, wood preservatives, electronics and glassware production, treatment of ores and metals, processing, and production, combustion of

waste, cement works, disinfectants and pesticides, waste disposal, dyes and colors and cotton drying agents.¹²⁻¹⁵ Human activities, besides surface application of As-containing chemicals, pumping water also causes contamination of groundwater due to dissolution and washing of As bearing sediments. Since 1993, the WHO guideline value for As in drinking water was decreased from 50 to 10 $\mu\text{g L}^{-1}$. Similarly, the permissible limit for As in drinking water in Japan is 10 $\mu\text{g L}^{-1}$, whereas the maximum permissible concentration for As in Canadian drinking water is 25 $\mu\text{g L}^{-1}$. Indeed, on a global scale As is considered one of the most harmful inorganic contaminants in drinking groundwater.

Laterite is a red colored mineral rock, extensively found in various parts of the country.¹⁶ Rocks containing high ferromagnetism minerals give rise to thicker layers of laterite having relatively higher concentration of iron.¹⁶ The iron and aluminum contents are higher than the silicon content. Subsequently, natural laterite comprises minerals that are assemblages of goethite, hematite, Al hydroxide, kaolinite and quartz.¹⁷ Due to its rich content of Fe and Al oxides, Laterite could be a potential adsorbent media for the removal of As from drinking water.

In India (Bengal, Purulia, Bankura and West Midnapore) and Bangladesh, laterite soils are extensively found and have been tested for the removal of arsenic from drinking water.¹⁸⁻²⁰ During the studies, laterite was used as a filtering material, which reduced the arsenic content by up to 99 % from the actual arsenic in the contaminated groundwater.¹⁹ In Sri Lanka, naturally obtainable laterite was used as an effective adsorbent for the removal of arsenic from contaminated water.²¹ The dominant form of arsenic in water is arsenate, which could also be removed using laterite as the adsorption material.²² In one study, the operational conditions were accessed for the evaluation of the natural efficiency of laterite to remove As(V) from groundwater after determining the adsorption capacity through the Langmuir isotherm model, which was 0.565 mg g^{-1} . In another study, the acid treatment for the activation of four raw laterite samples with different compositions was optimized for their use their as adsorbents for the removal of arsenic from an aqueous system.²³

Several studies were carried out on the preparation of indigenous filters for removing As from drinking water using low-cost adsorbing materials. Several natural sorbents, such as activated red mud and natural zeolite,^{17,24} and a mixture of Fe, Al, manganese and titanium oxides and hydroxides with clay minerals and quartz grains,^{25,26} were used for the sorption of inorganic As compounds from an aqueous solution.

The people living in rural areas are exposed to As toxicity, leading to serious health problems. Socio-economic constraints are creating hurdles in accessing As free water. A low cost and socially acceptable solution is required for the people living in affected areas. The present study was designed to evaluate local reserves

of laterite present in Pakistan as an adsorbent media for As removal from drinking water and develop a low-cost filter by using indigenous (laterite) material.

EXPERIMENTAL

To evaluation raw laterite as an adsorption media for As removal from drinking water and to prepare a low-cost filter, chemical analysis related to drinking water quality and a study of the As adsorption capacity of laterite was carried out.

Sampling and processing

Raw laterite was collected from District Rawalpindi (Near Nicholson Monument) ground and passed through 53-micron mesh size sieve. Fine sand was collected and thoroughly washed with distilled water before packing. Brick chips were collected, ground (passed through 2 mm sieve), and washed with distilled water before packing. Wood charcoal was collected, crushed, and treated with 25 % CaCl₂ to convert it into activated carbon²⁷ before packing.

