Preparation and Chrstrazatio New Reagent to Determination Vital Ion Mn (II) Spectrophotometrically Using Cloud Point Extraction Technique and Its Applications

Haider Dikhal Hamza, Ibtehaj Raheem Ali
Department of Chemistry, College of Education for Women, University of Kufa, Najaf, Iraq

Abstract

A new organic reagent is preparation which is 2-[3- methoxy phenyl azo ]- Doxycycline from drug compound, the reagent was diagnosed by spectral methods using (UV-Vis) and infrared (FTIR) as an identification using (HNMR) spectrum and (C.H.N). This reagent use to determination Mn (II) ion as pair ion complex that estimated and extracted according to the cloud point extraction (CPE) technique in enrichment layer, after adjusting the optimal conditions and factors affectedin efficiency extraction processes. The ion pare complex of manganese (II) is estimated according to the spectral method at $\lambda_{\text{max}}=410$ nm. The optimization of complexation and extraction conditions by (CPE) investigated as well as PH= 8, critical concentration of TX100= was 0.5 ml from TX-100 0.01%, heating time = 80°C. Thermodynamic parameters of CPE for extraction process of the ion –pair association complex in the triton x-100 were also considered $\Delta H=0.1824$ KJ, $\Delta G=-65.1620$ KJ, $\Delta S=185.1118$ J That referred endothermic reaction, with limit of Detection(LOD=0.0323µg mL-1) and limit of quantitation(LOQ=0.3237µg mL-1), Molar absorptivity ($\varepsilon=8170.4$Lmol-1.cm-1). The stoichiometry study to determination complex structure that ratios of metal : reagent obtained are (1:1). Underthe optimized conditions of a 10 ml sample gave perconcentration and enrichment factors are (20 and 1.3) respectively with sandells sensitivity (7.9176x10-4µg cm-2/0.001A.U).The calibration curve linear in the range of 1-7ppm with acorrelation coefficient of $R= 0.9996$. The relative standard deviation for replicate determination at (100)µg 10ml-1 level is 2.3537%. The proposed method applied for the determination of manganese in vegetables, plant leaves, fish and water which gave satisfactory results.

Keywords: Cloud Point Extraction Determination Azo Preparation Identification Thermodynamic Treatment Purification Mn

1- Introduction

By using an environmentally friendly technology, it is point cloud technique for determination, enrichment and extraction of manganese (II) after converting it into an ionic bonding complex by using the organic reagent prepared from a drug compound which is less harmful and less toxic to humans.

A newazo reagent is prepared to study it interacts with the metal ions, such as manganese (II) ion. Recently, viewed actions involving separation and perconcentration for the determination of manganese in various matrices using spectrometric technique, such as HPLC-ICP –MS[1], as well as the Technique for extraction of liquid micro- liquid dispersed with FAAS[2]. Although, some of the methods of extraction have high per concentration factor and extraction efficiency, but they have some defects are associated with sample contamination, relatively time consuming or rigid control of the conditions, high cost, relatively poor accuracy and require a large volume of organic solvent. In past decade the separation and per concentration of metal ions, after the formation of chelates or ion association complexes, by cloud point extraction (CPE) has been extensively use in the field of extraction in analytical chemistry because of the speed, accuracy, high sensitivity, does not require high skill, dose not use organic solvents in addition to high efficiency, as well as through which it can estimate, extract and enrich trace elements[3][4], compared with actions mentioned. many research has been published in chemistry on the per concentration of manganese, alone or with other elements.
2-Experimental

a. A Shimadzu double beam UV-Vis Spectrophotometer model UV-1700 (Japan) working at wavelength of 190-1100 nm (±0.3nm accuracy at D2 peak 656.1nm, 486.0 nm and ± 0.1 repeatability), spectral bandwidth of 1nm (190 to 900nm) equipped with 10-mm optical path cell was used for the scanning of absorption spectra of all reagents and complexes throughout this study. b. While absorbance measurements in the optimization study and detection of metals were done with Single beam (UV-Vis) Spectrophotometer, TRIUP International Corp - TRUV. 74, S (Italy). FTIR- 8400S, Shimadzu (Japan), CHN/O Analyzer, Nuclear Magnetic Resonance Spectrometer-HNMR (Central Dastcami laboratory – Iran).

