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FULL PAPER

The functional monomers allyl chloride and acrylamide were used to determine lead using atomic absorption spectroscopy based on molecularly imprinted solid-phase

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To determine the lead ion, a novel method with high sensitivity, low cost, and high stability was developed. To fabricate a monolithic solid-phase micro extraction (SPME) fiber, this approach uses a molecularly imprinted polymer (MIP) with a functional monomer of allyl chloride and acryl amide, a fitting cross-linker, and an EGDMA. A polymer was also prepared without selective binding, referred to as a non-imprinted polymer (NIP). Considering SPME with Atomic absorption spectroscopy (AAS), all these analytical methods used for extraction, preconcentration and selective determination of lead ion (Pb^{2+}). The stability, stability and durability of the manufactured fibers play an essential and indispensable role in SPME, where samples were collected blood of those suffering from kidney diseases and industrial water samples (waste batteries discarded to the sewer network), and the monitoring of analyzes was performed using (AAS) and the use of electron microscopy and scanning (SEM) and FTIR.

KEYWORDS

FTIR; AAS; NIP; SPME; MIP; EGDMA.

Introduction

Lead is a systemic toxicant that affects many body functions and it is particularly dangerous to young children. Lead is spread across the body [1], with the brain, liver, kidneys, and bones being the most vulnerable. It is contained in the teeth and bones and builds up over time. Lead is a poisonous metal that occurs naturally in the Earth's crust [2]. In certain areas of the world, its pervasive use has resulted in substantial environmental pollution, human exposure [3], and public health issues. Mining, smelting, refining, and disposal practices, environmental contamination is still exacerbated by the continued usage of leaded powder, gasoline, and aircraft fuel in certain countries. The manufacturing of lead-acid batteries for automobiles accounts for more than three-quarters of global lead consumption [4]. Typically, samples must be processed through one of the following methods: Liquid fluid extraction (LLE) and solid phase extraction (SPE) [5,6]. Because of time and organic solvents that are heavily used to adjust and remove the sample, this multi-step procedure wastes time of the analyst. Precision extraction at SPME is easy, strong, and fast. This method does not require any solvent.These characteristics solve many difficulties in sampling and sample injection into an analytical device.The newly developed method [7], such as direct SPME [8,9,10,11] have been used in the tube to determine lead ion .

There is a real need to get rid of the least selectivity which is a major drawback of this method, leading to significant obstacles in sample analysis [12, 13]. On the other hand, commercially available fibers are characterized by low stability, low selectivity, not strong enough and very expensive, so there is a need to improve the properties of these fibers. [14,15]. MIP is based on the use of materials with high-ability properties to identify specifically the analytical molecules that make up the identification sites specified in the polymer matrix by structure in an analytical presence such as particle printing.

We may make cross-linked synthetic polymers using a typical monomer polymerization process carried out in the presence of a template molecule [16]. Both the silicone and the mold have been cleaned and contain clear areas that have been identified as identification sites [17]. These sites and model particles complement each other in shape, size and chemical function. MIP shows the ability to selectively select the template and its derivatives

The aim of this study was to identify lead ion by preparing new MIPs that are used as solid-phase recovery and Atomic absorption spectroscopy as a detector.

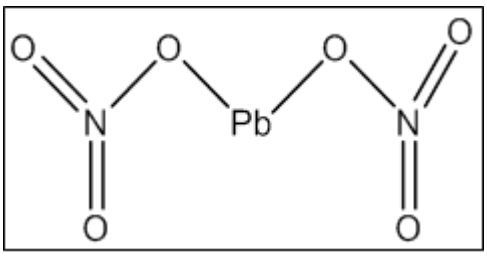

FIGURE 1 Structure of lead nitrate ($Pb(NO_3)_2$)

Experimental reagents and chemicals

Allyl chloride, Acryl amide, Ethylene glycol dimethylacrylate (EGDMA) and benzoyl peroxide were purchased from Sigma–Aldrich (St. Louis, MO, USA, www.sigma-aldrich.com). Methanol, chloroform, acetonitrile, acetic acid, formic acid and lead nitrate ($Pb(NO_3)_2$) were purchased from Merck (Darmstadt, Germany,www.merck.com). Nitrogen gas (99.99) was prepared from Arab gulf factory Baghdad.

Instrumentation

The control was performed using atomic absorption spectrophotometer AA-7000 (shimadzu made in Japan) and the use of UV (Shimadzu U.V spectrophotometer 1800 pc) and scanning electron microscopy (SEM) (JSM.6390A). FTIR Shimadzu (FTIR) - 8000 (Japan) was made to parameter settings through the operator panel. Ultraviolet radiation was used to measure pure lead nitrate of 206 nm and was then used again to measure MIP-Pb uptake, which was pre-washed after washing to ensure that all lead ion was removed. Ultrasonic (W.GERMANY) was used to stir up the prepolymer solution.

MIP procedure

0.015 mmol 0.009 gm template ($Pb(NO_3)_2$ was dissolved in 2 mL methanol and 0.3 mmol 0.4 mL of functional monomer Allyl choride was added. After the ultrasonic flipping, the resulting mixture was added for 15 minutes, 3.964 mmol 3 mL of EGDMA as kross linker and 0.619 mmol 0.3 mg initiator (benzoyl peroxide) to the solution. The solution was bubbled with nitrogen for 10 min and used as bulk solution. The tub was sealed by the rubber. Then the tub was left in the water bath at 60c overnight. The wire was completely removed after the polymerization process was completed. The coating was performed with a NIP layer in the same manner as described above except that lead nitrate was not included in the polymerization process. MIP and NIP coated tubes were washed several times with an excess amount of methanol/acetic acid/distilled water multiplier (30:5:15 v/v/v) in the soxhlet for 48 hours until the mold and the non-reacting compounds were removed as much as possible, followed by drying them for 2 hour in a vacuum. MIP and NIP were prepared in the

oven to examine MIP and NIP prepared in the oven for its scale, before extraction, from the sampling device and used as extraction needles.