Adsorption experiment

In triplicate, 3 g laterite sample was equilibrated in batch sorption experiments with 30 mL 0.01 M KNO₃ solution containing As (as Na₂AsO₄) 0, 0.1, 2.5, 5, 8, 10, 15, 20, 25, 40 and 100 mg L⁻¹. The suspension was shaken for 48 h at room temperature and centrifuged. A 0.45 micron cellulose membrane of was used to filter the supernatant, and the total As was determined. The sorbed amount of As was calculated from the change in the solution phase concentration. The adsorption isotherm data was fitted to the Langmuir model to calculate maximum adsorption capacity (*b*) and surface binding strength (*K*).^{28,29} The following Langmuir equation was used:

$$x = \frac{bKc_w}{1 + Kc_w} \quad (1)$$

The linear form of the Langmuir model is:

$$\frac{c_w}{xm^{-1}} = \frac{1}{Kb} + \frac{c_w}{b} \quad (2)$$

where *c_w* is the equilibrium concentration, *x* is the adsorbed concentration, *m* is mass of soil, *K* is surface binding strength, and *b* is the maximum adsorption.

Filter preparation

For the filling of substrates, a clay pitcher was used due to its low cost, local manufacture, and easy availability. Layers of the substrates material were packed in the pitchers (Table I). During packing, an nylon mesh was placed between each layer to keep the layers intact. Laterite was the active As removal component. Sand was used for filtering any suspended particles and ensuring an equal distribution of flow. Activated carbon was used for its ability to remove organic pollutants while the function of brick chips was to stabilize the flow. The two major differences in the packing material of the filters were the size of the particle size of the laterite and the nature of the carbon used.

Drinking water quality parameters

Both non-filtered and filtered water were analyzed for various water quality parameters. Electrical conductivity and pH was measured using calibrated EC and pH electrodes.^{30,31} Arsenic contaminated samples before and after filtration were analyzed for Na, K and Ca

using a BWB XP flame photometer following standard methods of APHA.³² Chloride was measured by a Cl specific ion electrode using potentiometry,³³ CO₃⁻ and HCO₃⁻ were determined by the titration method,³⁴ using phenolphthalein and methyl orange indicators, respectively and 0.01 M H₂SO₄ as the titrant. Sulfate was determined in the samples using the turbidity method.³⁵ In this method, turbidity was produced by the addition of barium chloride crystals to acidified water samples, which was measured at 420 nm using Shimadzu UV-Vis spectrophotometer. The NO₃⁻ in water samples was determined by a colorimetric method.³⁶ The absorbance was measured at 410 nm after the addition of salicylic acid and H₂SO₄. The water quality parameters of the As-contaminated water used in this study are given in Table II.

TABLE I. Description of the materials used in the filters; values in parenthesis in second and third column are the mass of material used

Materials used	Filter 1	Filter 2
Laterite	Unit: 1 (6 kg)	Unit: 1 (6 kg)
	Unit: 2 (6 kg)	Unit: 2 (6 kg)
	53 μm particle size	2 mm particle size
Charcoal	Unit: 2 (2 kg)	Unit: 2 (2kg)
	Used as activated carbon	Used as raw charcoal
Sand	Unit: 1 (4 kg)	Unit: 1(4 kg)
	Unit: 2 (4 kg)	Unit: 2 (4 kg)
Brick chips	Unit:1 (0.5 kg)	Unit:1 (0.5 kg)
	Unit: 2 (1 kg)	Unit:2 (0.5 kg)

TABLE II. Water quality parameters for the unfiltered raw water used in the experiments; ND – not detected

EC / μS cm ⁻¹	pH	Concentration, mg L ⁻¹									
		As	SO ₄ ⁻	Cl	TDS	Na	K	Ca	NO ₃ ⁻	HCO ₃ ⁻	CO ₃ ⁻
8.5	7.8	0.093	120	5877	6500	50	55	44	0.45	47	ND*

Determination of As

Total As in the non-filtered and filtered samples was determined by using a Shimadzu AA-6300 atomic absorption spectrophotometer coupled with Shimadzu HVG-1 hydride vapor.

*Generation assembly.*³⁷ Initially, arsine (AsH₃) was produced by a premix of 0.4 % NaBH₄ and 0.5 % NaOH solutions mixed with 5 M HCl in a mixing chamber and gas-liquid separator chamber.³⁸ The detection limit was 2.42 μg L⁻¹ as determined by analyzing 10 blanks and calculating the standard deviation ($\sigma = 0.26$). The detection limit was mean of 10 blank samples plus three times the standard deviation.