2-1: Reagent and materials

All analytical grade reagents were used without further purification as received from different company. Doubled distilled water was used for diluting the standard, reagents and samples. The nonionic surfactant (Triton X-100) whose chemical structure is C₈H₁₇C₆H₄(OCH₂CH₂)ₙ with n equal to 9-10 and an average molecular weight of 625 g/mol, was purchased from Sigma (Sigma Ultra, >99.6%). (UK) and used without further purification. NaOH (99%), HCl (37%), NaNO₂(99%) were purchased from CDH(UK), Mn (II) standard solution (1mg/mL) prepared by dissolving (3.7752g) of MnSO₄ (Merck, 99.97%) in 25mL distilled water in volumetric flask.

As well (2-[3-Methoxy phenyl azo]-Doxycycline solution with 5×10⁻³M concentration prepared by dissolving (0.1478 g) in 0.5mL Triton X-100 and distilled water. A special solution prepared by dissolving 7.5g from mercuric sulfate(HgSO₄) in 10mL from nitric acid(HCl) and 20 mL from phosphoric acid (H₃PO₄) and 0.003g from silver Nitrate(AgNO₃), Then the solution is diluted with 100mL of water. All working solutions prepared by dilution appropriate volume.

2-2: Synthesis of (2-[3-Methoxy phenyl azo]-Doxycycline (MPAD) as a complexing reagent

The reagents is prepared according to the procedure published elsewhere[5] by dissolving (1.9806g 0.01 mole) of doxycycline in a mixture containing 4 mL concentration(12M)HCl and 25 mL distilled water. After cooling this solution to 0 C°, 1.4 g of sodium nitrite dissolved in 10 mL, distilled water was added with maintaining the temperature at 0 C°. The mixture was set aside for 15 min for complete diazotization process. Thereafter, the diazonium solution is added drop by drop into beaker containing (1.3516g , 0.01 mole) of 3-Methoxy aniline 1.2 g sodium hydroxide dissolved in 150 mL ethyl alcohol with keeping temperature at 0 °C. After complete addition, the contents was left for two hours, then 150 mL of cooled distilled water was added, the pH of the solution adjusted to 7 by HCl, a brown powder was precipitated and left for 24 h. The solid product was filtered off, washed with cold water. The chemical formula of C₃₀H₃₁O₉N₄ with Mw. (591.59g. mol⁻¹). The reaction pathway can be show schematically in Figure 3. The azo reagent synthesized in this work were identified by UV – Vis., FTIR, H¹ NMR that following study, and C.H.N elemental analysis as shown in table (1). This reagent dissolved in water, it was prepared in 0.5% Triton X-100 before use.
2.3: Elemental Analysis CHN/O

Table 1: Elemental Analysis of MPAD

<table>
<thead>
<tr>
<th>Compound: C_{30}H_{31}O_{9}N_{4}</th>
<th>Calculated</th>
<th>Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>C%</td>
<td>60.95</td>
<td>59.60</td>
</tr>
<tr>
<td>H%</td>
<td>5.28</td>
<td>4.30</td>
</tr>
<tr>
<td>N%</td>
<td>9.47</td>
<td>8.51</td>
</tr>
</tbody>
</table>

2.4. Recommended Procedure

For cloud point extraction, aliquots of 10 mL of the standard or sample solution containing the analyte (1.8202 x 10^{-4} M, 100 µg/10 mL MnSO₄, at pH = 8 and Triton X-100 (0.5 mL of 0.1% w/v) were allowed to heated for 15 min in a thermostated bath at 80°C. Separation of the two phases were occurred immediately where the surfactant-rich phase became a highly viscous (without need of centrifugation and cooling) and settled down at the bottom of the tube making the aqueous phase easily separation by decantation. Later, the surfactant-rich phase in the tube was dissolved in 5 mL of ethanol and the absorbance of the resulting solution was measured at λ_{max} = 410 nm in a 1 cm cell against a reagent blank. prepared a same way and determination the remain Mn^{2+} in aqueous solution by spectrophotometric method special solution[6] to calculate extraction ratio D.

2.5. Preparation of Samples

A duplicate sample (fish or plant) solution was prepared by transferring approximately 5 g of dried sample into a 250 mL conical flask and adding 10 mL of concentrated HNO₃. The contents of the flask were heated on an electric hotplate until the volume was reduced to 2-3 mL. After cooling, a further of 10 mL of concentrated HNO₃, 5 mL of concentration H₂SO₄ and 4 mL H₂O₂ were added and the content reheated to boiling until the volume became 2-3 mL, then 10 mL of water were added until colorless solution was obtained indicating of the oxidation of organic matter. The content was cooled and transferred into 100 mL volumetric flask and diluted to the mark with distilled water after filtration.

