Study the Effect of Laser on some Natural Dyes, Pharmaceutical Drugs and Chemical Compounds

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Keywords:
- Laser Light
- Natural Products
- Heavy Elements
- The Wavelength
- Absorbance

Abstract

Due to the change of some drugs and natural products in the chemical components or chemical structure by exposing them to a laser beam or light, and the effect of heavy metals that may be present in them as a component in them, or as impurities in some medicines, colored dyes, and natural products. The presence of light and laser beam has been studied at time 40 minutes. There are chemical reactions or chemical bonds that may form between the metal ions of medicines such as ibuprofen, folic acid, librex, albendazole, and the iron drug, except for Ca^2+ and Ni^2+ because they have the same λ max, and the pigments found in carrots, red cabbage, beets, turmeric, and maringa, sage, excluding Ca^2+ and Ni^2+ due to having the same λ max, beet, folic acid, iporphine, and turmeric had the most changes with metal ions, Cu, Ca, Ag, Ni, Fe, Cr, Cd, Pb, Zn and Mn ions after inducing the laser beam. The Ca^2+ and Ni^2+ ions are the most stable ions with all drugs, and pigments extracted from natural products than the rest of the other ions. Previous studies focused on studying the effect of the laser beam on chemical compounds, both separately. In this study, they focused on the effect of the laser beam on medicines and natural dyes, as well as what they may contain of heavy metals or impurities and the chemical changes that occur with them.

Keywords:
- ضوء الليزر
- المواد الأيضية
- العناصر الثقيلة
- الأصباغ الطبيعية

1. Introduction:

Some chemical compounds are affected by light, including medicines and dyes extracted from natural products. Dyes, chemical compounds...
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and drug efficacy and safety of the formulated products during manufacture, stock piling and uses, and some photochemical reactions happened in chemical composition by light or laser light were studied. The fluorescence spectroscopy potential was determined for the characterization and comparison of different components of curcuminoids content in powders turmeric [1]. Nickel layer have a complex interaction between with a 4H-SiC substrate under irradiation of UV-Laser of the atomic inter-diffusion was investigated [2]. After π-π* excitation, the electronic dynamics of 4,5-dimethoxy-2-nitrobenzyl acetate was examined using a near-UV and pulse Laser [3]. The investigated of photochemical reactions of eight Bromophenols (BPs) and hydroxy radical (OH) generated from NaNO₃ using Laser flash photolysis (LFP) in aqueous solution [4]. The investigated the reaction between 2-chlorobiphenyl and N(III) photochemically in acidic nature by using co-linear LFP technique [5]. A study of photochemical formation process of photostable azobenzene (AB; 4-tet-butyl-4′-methoxy dibenzoyl methane) from 1,1-(4-tet-butybenzoyl) (4′-methoxybenzoyl) butane (Pr AB) by steady-state and Laser flash photolysis in solution [6]. Femtosecond Laser has better ability to change the size and shape of the material than nanoplasmonic Laser then the size of the nanospheres decreased gradually due to many of photochemistry reactions at the surface of Ag nanospheres [7]. Converted Sm³⁺ to Sm²⁺ by the photoreduction and the formation of real defects are recorded at an irradiance less than the threshold for damage introduced by Laser [8]. The photoinduced electron-transfer reaction between pyrene and indole is reported by (LFP) [9]. A chemical reaction by Laser-driven have been expanded for thin-film microelectronics fabrication [10]. Investigated 10⁻¹² and 10⁻⁸ s dynamics of the ion pair formed by the electron transfer reaction between the triplet state benzophenone (3BP*) and 1,4-diazabicyclo[2.2.2]octane (DABCO) by Laser-induced photocconductivity measurement [11]. In an equivalent lamarin methane / air flame, photo-fragmentation Laser-induced fluorescence (PFLIF) is for the first time perfect based on 10⁻¹⁵ s Laser pulses for detection of (HO) radicals [12]. The observed IR photochemical reaction of CaF©/Cu induced by transversely excited atmospheric CO₂ (TEA CO₂) Laser [13]. A stibazolium betaine (M) and (MH⁺) was studied for their dynamical behaviour in their excited singlet states (S) using 10⁻¹² s (LFP) [14]. In the pharmaceutical industry the photostability of drugs and drug products are studied by an integral part of the product evolution process [15]. Sensitized the photochemical produced reactive intermediates (PPRIs) by the pharmacinals in sunlit natural waters may induce photodegradation of coexisting compounds [16]. Phenothiazine (PTH) cation and neutral radical have been described by 10⁻¹⁵ s (LFP) in acid and basic acetonitrile [17]. Dye degradation may initiate via photodegradation of coexisting compounds (PPRIs) and is determined for the degradation of paracetamol (PC) in aqueous solution under UVA irradiation [20].