RESULTS AND DISCUSSION

Adsorption isotherm and model parameters

The adsorption capacity of laterite was tested as a potential adsorbent for As removal from the drinking water by employing the sorption batch method. The sorption isotherms were developed and Langmuir adsorption parameters were calculated by fitting adsorption isotherms in the Langmuir equation.

The isotherms for As depicted the sorption was initially fast with only a very small increase in the concentration of the equilibrium solution (Fig. 1). This trend of sorption isotherm was in line with the several previous studies in which a quick initial rise in sorption was observed, while later, the rise was moderate.³⁹ The maximum increase for As sorption was below 8000 mg kg⁻¹. It appears that oxides of Fe and Al play a vital role in the sorption of As. According to several studies, a strong adsorption relation of As with the Fe and Al oxides content has been observed.^{40,41}

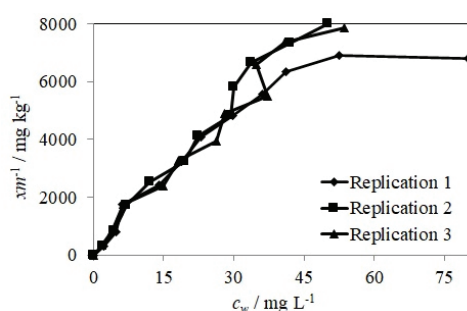


Fig. 1. Arsenic adsorption isotherms plotted between adsorbed concentration and concentration in the solution, indicating an initial fast adsorption and moderate adsorption later.

The fitted isotherms in the Langmuir equation, Eq. (1), showed $r^2 > 71$ as presented in Fig. 2. The maximum As adsorption capacity, b , was 20000 mg kg⁻¹ and binding energy constant, K , was 0.011 L mg⁻¹ as calculated from the linear regression Eq. (2). The results indicated high efficiency of laterite for the adsorption of As. As discussed earlier the major components in the laterite are Fe and Al oxides, which control the adsorption mechanism. Several studies showed the importance of Fe and Al oxides for the removal of As from aqueous solution. In most cases, the oxides were purchased from manufacturers, which resulted in increased the cost of the adsorbents. In one study, Fe₂O₃ and Al₂O₃ were used for the adsorption of As and observed maximum As adsorption was at pH 7 and values of b for Fe₂O₃ and Al₂O₃ were 660 and 117 mg kg⁻¹, respectively.⁴² Similarly, synthetic Fe oxides-hydroxides (akaganeite) and modified akaganeite achieved a maximum adsorption capacity of 148.7 and 170.9 mg g⁻¹ through the Langmuir isotherm.⁴³ As(III) and As(V) adsorption characteristics on laterite soil using both (Langmuir and Freundlich) adsorption models were observed with maximum adsorption capacities of 1.384 mg g⁻¹ for arsenite and 0.04 mg g⁻¹ for arsenate.¹⁹

Arsenic adsorption capacity in batch experiments was evaluated using a synthetic solution simultaneously containing arsenate and arsenite.¹⁸ Additionally, it is apparent that the Langmuir isotherm better fitted the batch experiment results for calculating the adsorption capacity. The limitation regarding the use of synthetic and pure forms of the oxides of Fe and Al is its cost and availability in large quantities. Thus, laterite could be a better option as it is low cost and easy

availability. Furthermore, it has comparable adsorption capacity for As to those of sophisticated synthetically prepared Fe and Al oxides.

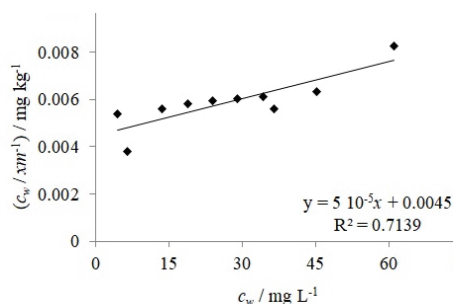


Fig. 2. The As removal by laterite isotherm fitted to the linear form of the Langmuir equation (Eq. (2)). Adsorption parameters for As were calculated from the regression equation.