Before extraction, from the sampling device and use it as extraction wells, the plastic injector (Column) was filled with the MIP using a plastic syringe. The solution (Serum or standard solution or west water) was poured from the top end of the column. The solution movement was at an electric discharge at 50 rpm.

Sampling procedure

A stock solution at concentration (20, 30, 40, 50 ppm) of lead nitrate for Pb -MIP (Ally chloride) and Pb – MIP (Acryl amide (Column at a flow rate of 50 rpm was prepared. The column was removed from the MIP after being cleaned twice with 5 mL purified water to prevent matrix interference.

The sampling device

A 3 mL plastic syringe was used and each syringe was filled with different weights ranging (0.2 gm) from MIP which was previously ground and sifted 0.75 microns.

Real sample

Serum of kidney diseases and waste water samples of liquid waste from batteries were discarded into the sewage system. and the non-pointed and squid samples were subjected to extraction by column.

Extraction procedure

lead ion was extracted from Serum (kidney disease and waste water samples of liquid waste from batteries discarded into the sewage system using MIP- Pb (Allyl chloride) and MIP -Pb (acryl amide) solid phase extraction (SPE) column. This Column was prepared by packing it with a machete, 0.2 mg, the size of its container, 3 mL.The SPE vacuum was loaded with floating material from the serum(Have kidney disease and west water samples of Liquid waste from batteries discarded into the sewage system sample centrifuged at a flow rate (50)rpm.

After the light of the ceiling was collected from column in the small beaker. Then it was dried for 60 minutes. Next, it was collected from the column, put a baker, and a1mL of concentrated sulfuric acid was added to it and left for a 8 minute, then concentrated nitric acid 0.5mL was added to it and heated at a 60Ċ temperature after the mixture was added to distilled water and filtered with a filter paper and then estimated directly by atomic absorption

Results and discussion

To synthesize MIPs for lead ion (Pb^{2+}), two MIPs of lead ion were installed by self-assembly (non-covalent) bulk polymerization method. Functional monomers have been instrumental in studying interactions with template. Two monomers were used allyl chloride, acryl amide for the synthesized the MIPs and NIPs.

FTIR analysis

Figures 2, 3, 4 and 5 show the FTIR spectra (before and after the removal of Pb^{2+}) for MIP based on allyl chloride and acryl amide as a basic functional monomer. The main peaks were obtained from figures list in the Tables 1 and 2.