An aliquot of 5 mL of sample solution input in 25 mL conical flask and treated with 1 mL of 5% potassium iodide solution with continuous shaking and then filtered. The filtrated was transferred into 10 mL volumetric flask and diluted to the mark with water. The Manganese(II) was determined according to the recommended procedure. The blank solution was prepared in the same manner without analyte.
3-Results and Discussion

3.1 Absorption Spectrum of Prepared (MPAD) Reagent and Ion Pair Association Complexes\textit{[Mn; (MPAD)] Extracted by Cloud Point Extraction (CPE)}

The UV-visible spectrum of the synthesized (MPAD) reagent that dissolved in Triton X-100 (0.5 mL of 0.1% w/v) were composed of two main maximum absorption peaks shown in (Figure 4). The formation of ion-association complex between Mn$^{+2}$ and MPAD in basic, medium at pH=8 critical concentration of TX-100 was 0.5 mL, heating time=80˚C, critical concentration of MPAD is (5 x 10^{-3} M), under the conditions of CPE procedure is also achieved via an emergence of a new absorption maxima at $\lambda_{\text{max}}$ of 410 compared with that found with the reagent MPAD alone which gave an absorption maxima at $\lambda_{\text{max}}$ of 373 nm as depicted in the spectra (a) and (b) of (Figure 2).

![Absorption Spectrum of MPAD Reagent](image)

Figure (2) UV-Vis spectra of 5 x 10^{-3} M(MPAD) in dilute TX-100 was 0.5 mL surfactant and (1.8202 x 10^{-4} M of Mn$^{+2}$) Absorption spectra complex of Mn$^{+2}$

3.2 - FT-IR Spectrum of MPAD Reagent

The FTIR spectrum of [MPAD] is obtained for compound sample prepared as KBr disk by using a Shimadzu FT-IR spectrophotometer series 8400S. Figure (3) and summarize the IR data of the synthesized MPAD. The occurrence of the azo bands at (1514.17-1462.09 cm$^{-1}$) confirmed that a synthesized dye containing azo group in the solid state[7][8].

IR data (400-4000 cm$^{-1}$) of MPAD((OH)stretching(m,v)3415 cm$^{-1}$,(C-H) aromatic(w,v) 2945 cm$^{-1}$,(C-H) aliphatic(w) 2945 cm$^{-1}$, (C=N)(s,v) 1604 cm$^{-1}$,(N=N)(m,v) 1456 cm$^{-1}$, (C=C)(m,v) 1382 cm$^{-1}$,(C-O)(m,v)1057 cm$^{-1}$,(C=N)(m,v) 1209 cm$^{-1}$,(C-H)(s,6,bend aromatic) 2945 cm$^{-1}$,(C=O) 1618 cm$^{-1}$)

3.3 - HNMR Spectra of MPAD Reagent

respectively (A6) were also identified by using 1H-NMR appearing of (2.74) for (2H) (CH$_2$-S) 3,6-dihydro-2H-1,3-thiazine (3.81) (3H) for (CH$_3$-O-)methoxy methane (3.82) for (3H) (CH$_3$-O-N=)formaldehyde O-methyl oxime (4.70)
for (2H) (O-CH$_2$)-methoxy ethane for (1H) (N-CH-C=O)azetidine (6.5-7.8) for (1H) Aromatic (8.47) for (1H) (NH-C=O) formamide (9.64) for (HO-) Hydroxyl (12.70) for (1H) (HO-C=O) Hydroxyl.

3.4- Optimization of The Parameters for Cloud Point Extraction of Mn(II) Efficiency by CPE

many of factors impact the CPE procedure to determination of Mn(II) such as pH investigated there are (Triton X-100, MPAD, Mn$^{2+}$) concentration, heating time and equilibrium temperature by using classical optimization.

3.4.1 Effect of pH$_{ex}$ on Extraction Efficiency by Cloud Point Extraction by CPE

The results in Figure (3.6.a and3.6.b) shows that optimum value for pH$_{ex}$ is pH=8 which give higher distribution ratio (D). The pH lower than optimum value of aqueous layer effect to may be protonated the nitrogen atom in thiazol ring in reagent molecule and occupy the lone pair electron caused to minimizing the complexation ability and decrease the distribution ratio (D), in the other hand the pH higher than optimum value caused to decrease distribution ratio (D) by produced stable species of Mn$^{2+}$ ions in aqueous solution cannot be extracted in addition of produced ion pair complex contain hydroxyl ion (OH$^-$) as anion which is more stable in aqueous phase and minimizing.