After testing the adsorption capacity of laterite, a filter run test was performed by using laterite as the adsorbing medium in clay pitcher filters. Two different grain sizes of laterite were used with additional substrates. In one filter activated carbon was used while in other raw charcoal was used. The purpose was to improve the efficiency of the designed filter. Both filter sets were tested for a month by applying As containing tap water to mimic the natural environment.

Filter test and water quality parameters

In the trial, the designed filters were tested for 30 days by adding water daily. Detail of the application rate was briefly discussed in the methodology section. The collected samples were analyzed for EC, pH, TDS, K, Ca, Na, SO_4^- , NO_3^- , Cl^- and HCO_3^- (the results are presented graphically in Fig. S-1 of the Supplementary material to this paper and Fig. 2) and As.

Throughout the experiment, tap water was used with $93 \mu\text{g L}^{-1}$ As added. Arsenic was determined in the samples collected on the 1st, 15th and 30th day of the experiment. Details of the results are given in Table II. On the first day the removal efficiency was low, but it improved later on the 15th day and 30th day of the experiment. Arsenic adsorption was greatly increased in Filter 1. Filter 1 efficiently increased the adsorption concentration of As. On the first day, filter 1 had an efficiency of about 83 % and after 15 days its efficiency was increased to 92 % and at the end, after 30 days its efficiency increased to 93 %. Filter 2 also efficiently removed As from the drinking water. On the first day, Filter 2 showed an As removal efficiency of 67 % and after 15 days of continuous filtration and application of As contaminated water, its efficiency was about 80 % and after the 30th-day, the efficiency was up to 85 %. Both the filter adsorbates had a fast rise in adsorption. In Filter 1, fine laterite was used which was ground and passed through the $0.53 \mu\text{m}$ sieve. Furthermore, the activated carbon used in this filter was derived from treated wood charcoal. Sand (4 kg) was spread in the upper

layer for easy drainage of water. Six kg laterite material (6 kg) was used for As adsorption due to its high Fe and Al oxides contents that have a high adsorption capacity to remove As. Brick chips (2 kg) were used for transient water flow. In Filter 2, coarse laterite material, which had been ground and past through 2 mm size sieve was used. The wood charcoal was used without CaCl_2 treatment. The result indicates that Filter 1 performs well due to the fine laterite particles and activated carbon as compared to Filter 2. It revealed that Filter 1 had an efficiency of about 93 %. This filter reduces As concentration significantly. It is easy to use and can be prepared at home using indigenous materials. Furthermore, its operational cost is very low and can be regenerated easily. The prepared filter had an efficiency of 85 to 93 %. It is recommended for those areas where the As concentration in groundwater is around $70 \mu\text{g L}^{-1}$ so that the As concentration in the filtered water can be reduced to below $10 \mu\text{g L}^{-1}$. Initially, the filter was not fully saturated, and the water did not contact the whole matrix. Over time, all the matrix in both units became completely saturated and allows more matrix surfaces to contact the flowing water, which results in increased adsorption of As and ultimately greater efficiency. This suggests that initially, the filter needs to be equilibrated for a few days until all the matrixes in the units become completely saturated. After treatment, the filtrate can be consumed for drinking purposes. Role of pH on arsenic removal efficiency of laterite was studied and showed that at pH 10, more than 90 % As(III) was removed and less than $10 \mu\text{g L}^{-1}$ could be maintained within 5 min by keeping the arsenite and laterite ratio to less than 10.²¹