In this study, we show the extent to which light and laser beam are affected by some medicines and natural dyes that are found in plant foods that humans use through the change in the value of the wavelength of absorption of these substances, as well as their influence in the presence of some Heavy metal ions, as previous studies did not show the effect of laser beams on them, while they indicated the cekect of laser on some chemical compounds or some natural pigments, both separately.

2. Experimental

2.1. Chemicals and Used equipment’s

100 beakers of 100 ml capacity, filter paper, funnel, Graduated cylinder, cup, conical flasks – (He – Ne) Laser device, (Fig. 1), spectrophotometer, sensitive balance and standard 100 ml beaker

2.2. Preparation of solutions

100 ml of solution of 0.1 molar are prepared from the following materials: CuSO₄·5H₂O (2.4968g), Ca (NO₃)₂, 4H₂O (2.6313g) AgNO₃ (1.9687g), NiCl₂.6H₂O (2.7371g), FeSO₄·7H₂O (2.27g), Cr (NO₃)₃·9H₂O (4.006g), Cd (NO₃)₂·4H₂O (3.084g), (CH₃COO)₂·3PbH₂O (3.753g), ZnSO₄·7H₂O (1.815g) and 10/ Mn SO₄·H₂O (1.9602g)

2.3. Preparation of plant extracts

Grind 5 tablets of the following drugs and dissolved them in 100 ml of distilled water ibuprofen, folic acid, librax, ranitidine, albendazol, and iron drug. Boil 5 g of the leaves of some plants or fruits for three minutes, in 100 ml distilled water such as carrots, cabbage, beets, turmeric, maringa, and sage about 100 ml of their extractions and juices with distilled water are filtered.

2.4. The method of work

Absorbance and λ max of each of the ion solutions drugs and the extracts is measured, then about 10 ml of each type of plant extract is added to 10 ml of the solutions of heavy elements and left for 24 hours.

We apply laser beams to drug solutions and extracts with metals and measure the absorbance and wavelength of it every 10 minutes up to 40 minutes.

Table 1. Measurements of max. wavelength λ max. of metal ions, extractions and drugs compounds before apply Laser beam, Cm = (1-ibuprofen, 2-folic acid, 3-librax, 4-raftidine, 5-albendazol, 6-iron drug, 7-carrats, 8-cabbage, 9-beets, 10-turmeric, 11-maringa, and 12-sage).

| C    | λ max Fe²⁺ | λ max Cr³⁺ | λ max Cu²⁺ | λ max Zn²⁺ | λ max Mn²⁺ | λ max Ni²⁺ | λ max Cd²⁺ | λ max Pb²⁺ | λ max Ni³⁺ | λ max Mn³⁺ | λ max Pb³⁺ |
|------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 1    | 476        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 2    | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 3    | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 4    | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 5    | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 6    | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 7    | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 8    | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 9    | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 10   | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 11   | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |
| 12   | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        | 361        |