![Figure 3](https://example.com/figure3.png)

**Figure 3** :a Effect of pH$_{ex}$ concentration on formation and stability of species extracted. b : Effect of pH$_{ex}$ on distribution ratio (D), and stability of species extracted.

3.4.2 Kinetic Study and Effect of Heating Time on Extraction Efficiency by CPE

The import phase separation and preconcentration of an analyte efficiently, optimal time are very crucial parameters for complete reaction for that the incubation time were examined due to the reaction completion and efficient separation of the phases, 100µg/10mL Mn$^{2+}$ ion in 10mL aqueous solution was extracted at varied and different incubi time (70 C˚,75 C˚,80 C˚,85 C˚,90 C˚) in thermostat and [MPAD] =5x10$^{-3}$ by CPE method at pH =8 after adjusted by drops of dilution ammonium solution and (0.5 mL of 0.1% w/v) of Triton X-100 as a surfactant that formation rich- phase at temperature 80 C˚ after that separation cloud point layer (rich- phase ) by decantation and dilute by ethanol at 5 mL volumetric flask and absorption measured at $\lambda_{max}$ = 410 nm against blank prepared a same way, determination the residual Mn$^{2+}$ in aqueous solution by spectrophotometric method special solution to calculate distribution ratio D the results were demonstrated in Figures 5.

![Figure 4](https://example.com/figure4.png)

**Figure 4** :a Effect of incubi time b : Effect of incubi time ion pair complex extraction efficiency. formation on association and D value.

The results show 15 min. is the optimum heating time to reach higher extraction efficiency whereas heating time represent the kinetic side of extraction method at this time reaching maximum ion pair association complex formation.
and extraction, any time less than optimum not allow to reach the favorable equilibrium, so that any heating time more than optimum heating time effect to decrease extraction efficiency because increase backward direction of equilibrium that is mean increase the rate of dissociation and decreasing in ion pair complex extracted. It was also observed that the incubation time of 10 min is sufficient for the maximum absorbance of manganese complex.

3.4.3 Thermodynamic study and Effect of Temperature on Extraction Efficiency by CPE

10mL aqueous solution contain 100 μg/10mL Mn$^{2+}$ and 5x10$^{-3}$M of MPAD at different temperature. The temperature was varied from 75 to 90 C˚ in a search of optimum value. It was shown that the highest absorbance signals at the temperature 80 C˚ achieving quantitative extraction (Figure 3.6.4 a and 3.6.4b ). High temperatures are not suitable to procedure the CPE because higher temperatures cause instability of complex due to thermal decomposition of ion-pair association complex. In this study, 80 C˚ is chosen as the optimized temperature for subsequent experiments.

![Figure 5-a : Effect of temperature on stability extraction efficiency](image)

**Figure 5-a : Effect of temperature on stability extraction efficiency**

After calculated Thermodynamic study

Thermodynamic parameters and the equilibrium extraction constants ($K_{ex}$) for the extraction of [Mn$^{2+}$ :MPAD] ion pair complex during the CPE using Triton X-100 as a extracting agent at various temperatures were determined. The equilibrium constants ($K_{ex}$) at the selected temperature were calculated from equation below. These thermodynamic equilibrium constants ($K_{ex}$) is actually represents all equilibrium constants that affect the separation process such as complex transportation constant from aqueous phase to surfactant phase, aggregation micelles constant with increasing temperature, association constant of the complex and distribution constant of the surface between aqueous phase and surfactant (micelles) phase and the results are shown in Table 2 and Figure 6.

$$K_{ex} = \frac{D}{[Mn^{2+}][MPAD]}$$

From the slope of straight line from the plot of log $K_{ex}$ versus $1/T$ (Figure 3.6.5c) and relations below[9].

calculated thermodynamic parameters demonstrated in Table 3:

**Figure 6: Effect of temperature on extraction constant**
Slope = $-\frac{\Delta H_{ex}}{2.303 R}$

$\Delta G_{ex} = -RT \ln K_{ex}$

$\Delta G_{ex} = \Delta H_{ex} - T \Delta S_{ex}$

Table 2: Thermodynamic data for extraction Mn$^{2+}$ ion

<table>
<thead>
<tr>
<th>TC°C</th>
<th>TK°C</th>
<th>$\Delta H_{ex}$ J mol⁻¹</th>
<th>$\Delta G_{ex}$ KJ mol⁻¹</th>
<th>$\Delta S_{ex}$ J mol⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>348</td>
<td>0.1824</td>
<td>-60.9933</td>
<td>175.7925</td>
</tr>
<tr>
<td>80</td>
<td>353</td>
<td></td>
<td>-65.1620</td>
<td>185.1118</td>
</tr>
<tr>
<td>85</td>
<td>358</td>
<td></td>
<td>-63.0145</td>
<td>176.7791</td>
</tr>
<tr>
<td>90</td>
<td>363</td>
<td></td>
<td>-62.9698</td>
<td>173.9734</td>
</tr>
</tbody>
</table>

Enthalpy value ($\Delta H_{ex}$) found to be 0.1824 kJ mol⁻¹ while the values of Gibb's free energy ($\Delta G_{ex}$) were obtained at different temperatures. Once these two parameters are obtained, the values of entropy ($\Delta S_{ex}$) were also calculated. The results revealed that the extraction of ion-pair complex is easy and thermodynamically favorable due to the small value of $\Delta H_{ex}$ which leads to dehydration of micelles (i.e decrease the value of $\Delta H_{solv}$ and increase $\Delta H_{hyd}$) and resulting in increasing the phase-volume ratio thus extraction efficiency enhancement.

$$\Delta H_{ex} = \Delta H_{solv} - \Delta H_{hyd}.$$  

It was also noted form Table 3 that the values of $\Delta G_{ex}$ approximately decreased with temperature. The negative values of $\Delta G_{ex}$ indicate that the ion-pair complex solubilization process is also spontaneous and thermodynamically favorable.[10] The reaction of extraction by CPE is endothermic reaction and positive value of $\Delta S_{ex}$ mean the reaction is entropic inregine.

3.4.4 Stoichiometry and Effect of MPAD Concentration on Extraction Efficiency by CPE

The variation of absorption signal as a function of (2-[3-methoxy phenyl azo]-doxycycline) MPAD amount is investigat extracted 100µg/10mL Mn$^{2+}$ from 10mL aqueous solution by different concentrations (1x10⁻⁵M- 1x10⁻³M) of (MPAD) dissolved in (water with 0.5 mL Triton X – 100) by CPE method at pH =8 after adjusted by drops of dilution ammonium solution and (0.5 mL of 0.1% w/v) of Triton X-100 as a surfactant that formation rich- phase by 15 min. heating time in thermostat at temperature 80°C after that separation cloud point layer (rich- phase ) by decantation and dilute by ethanol at 5mL volumetric flask and absorption measured at $\lambda_{max}$= 410 nm against blank prepared a same way, determination the residual Mn$^{2+}$in aqueous solution by spectrophotometric method special solution to calculate distribution ratio D. The results were illustrated in Figure 7.
The results have shown that the concentration of $5 \times 10^{-3}$ M (MPAD) provides a high distribution ratio (D) with highly stable ion pair complex formation extractable into surfactant, whereas at $1 \times 10^{-3}$M gave lowest extraction. At lower than $5 \times 10^{-3}$M MPAD, unstable ion-pair complex was formed which led to depress the extraction into surfactant. Whilst, at higher than of $5 \times 10^{-3}$ more dissociation of complex might occur resulting in a negative deviation in the absorbance values because of mass action.

It is another hand reported the analysis of the dependence log D vs (log $C_{MPAD}$) by preparing it 10 mL aqueous solution contain $100 \ \mu g/10\text{mL}$ of Mn$^{+2}$ and $5 \times 10^{-3}$M MPAD as a complexation reagent that formation ion pair association complex [Mn$^{+2}$;MPAD] that extracted by CPE method in pH =8 after adjusted by drops of dilution ammonium solution and (0.5 mL of 0.1% w/v) of Triton X-100 as a surfactant that formation enrichment phase by 15 min. heating time at temperature 80°C after that separation cloud point (rich-phase) by decantation and dilute by ethanol at 5 mL volumetric flask and absorption measured at $\lambda_{max} = 410\text{nm}$ against blank prepared a same way and determination the remain Mn$^{+2}$ in aqueous solution by spectrophotometric method special solution to calculate extraction ratio D. permits determination of the stoichiometry in the extracted complex The slope on the Figure 3.6.2.C and 3.6.2.d) coordinates is nearly equal to one, indicating the ion pair complex with Mn$^{+2}$: MPAD ratio 1:1 is extracted into the surfactant-rich phase.