Electrical conductivity indicates the amount of dissolved ionic constituents in water. Non-significant variation occurred in the *EC* of Filter 1 was observed throughout the experiment and it remained in the range from 2 to $2.8 \mu\text{S cm}^{-1}$, whereas in case of Filter 2, the *EC* was reduced significantly from 10 to $5 \mu\text{S cm}^{-1}$ and then remained below $4 \mu\text{S cm}^{-1}$ throughout the experiment. These small variations in Filters 1 and 2 may be attributed to the seasonal variation in the groundwater that was used as the input source to the filters. Several studies showed that the *EC* of the groundwater sample was in the range from 14.44 to $12.22 \mu\text{S cm}^{-1}$.⁴⁴ Similarly, a study reported the *EC* of the groundwater was $11.08 \mu\text{S cm}^{-1}$ throughout the study.⁴⁵ The pH of Filters 1 and 2 was in the range of 7.3 to 8 and did not change significantly throughout the experiment. A study showed the pH values of drinking groundwater samples in the range of 6.09–7.05, with the lower value was in the acidic range, which later somewhat drop to the limit of 8.5, which is the endpoint of the safe limit.⁴⁶ The WHO recommends a pH range of about to 6.5 or higher for drinking water.⁴⁷ Although drinking water with a pH greater than 8.0 would be harmful and need treatment. Good quality water usually has pH values in the range of 6.5 and 8.5. This pH range is observed for some of the typical greatest basins of the world.⁴⁸

Filter water samples from both filters were analyzed for their SO_4^- concentration and the results showed that the SO_4^- concentration in Filter 2 was slightly higher throughout the experiment. In the initial 10 days, the variation in the concentration of SO_4^- was higher but later both the filters showed the same trend with minor variations. Overall, the SO_4^- concentration was with the threshold level of 250 mg L^{-1} . No strict health guideline for SO_4^- has been established but if the SO_4^- concentration increases to above 500 mg L^{-1} , there is an increased probability of health problems.⁴⁹ Globally conducted surveys indicated the SO_4^- concentration of freshwater is around 20 mg L^{-1} while in rivers, the range is from 0 to 630 mg L^{-1} . In Belgium and Mexico, the SO_4^- concentration of groundwater is in the range of 2 to 250 mg L^{-1} while in Chile and Morocco, the SO_4^- concentration in the groundwater is in the range 0 to 230 mg L^{-1} .⁴⁸ The chloride concentration in both the filters varied significantly. Initially, Filter 1 had a high value on day 1 but during the remaining experiment duration, the Cl contents were almost constant and remained mostly below 100 mg L^{-1} . While the Cl concentration in water obtained from Filter 2 decreased over time but remained significantly higher than in the water from Filter 1. This may be attributed to the addition of Cl in the reservoir for groundwater collection when the Filter 2 experiment was performed. A study on Cl analysis of the water samples indicated the 13 samples had a statistically different concentration of Cl with a maximum value of 62 mg L^{-1} .⁵⁰

The concentration of Na in Filters 1 and 2 varied initially up to 20 days, thereafter the variation was minimal. In Filter 1, Na was slightly higher compared to Filter 2 but the variation in Na concentration remained constant in Filter 1 while in Filter 2 the Na concentration increased with duration of the experiment. Overall, the Na concentration remained below 50 mg L^{-1} . Usually, the water from the highland springs showed lowered Na concentration, *i.e.*, around 2 mg L^{-1} . However, in some areas, the water samples had a Na content as high as 331 mg L^{-1} . Several studies reported that a concentration of Na above 100 mg L^{-1} in drinking water may result in hypertension.⁵⁰ The calcium concentrations in both filters was low and varied only slightly up to the 18th day of the experiment and then it increased in both the filters to the maximum Ca concentration in Filter 1 of 65 mg L^{-1} and in Filter 2 of 50 mg L^{-1} . In several studies were performed to examine the composition of bottled mineral water in which the Ca concentration varied from 2 to 384 mg L^{-1} .⁵⁰ The concentration of the K in the filters decreased with increasing days of the experiment. However, Filter 2 showed significantly higher values of K as compared to Filter 1. Overall, Filter 1 had K concentrations in the range of 9 to 44 mg L^{-1} , while in Filter 2, the K concentration varied from 32 to 56 mg L^{-1} . In one study, it was observed that the K concentration was as low as 0.3 mg L^{-1} in Perrier water samples while in some samples the concentration of K was around 54.4 mg L^{-1} .⁵⁰