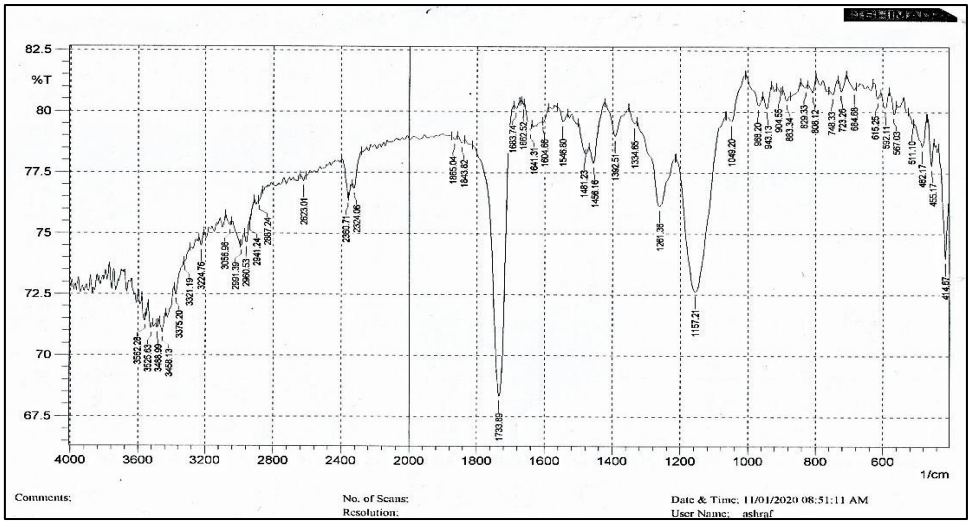

FIGURE 2 Pb – MIP (Ally chloride) before extraction

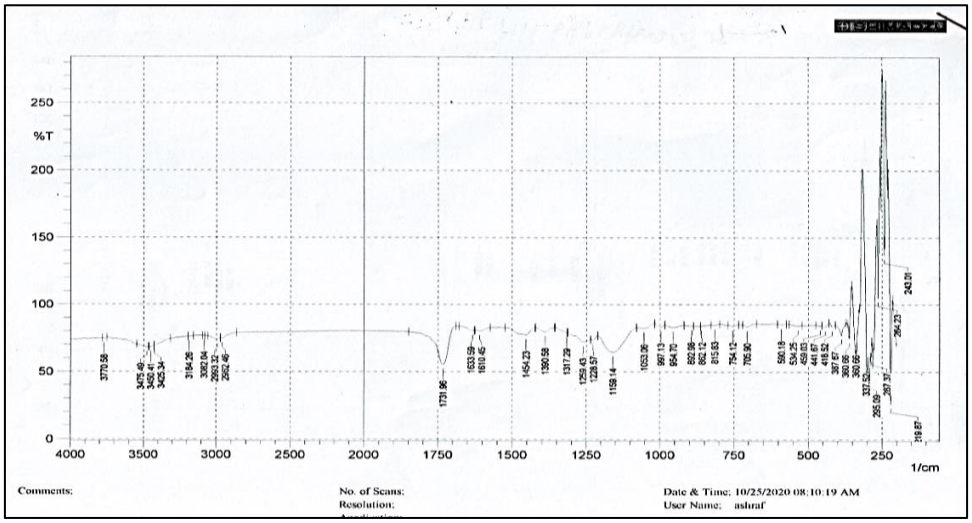

FIGURE 3 Pb – MIP (Ally chloride) after extraction

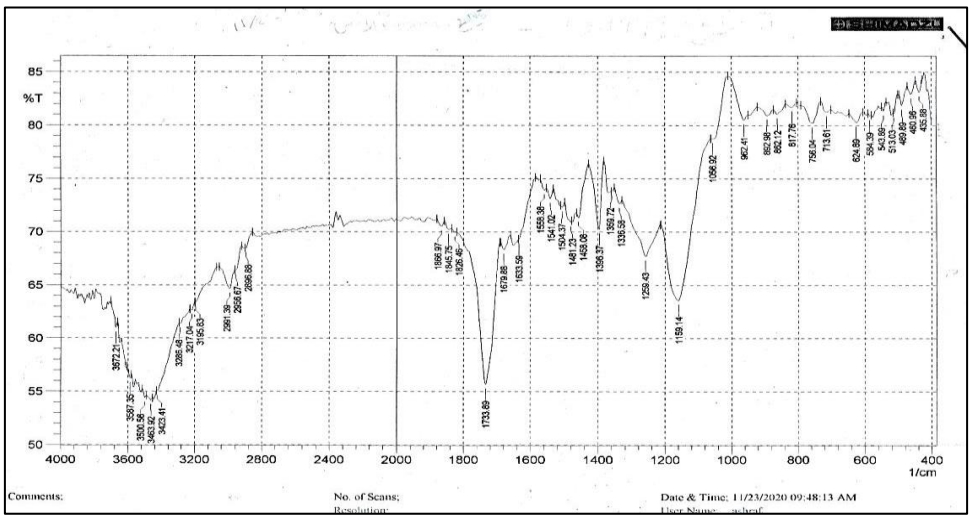

FIGURE 4 MIP (Pb – Acryl amide) before extraction

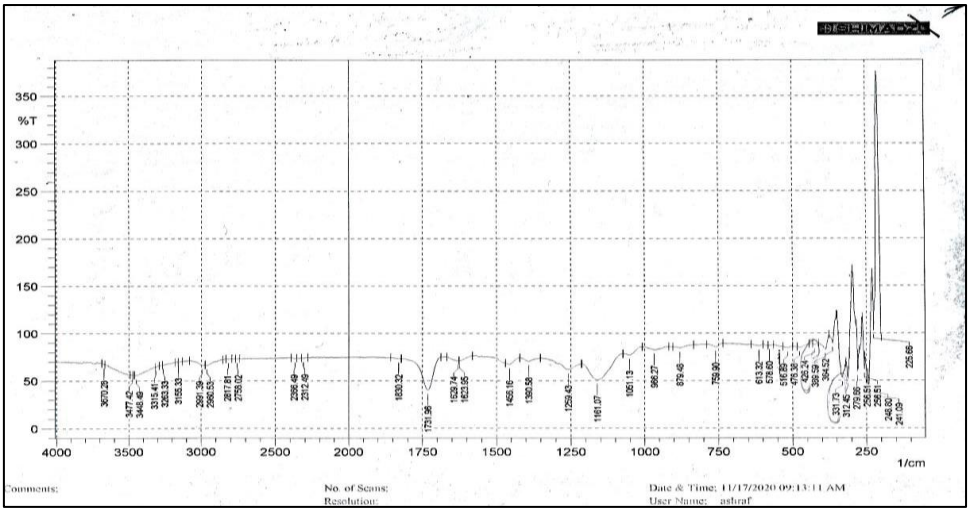

FIGURE 5 MIP (Pb – Acryl amide) after extraction

TABLE 1 MIP (Pb –Allyl chloride)

	Functional Group	Pb-MIP (Allyl chloride) before template removal	Pb-MIP (Allyl chloride) after template removal
1	ν Pb-O (cm^{-1})	455.17	----------
2	ν N=O (cm^{-1})	1546.80	----------
3	ν C=O acid (cm^{-1})	1733.89	1731.96
4	ν C=C Allyl	1641.31	1633.59
5	ν $H_2C{=}{=}CH_2$ aromatic	1604.66	1610.45
6	ν CH-aliphatic.(cm^{-1})	2960.53 2887.24	2962.46

TABLE 2 MIP (Pb–Acryl amide)

	Functional Group	Pb-MIP (Acryl amide) before template removal	Pb-MIP (Acryl amide) after template removal
1	ν Pb-O (cm^{-1})	460.96	----------
2	ν N=O (cm^{-1})	1541.02	----------
3	ν C=O acid (cm^{-1})	1733.89	1731
4	ν C=C Allyl	1633.59	1633.59
5	ν NH2	3463 3423	3487 3444
6	ν CH-aliphatic.(cm^{-1})	2991 2956	2989 2956

Infrared spectroscopy (FTIR) is used to diagnose the synthesis of lead molecular imprint polymer with a band at 455.17 cm^{-1} for Pb-O stretching,1546.80 cm^{-1} for N=O stretching, 1733.89 cm^{-1} for C=O acid stretching, 1641.31 for C=C allyl stretching, 1604.66 cm^{-1} for stretching allyl carbonyl and (2960.53,2887.24) cm^{-1} C-H stretching alphatic. When compared with FTIR after removal, the lead ion showed the disappearance of the band of Pb-O stretching and N=O stretching which indicated the removal of lead ion and formation of the molecular imprint polymer.