\[
\text{Slop organic reagent} = 0.0241 \\
\text{Slop ratio} = \frac{0.0241}{0.0178} = 1.35 \\
\text{Slop metal anion} = 0.0178
\]

![Graph](image.png)

**Figure 8**  a- Effect of organic reagent Concentration.      b- Effect of metal anion concentration.

3.4.5 Calibration curve and Effect of Manganese Ion Concentration on Extraction Efficiency by CPE

Extracted different concentrations of metal ion Mn$^{+2}$ (1 ppm-12 ppm), the general way[11].
The maturity numbers were calculated to curve calibration as in the table 3:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda_{\text{max}}$ (nm)</td>
<td>410</td>
</tr>
<tr>
<td>Regression equation with CPE procedure</td>
<td>$y = 0.0177x - 0.013$</td>
</tr>
<tr>
<td>Correlation coefficient ($r$)</td>
<td>0.9991</td>
</tr>
<tr>
<td>Concentration range (ppm)</td>
<td>(1-12)</td>
</tr>
<tr>
<td>Limit of Detection (ppm)</td>
<td>(0.0666)</td>
</tr>
<tr>
<td>Limit of Quantitation (ppm)</td>
<td>0.6666</td>
</tr>
<tr>
<td>Sandell's sensitivity ($\mu g \text{ cm}^{-2}/0.001 \text{A.U}$)</td>
<td>$(7.9176 \times 10^{-4} \mu g \text{ cm}^{-2}$</td>
</tr>
<tr>
<td>Molar absorptivity ($L.\text{mol}^{-1}.\text{cm}^{-1}$)</td>
<td>8170.4</td>
</tr>
<tr>
<td>Composition of complex (M: L)</td>
<td>1:1</td>
</tr>
<tr>
<td>RSD% ($n=8$)</td>
<td>2.3537</td>
</tr>
<tr>
<td>Preconcentration factor</td>
<td>20</td>
</tr>
<tr>
<td>Enrichment factor</td>
<td>1.3</td>
</tr>
</tbody>
</table>

### 3.4.6 Application

The regression line was used to estimate the analyte concentration in the samples selected which appears justified on statistical basis. The proposed method was applied for the determination of Manganese(II) in various samples including plants (vegetable), fish and water selected randomly from different areas of the Dewaneyah City (middle of Iraq) in order to test its applicability and reliability. For this purpose, an aliquot of each sample prepared according to recommended procedure was preconcentrated following CPE for manganese determined spectrophotometry. The results of the proposed method for each type of the selected samples were compared with flame atomic absorption spectrometry (FAAS) in our laboratory. The results are summarized from Table 4

**Table 4: Concentrations of Mn$^{2+}$ (ppm) in different Samples of The Dewaneyah City (Middle of Iraq).**

<table>
<thead>
<tr>
<th>NO.</th>
<th>Sample name</th>
<th>Proposed method ppm</th>
<th>FAAS method ppm</th>
<th>Paired t –test</th>
<th>$t_{\text{cal}}$ ($n=5$)</th>
<th>$t_{\text{crit. at 95%}}$ DF=5</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Local fish from the Euphrates River</td>
<td>25.7566</td>
<td>23.0214</td>
<td>15.70</td>
<td>80.0143</td>
<td>0.1511</td>
<td>2.571</td>
</tr>
<tr>
<td>2</td>
<td>Water from the Euphrates River</td>
<td>2.7899</td>
<td>3.7576</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Aubergine</td>
<td>20.6891</td>
<td>21.4263</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cucumber</td>
<td>11.0235</td>
<td>10.0452</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>zucchini</td>
<td>22.5678</td>
<td>20.2975</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
All statistical results performed by the paired t-test for comparison of means between the proposed and FAAS methods for all samples (Table 6) have revealed that all p values [P(t _cal.) < P(t _crit.)] were more than the t calculated values indicating acceptance of null hypothesis (Ho), and this means that the proposed method under study is better than the method FAAS.

4-Conclusions

1- The possibility of preparing compensation in a quick and simple way after installing the best conditions of the concentration of optimal detector and acid function.
2- The extraction technology was based on the cloud point on the use of MPAD detector for complex from the positive ion under study and extract those held in the CP cloud point layer.
3- The process of extraction within the CPE technology is a thermodynamic process and was an important role to create a cloud point layer.

References