In the case of *TDS*, the Filter 1 concentration was lower as compared to Filter 2 and remained almost unchanged throughout the experiment. While in Filter 2, the *TDS* was initially very high and decreased with the experimental days. Studies reported a *TDS* of groundwater of around 1000 mg L^{-1} represents a very deep water level or water from uplands. A low *TDS* is known to be a characteristic of mountains and upland areas that represent areas of recharge.⁵¹ It was reported that the range of particulate matter or suspended particles was consistently found as around 350 mg L^{-1} .⁵² Globally, these particles also came into the low range in contrast with dissolved matter concentrations, which are found to be numerous hundreds of mg L^{-1} . It was reported that if the water contains a *TDS* of less than 1000 mg L^{-1} then it could be freshwater and good enough for both drinking and irrigational purposes.⁵²

An important water quality parameter, NO_3^- , was also studied during the filter test. Overall, the concentration of the NO_3^- was within the permissible limits, but Filter 2 showed extreme variations as compared to Filter 1, which remained almost consistent throughout the experiment. It was reported that in different countries the level of NO_3^- does not exceed 10 mg L^{-1} in drinking-water. While in most European countries, 0.5 to 10 % of the population⁵³ uses well water having NO_3^- concentration above 50 mg L^{-1} for drinking water. In the Netherlands, the NO_3^- range is frequently below 0.1 mg L^{-1} .

The concentration of HCO_3^- in both the filters showed the same trends as it remained continuously variable throughout the experimental days. The concentration of HCO_3^- was in the range of $180\text{--}701 \text{ mg L}^{-1}$.

CONCLUSIONS

The study concludes that Filter 1 had higher adsorption due to fine laterite particle and activated carbon as compared to Filter 2. The removal efficiency of Filter 1 was 93 % compared to 83 % for Filter 2. The results revealed that the laterite mineral had a high adsorption capacity to remove As from drinking water and it could easily reduce the cost of filtered water. The $0.53 \mu\text{m}$ particle size fraction of laterite and activated carbon combination was found better. These filters can reduce the As concentration below WHO international safe limit of $10 \mu\text{g L}^{-1}$ from highly As contaminated drinking water having As up to 60 and 70 mg L^{-1} . It is easy to use and can be prepared at home using indigenous materials. Furthermore, its operational cost is meager and it can be regenerated easily. Most of the water quality parameters, such as *TDS* and Cl, remained well below the WHO guideline values.

SUPPLEMENTARY MATERIAL

Additional data are available electronically at the pages of journal website: <https://www.shd-pub.org.rs/index.php/JSCS/index>, or from the corresponding author on request.

ИЗВОД
МОГУЋНОСТ КОРИШЋЕЊА ЛАТЕРИТА КАО ФИЛТАРСКОГ МЕДИЈА ЗА УКЛАЊАЊЕ
АРСЕНА ИЗ ПОДЗЕМНИХ ВОДА

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Арсен (As) у води за пиће има хронични утицај на људе и стога представља глобално здравствено питање. Становници Пакистана углавном користе подземне воде за пиће, што је представља потенцијални извор тровања арсеном. Циљ ове студије био је да се процени латерит као адсорбциони медиј за уклањање арсена и накнадна израда јефтиног филтера за његово уклањање. Латерит је тестиран на адсорпциони капацитет арсена кроз експеримент шаржне сорпције и фитовање параметара Лангмировим моделом. Два идентична филтера су припремљена користећи различите односе величине честица латерита и материјала подлоге (песак, активни угаљ и уситњена опека). Вода загађена арсеном свакодневно је пропуштана кроз филтер и сакупљана за анализу. Узорци воде су анализирани на присуство As користећи атомски апсорпциони спектрофотометар упарен са системом за стварање хидрида. Остали параметри квалитета воде, као што су електрична проводљивост, рН, садржај хлорида, укупне суспендоване чврсте честице, укупне растворене соли, садржај нитрата, калцијума, магнезијума, натријума, калијума, карбоната, бикарбоната и сулфата такође су одређивани. Филтер 1 је имао ефикасност уклањања As од око 83 до 93 %, а Филтер 2 од око 67 до 85 %. Већина параметара квалитета воде остала је испод препоручених граница Светске здравствене организације, што указује на то да супстрат не утиче на квалитет филтриране воде. Може се закључити да латерит може послужити као економична опција за уклањање арсена из контаминираних подземних вода.

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