The FTIR spectra for before lead removal showed the appearance of band at 460.96 cm^{-1} for Pb-O stretching, 1541.02 cm^{-1} for N=Ostretching,1733.84 cm^{-1} for C=O acid stretching,1633.54 cm^{-1} for C=C allyl stretching,(3463,3423) cm^{-1} for stretching H-N-H. When compared with spectra of FTIR after removal, lead ion showed disappearance

the band of Pb-O and N=O which indicate to remove the lead ion and the formation of the molecularly imprint polymer

Among these trails, the molar ratios (template: monomer: cross linker) of (0.015:0.3:3.964) and (0.015:0.184:3.964) for MIP Pb-Allyl chloride and MIP Pb- Acryl amide has developed a polymer with excellent performance characteristics. These ratios match those found in the literature for certain prepared MIPs. The optimal ratios used in the synthesis of MIPs and NIPs for (Pb^{2+}) ion are summarized in Table 3.

TABLE 3 The variation ratios of [T: M: C] and progeny used in the preparation of MIPs and NIPs for

N		Salt $Pb(No_3)_2$	Monomer Ally chloride	Cross linker EGDMA	Initiator	Solvent	Result
MIP1	**%**	0.350	7.010	92.63	0.3	6 mL	Light
	mmole	0.015	0.3	3.964	0.32	CH_3OH	white
MIP1	**%**	0.350	4.744	94.89	0.3	6 mL	Light
	mmole	0.015	0.2	4	0.32	CH_3OH	white
MIP1	**%**	0.59	28.40	71.00	0.3	6 mL	Light
	mmole	0.025	1.2	3	0.32	CH_3OH	white
NIP1	**%**	------	7.010	92.63	0.3	6 mL	Light
	mmole	------	0.3	3.964	0.32	CH_3OH	white
N		**Salt $Pb(No_3)_2$**	**Monomer Acryl amide**	**Cross linker EGDMA**	**Initiator**	**Solvent**	**Result**
MIP2	**%**	0.360	4.419	95.219	0.3	6 mL	Light
	mmole	0.015	0.184	3.964	0.3	CH_3OH	white
MIP2	**%**	0.350	4.744	94.89	0.3	6 mL	Light
	mmole	0.015	0.2	4	0.32	CH_3OH	white
MIP2	**%**	0.59	28.40	71.00	0.3	6 mL	Light
	mmole	0.025	1.2	3	0.32	CH_3OH	white
NIP2	**%**	------	7.010	92.63	0.3	6 mL	Light
	mmole	------	0.3	3.964	0.32	CH_3OH	white

The control NIPs and MIPs after the elimination of the lead ion, on the other hand, have identical spectra, showing structural similarities, demonstrating that washing the MIP particles with 70% acetic acid solution using a soxhlet extraction method is an effective way to eliminate the template molecule and leave unique recognition binding sites in the polymer structure.

Adsorption isotherm

The absorption of isotherm is useful in the understanding of the adsorption mechanism of the adsorption mold with polymer surface. The data obtained from isothermal equilibrium was analyzed to show the isochromatic type of LANGMUIR or Freundlich models. This is determined by plotting the binding capacity (Q) versus the free concentration of the drug, and Q is calculated according to the following Equation:

$Q = [(Ci–Cf)\ Vs \times 1000]/MMIP$

Ci = initial drug concentration (µmole/mL)

Cf = final drug concentration (µmole/mL)

Vs = volume of solution tested (mL)

MMIP = mass of dried polymer (mg)

Than measuring binding parameter

MIP/drug binding calculated by Scat chard analysis using the equation

$Q/Cf = (Qmax - Q) / Kd$

Qmax = maximum capacity

Kd = dissociation constant at binding side.

Isotherm adsorption was obtained by shaking various amounts of lead ion with a synthesis particle in a thermal water bath at

25 °C for 2 hours, as seen in Figure 6. Table 1 shows the experimental evidence for the regrouping trials

Effect of flow rate the flow rate

The peristaltic pump used to remove the lead ion from the extraction needle is crucial because it determines the amount of time required for extraction. The flow rate of the sample solution through the constructed extraction needle is the most significant aspect. It must be sufficient to avoid time wasting by limiting the overall study time. The flow rate, on the other hand, must be low enough to ensure effective analyte preservation. Thus, the effect of the sample loading flow rate has been studied in the range of 10-100 rpm to estimate the influence of the time of contact between the MIP and the sample solution on the recovery as shown in the Tables 4 and 5 and Figures 6 and 7 on the relationship between the flow rate and extraction time based on 0.2 gm of MIP-Pb-(Allyl chloride) and (Acryl amide).

TABLE 4 Effect of flow rate on time of extraction based on MIP (Pb-Allyl chloride)

Pb-MIP (allyl chloride)										
C_i (µM)	24.154									
Mass of MIP mg	200									
Flow rate (rpm)	10	20	30	40	50	60	70	80	90	100
Time (min)	90	85	75	60	55	50	45	35	20	20
C_i (µM)	36.231									
Mass of MIP mg	200									
Flow rate (rpm)	10	20	30	40	50	60	70	80	90	100
Time (min)	60	55	45	30	20	10	6	5	5	5
C_i (µM)	150.962									
Mass of MIP mg	200									
Flow rate (rpm)	10	20	30	40	50	60	70	80	90	100
Time (min)	85	75	70	65	55	45	30	20	20	20
C_i (µM)	162.979									
Mass of MIP mg	200									
Fiow rate (rpm)	10	20	30	40	50	60	70	80	90	100
Time (min)	60	55	45	30	20	10	6	5	5	5

TABLE 5 Effect of flow rate on time of extraction based on (MIP Pb-acrylamide)

Pb-MIP (acryl amide)										
C_i (µM)	12.0775									
Mass of MIP mg	200									
Flow rate (rpm)	10	20	30	40	50	60	70	80	90	100
Time (min)	91	85	75	60	58	50	40	35	20	20
C_i (µM)	60.1545									
Mass of MIP mg	200									
Flow rate (rpm)	10	20	30	40	50	60	70	80	90	100
Time (min)	69	50	45	30	26	15	8	5	5	5
C_i (µM)	151.153									
Mass of MIP mg	200									
Flow rate (rpm)	10	20	30	40	50	60	70	80	90	100
Time (min)	80	72	69	65	55	40	30	20	20	20
C_i (µM)	163.2301									
Mass of MIP mg	200									
Fiow rate (rpm)	10	20	30	40	50	60	70	80	90	100
Time (min)	65	55	50	35	20	10	7	5	5	5