Table 2. Measurements of max. wavelength λ max of metal ions, extractions and drugs compounds after apply Laser beam for 40 minutes, Cm = (1-ibuprofen, 2-folic acid, 3-librax, 4-raftidine, 5-albendazol, 6-iron drug, 7-carrats, 8-cabbage, 9-beets, 10-turmeric, 11-maringa, and 12-sage).
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Fig. 1. He – Ne gas laser device and JENWAY 6300 spectrophotometer

3. Results and Discussions
In Fig. 2. Shows the chemical reactions between metal ions and Ibuprofen. We expect that a chemical bond is formed and that needs more studies. For Ca\(^{2+}\) and Ni\(^{2+}\) the same \(\lambda_{\text{max}}\) is observed suggesting that there is no chemical reaction occur.

In Fig. 3. Shows the chemical reactions between metal ions and folic acid and due to the differences between \(\lambda_{\text{max}}\) value, we expect that a chemical bond is formed and that needs more studies. For Ca\(^{2+}\) and Ni\(^{2+}\) the same \(\lambda_{\text{max}}\) is observed suggesting that there is not chemical reaction occur.

In Fig. 4. Shows the chemical reactions between metal ions and librax, and due to the differences between \(\lambda_{\text{max}}\) value, we expect that a chemical bond is formed and that needs more studies. For Ag\(^{+}\), Ca\(^{2+}\) and Ni\(^{2+}\) which have nearly the same \(\lambda_{\text{max}}\) they need more studies.

In Fig. 5. Shows the chemical reactions between metal ions and ranitidine, due to the differences between \(\lambda_{\text{max}}\) value, we expect the formation of chemical bond and that its needs more studies. For Ca\(^{2+}\) and Ni\(^{2+}\) the same \(\lambda_{\text{max}}\) is observed suggesting that there is no chemical reaction occur.

In Fig. 6. Shows the chemical reactions between metal ions and albendazol, we expect that a chemical bond formation and that its needs more studies. For Ca\(^{2+}\) and Ni\(^{2+}\) the same \(\lambda_{\text{max}}\) is observed suggesting that is no chemical reaction occur.

In Fig. 7. Explains that there are no chemical reactions or chemical bonds are formed between metal ions and iron drug except Cu\(^{2+}\), Ag\(^{+}\) and Zn\(^{2+}\) due to sensitivity of AgNO\(_3\) to the beam light, and may be react the iron drug with CuSO\(_4\) and it may be reacted with ZnSO\(_4\).7H\(_2\)O.

In Fig. 8. Explains that there are chemical reactions or chemical bonds may be formed between metal ions and compounds in Carrots due to the differences between \(\lambda_{\text{max}}\) values. It needs more studies.

In Fig. 9. Explains that there are no chemical reactions occur or chemical bonds are formed between metal ions with compounds in red cabbage due to the stability of \(\lambda_{\text{max}}\).

In Fig. 10. Explains that there are no chemical reactions or chemical bonds are formed between metal ions and compounds in beets except Ca\(^{2+}\) we expect formation of new chemical bond due to new \(\lambda_{\text{max}}\) with Ni\(^{2+}\).

In Fig. 11. Explains that there are chemical reactions or chemical bonds are may be formed between metal ions and compounds in carrots dyes due to the differences between \(\lambda_{\text{max}}\) values.

In Fig. 12. Explains that there are chemical reactions or chemical bonds may be formed between metal ions and compounds in maringa except Ca\(^{2+}\) & Ni\(^{2+}\) because it has the same \(\lambda_{\text{max}}\).

In Fig. 13. Shows that there are chemical reactions, or chemical bonds may be formed between metal ions and compounds in sage with Fe\(^{3+}\) & Pb\(^{2+}\) because it has different \(\lambda_{\text{max}}\).
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Fig. 5. Show the relation between $\lambda_{\text{max}}$ of M$^{n+}$ and metal ranitidine complexes it may be formed.

Fig. 6. Show the relation between $\lambda_{\text{max}}$ of M$^{n+}$ and metal albendazol complexes it may be formed.