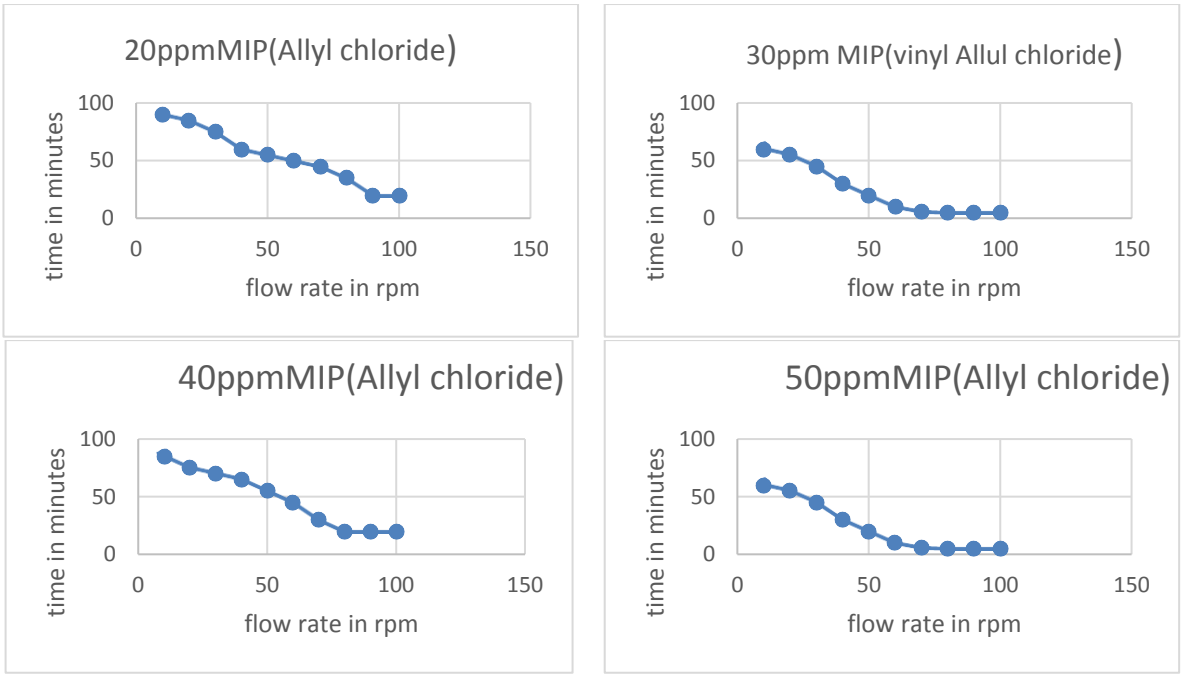

FIGURE 6 Relationship between the flow rate and extraction time based on 0.2 gm of MIP (Pb-Allyl chloride)

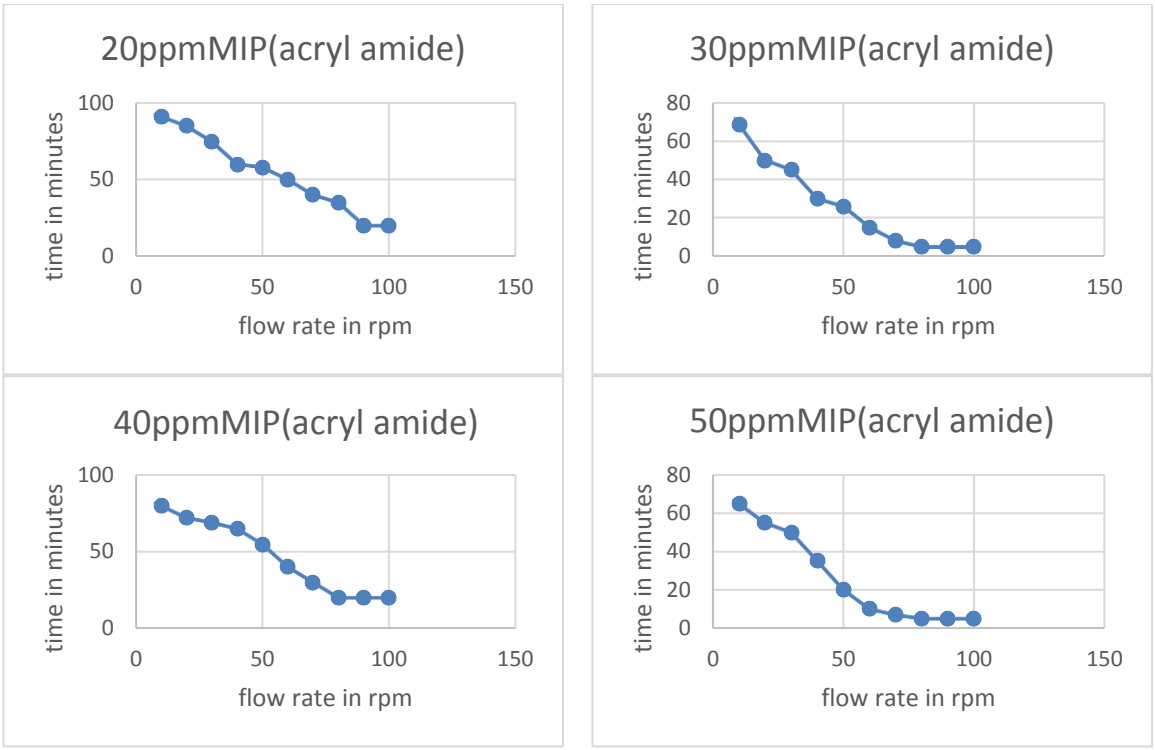

FIGURE 7 Relationship between the flow rate and extraction time based on 0.2 gm of MIP (Pb-Acryl amide)

Morphological Characterization

The main examination of the Imprinted Polymer particles collected with various methods was done using scanning electron microscopy (SEM). The SEM representations of the formulated polymers are seen in Figures 8 and 9. It can be shown that based on the process of Imprinted Polymer preparation, the views of the polymer particles vary

significantly. The polymerization of microemulsions produces very small particles. Spherically shaped polymeric particles with small sizes around (1 - 4) µm for (allyl chloride) polymer and (28.44 – 45.62) nm for (acryl amide) imprinted polymer can be distinguished in the related image

Serum sample analysis

Under optimal conditions, MIP Pb-allyl chloride and MIP Pb- acryl amide were applied homogeneously to determine Lead ion in serum samples. The serum sample matrix was passed through a glass tube containing 0.2 mg from MIP(Pb-allyl chloride) and MIP(Pb-acryl amide) using a prsitaltic pump and then 35 rpm in 14 min was washed. After that, the digestion process was done using 1 mL: 0.5 mL H_2SO_4 into HNO_3 (V: V) in order to prepare it for measurement in an atomic spectrometer. Figure 10 represents the lead ion calibration curve and Tables 8 and 9 the measurement results.

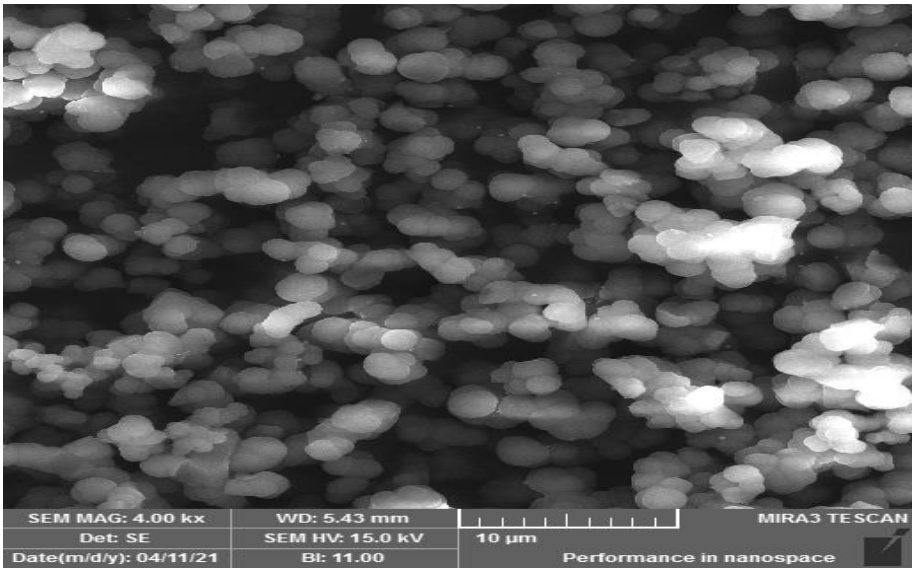

FIGURE 8 SEM of [MIP (Pb-allyl chloride)](10µm)obtained by bulk polymerization

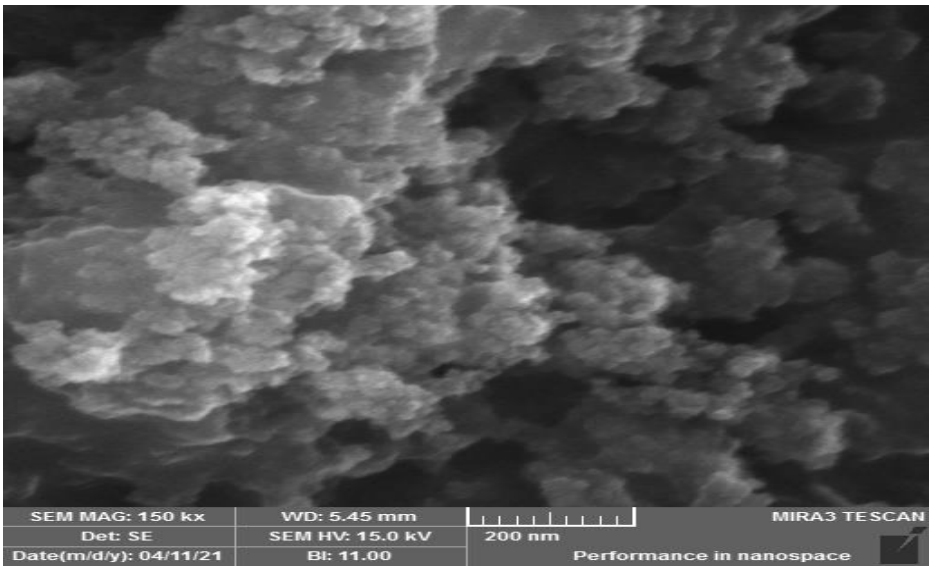

FIGURE 9 SEM of [MIP (Pb-acryl amide)] (200 µm) obtained by bulk polymerization

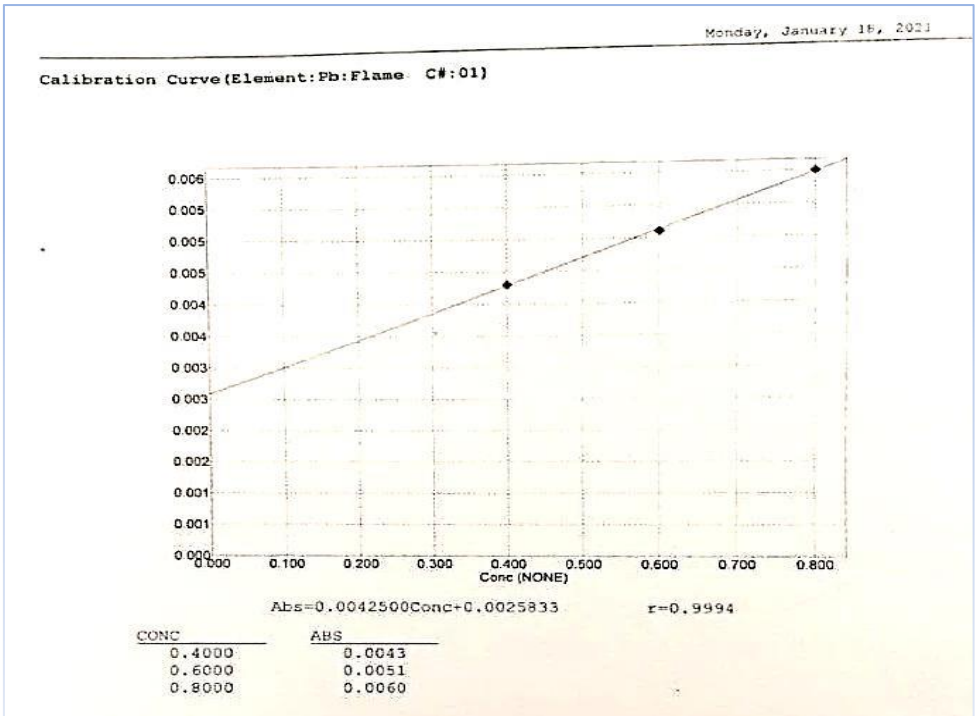

FIGURE 10 Represents the lead ion calibration curve

TABLE 8 Measurement results for serum samples (MIP Pb-Allyl chloride)

	MIP (Pb-Allyl chloride)						
	Taken	**Found**	**Creatine mg/dL**	**RE%**	**Rec%**	**RSD%**	**correlation coefficient**
1	0	0	0.8			0.12	R= 0.821
2	0	0	0.72			0.11	
3	0	0	0.5			0.12	
4	0	0	0.9			0.13	
5	0	0	1.1			0.13	
6	0	0	0.4			0.12	
7	0.027	0.0271	1.9	0.37037	100.3704	0.11	
8	0.0395	0.0396	1.4	0.253165	100.2532	0.10	
9	0.041	0.043	0.8	4.878049	104.878	0.11	
10	0.0548	0.0549	2..4	0.182482	100.1825	0.11	
11	0.0622	0.0623	2.5	0.160772	100.1608	0.11	
12	0.0791	0.0792	1.8	0.126422	100.1264	0.12	
13	0.103	0.123	1.9	19.41748	119.4175	0.12	
14	0.1306	0.1307	2.2	0.07657	100.0766	0.12	
15	0.1421	0.1431	2.6	0.70373	100.7037	0.11	
16	0.2264	0.2275	1.9	0.485866	100.4859	0.12	
17	0.2616	0.2627	3.1	0.420489	100.4205	0.11	
18	0.2726	0.2737	4.7	0.403522	100.4035	0.12	
19	0.301	0.303	8.9	0.664452	100.6645	0.13	
20	0.4	0.401	0.8	0.25	100.25	0.14	
21	0.402	0.415	4.3	3.233831	103.2338	0.11	
22	0.4265	0.4266	2.4	0.023447	100.0234	0.11	
23	0.454	0.465	1.6	2.422907	102.4229	0.11	
24	0.536	0.546	2.6	1.865672	101.8657	0.12	
25	0.5575	0.5584	2.9	0.161435	100.1614	0.11	

26	0.5604	0.5625	2.9	0.374732	100.3747	0.12
27	0.635	0.645	3.5	1.574803	101.5748	0.12
28	0.689	0.6991	4.9	1.465893	101.4659	0.11
29	0.7168	0.7178	2.9	0.139509	100.1395	0.10
30	0.72	0.721	6.3	0.138889	100.1389	0.11
31	0.7401	0.7421	2.8	0.270234	100.2702	0.12
32	0.8434	0.8545	5.9	1.316101	101.3161	0.11
33	0.9274	0.9285	3.6	0.118611	100.1186	0.12
34	0.9605	0.9627	2.7	0.229047	100.229	0.11
35	2.234	2.256	9.1	0.984781	100.9848	0.12
36	2.801	2.83	9.12	1.035345	101.0353	0.12
37	2.981	2.976	8.3	-0.16773	99.83227	0.12
38	3.014	3.052	7.2	1.260783	101.2608	0.11
39	3.0552	3.0563	9.5	0.036004	100.036	0.12
40	3.478	3.496	9.9	0.517539	100.5175	0.11
41	0.2067	0.2078	1.9	0.532172	100.5322	0.12
42	0.38	0.3804	2.3	0.105263	100.1053	0.13
43	0.4415	0.4431	2.6	0.362401	100.3624	0.14
44	0.4723	0.4745	5.5	0.465806	100.4658	0.11
45	0.323	0.3255	2.6	0.773994	100.774	0.11
46	0.2616	0.2627	2.4	0.420489	100.4205	0.11
47	1.461	1.472	8.1	0.752909	100.7529	0.11
48	2.441	2.45	9.10	0.368701	100.3687	0.12
49	2.775	2.786	7.3	0.396396	100.3964	0.12
50	3.001	3.012	8.2	0.366544	100.3665	0.12

TABLE 9 Measurement results for serum samples (MIP Pb-acryl amide)

	MIP (Pb-acryl amide)						
	Taken	**found**	**Creatine mg/dL**	**RE%**	**Rec%**	**RSD%**	**correlation coefficient**
1	0	0	0.8			0.12	**R= 0.788**
2	0	0	0.7			0.11	
3	0	0	1.01			0.41	
4	0	0	1			0.21	
5	0	0	1			0.14	
6	0	0	0.5			0.11	
7	0.043	0.0431	1.9	0.232558	100.2326	0.11	
8	0.0194	0.0196	1.4	1.030928	101.0309	0.11	
9	0.002	0.0021	0.8	5	105	0.12	
10	0.258	0.2549	2..5	-1.20155	98.79845	0.11	
11	0.2686	0.2687	2.3	0.03723	100.0372	0.12	
12	0.0901	0.0902	1.9	0.110988	100.111	0.12	
13	0.043	0.0431	1.8	0.232558	100.2326	0.11	
14	0.1136	0.1137	2.8	0.088028	100.088	0.10	
15	0.1026	0.1051	2.2	2.436647	102.4366	0.11	
16	0.0265	0.0275	1.3	3.773585	103.7736	0.11	
17	0.2606	0.2627	3.1	0.805833	100.8058	0.12	
18	0.1126	0.1137	2.7	0.976909	100.9769	0.12	
19	0.2176	0.2178	1.9	0.091912	100.0919	0.12	
20	0.003	0.0032	0.7	6.666667	106.6667	0.11	
21	0.1114	0.1116	2.3	0.179533	100.1795	0.12	
22	0.1206	0.1216	2.3	0.829187	100.8292	0.11	
23	0.0901	0.0902	1.6	0.110988	100.111	0.12	

24	0.2438	0.2449	2.7	0.451189	100.4512	0.13
25	0.2773	0.2784	3.0	0.396682	100.3967	0.13
26	0.3724	0.3725	1.9	0.026853	100.0269	0.12
27	0.2996	0.2997	3.2	0.033378	100.0334	0.11
28	0.945	0.9451	4.7	0.010582	100.0106	0.10
29	0.2077	0.2078	1.9	0.048146	100.0481	0.11
30	0.3803	0.3804	2.3	0.026295	100.0263	0.11
31	0.4421	0.4431	2.6	0.226193	100.2262	0.11
32	0.4735	0.4745	5.5	0.211193	100.2112	0.12
33	0.3254	0.3255	2.6	0.030731	100.0307	0.12
34	0.2625	0.2627	2.4	0.07619	100.0762	0.12
35	1.471	1.472	8.1	0.067981	100.068	0.11
36	2.43	2.45	9.10	0.823045	100.823	0.12
37	2.785	2.786	7.3	0.035907	100.0359	0.11
38	3.011	3.012	8.2	0.033212	100.0332	0.12
39	1.0862	1.0863	9.1	0.009206	100.0092	0.13
40	3.454	3.456	9.2	0.057904	100.0579	0.14
41	0.7165	0.7178	2.9	0.181438	100.1814	0.11
42	0.72	0.723	6.3	0.416667	100.4167	0.11
43	0.7401	0.7421	2.8	0.270234	100.2702	0.11
44	0.8524	0.8545	5.9	0.246363	100.2464	0.12
45	0.9274	0.9285	3.6	0.118611	100.1186	0.11
46	0.9617	0.9627	2.7	0.103983	100.104	0.12
47	2.245	2.256	9.1	0.489978	100.49	0.12
48	2.821	2.83	9.12	0.319036	100.319	0.11
49	2.964	2.976	8.3	0.404858	100.4049	0.10
50	3.051	3.052	7.2	0.032776	100.0328	0.11

Conclusion

In this study, lead ion was extracted from the serum samples using MIP (Pb-allyl chloride), (Pb-acryl amide) solid phase extraction (SPE) Column. The preparation of chemical sensors was done using different monomers with cross-linker to give the appropriate geometric shape to obtain the molecularly imprinted polymers (MIP), as well as knowledge of the capacity of each imprinted prepared for the lead ion. Two monomers were used: Allyl chloride and acryl amide. The lead ion can be estimated on the basis of small concentrations and multiple mixtures. The first step was to prepare the molecularly imprinted polymers of lead ion, where it is possible to concentrate and estimate small percentages of the lead. The second step was to obtain a concentration using solid phase extraction, thus the combination of a molecularly-imprinted polymer with solid-phase micro extraction (SPME) gave a preconcentration and estimation process in one step for better precision, sensitivity and selectivity. The effects of the extraction parameters such as flow rate of sample on extraction efficiency of the fiber to lead ion were examined by using atomic absorption. The time decreased as the flow rate increased and we fixed the flow rate of 30 rpm in which the time was 10 minutes. The volumes less than 0.015 mmol 0.009 gm for lead nitrate exhibited good reproducibility and was considered suitable for the determination of trace levels. The data obtained from the equilibrium of isotherm adsorption were analyzed to show the type of isotherm Langmuir or Freundlich models. The binding capacity increase with increasing the concentration of the lead ion. the MIP fibers were successfully applied for selective extraction of lead ion in serum samples ,100 samples, including 12 samples for peaceful people and 88 samples for people with kidney failure who have a background in dealing with

lead pollutants (lead smelter workers, and battery builders and maintenance workers) with lead concentrations above 3.001 ppm corresponding to the Creatine value 8.2. The minimum values for lead ions are 0.027 ppm the value of Creatine corresponds to 8.2 mg/dL using MIP (Pb-allyl chloride) and the highest value for lead corresponds to the value of Creatine 9.2 mg/dL and the minimum values for lead of 0.0021 ppm correspond to the value of Creatine 0.5 mg/dL using MIP (Pb-acrylamide) . The measurement of lead ions using preconcentration by MIP compared with the direct method for estimation using atomic emission spectroscopy showed higher accuracy as the correlation coefficient was 0.788 for MIP (Pb- allyl chloride)and 0.821 for MIP(Pb- acryl amide).

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