Fig. 7. Show the relation between $\lambda_{\text{max}}$ of M$^{n+}$ and metal iron drug complexes it may be formed.

Fig. 8. Show the relation between $\lambda_{\text{max}}$ of M$^{n+}$ and metal carrots dye complexes it may be formed.

Fig. 9. Show the relation between $\lambda_{\text{max}}$ of M$^{n+}$ and metal red cabbage dye complexes it may be formed.

Fig. 10. Show the relation between $\lambda_{\text{max}}$ of M$^{n+}$ and metal beet dyes complexes it may be formed.
In Fig. 11. Show the relation between $\lambda_{\text{max}}$ of $M^{n+}$ and metal turmeric dyes complexes it may be formed.

In Fig. 12. Show the relation between $\lambda_{\text{max}}$ of $M^{n+}$ and metal maringa complexes it may be formed.

In Fig. 13. Show the relation between $\lambda_{\text{max}}$ of $M^{n+}$ and metal sage complexes it may be formed.

3.1. Effect of Laser beam

In Fig. 14. Show the effect of laser beam in copper metal complexes or copper metal ligands compounds which may be formed by observed the change of $\lambda_{\text{max}}$ of copper metal complexes or copper metal ligands compounds before effecting of Laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, folic acid, beets and turmeric and others not changed.

In Fig. 15. Show the effect of laser beam in Calcium metal complexes or calcium metal ligands compounds may be formed by observed the change of $\lambda_{\text{max}}$ of copper metal complexes or Copper metal ligands compounds before effecting of Laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, folic acid, beets, sage and turmeric and others not changed.

In Fig. 16. Show the effect of laser beam in silver metal complexes or silver metal ligands compounds may be formed by observed the change of $\lambda_{\text{max}}$ of silver metal complexes or silver metal ligands compounds before effecting of Laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, folic acid, beets, sage and turmeric and others not changed.

In Fig. 17. Show the effect of laser beam in Nickel metal complexes or Nickel metal ligands compounds may be formed by observed the change of $\lambda_{\text{max}}$ of Nickel metal complexes or Nickel metal ligands compounds before effecting of Laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, folic acid, beets, and turmeric and others not changed.

In Fig. 18. Show the effect of laser beam in iron metal complexes or iron metal ligands compounds may be formed by observed the change of $\lambda_{\text{max}}$ of Iron metal complexes or iron metal ligands compounds before effecting of Laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, folic acid, beets, and turmeric and others not changed.

In Fig. 19. Show the effect of laser beam in Chromium metal complexes or Chromium metal ligands compounds may be formed by observed the change of $\lambda_{\text{max}}$ of Chromium metal complexes or Chromium metal ligands compounds before effecting of Laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, folic acid, beets, and turmeric and others not changed.

In Fig. 20. Show the effect of laser beam in Cadmium metal complexes or Cadmium metal ligands compounds may be formed by observed the change of $\lambda_{\text{max}}$ of Cadmium metal complexes or Cadmium metal ligands compounds before effecting of Laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, folic acid, beets, and turmeric and others not changed.

In Fig. 21. Show the effect of laser beam in Lead metal complexes or Lead metal ligands compounds may be formed by observed the change of $\lambda_{\text{max}}$ of Lead metal complexes or Lead metal ligands compounds before effecting of Laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, iron drug, folic acid, sage, beets, and turmeric and others not changed.

In Fig. 22. Show the effect of laser beam in Zinc metal complexes or Zinc metal ligands compounds may be formed by observed the change of $\lambda_{\text{max}}$ of Zinc metal complexes or Zinc metal ligands compounds before effecting of Laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, albenzadazol, sage, folic acid, sage, beets, and turmeric and others not changed.

In Fig. 23. Show the effect of Laser beam in Manganese metal complexes or Manganese metal ligands compounds may be formed by observed the change of $\lambda_{\text{max}}$ of Manganese metal complexes or Manganese metal ligands compounds before effecting of laser and after effecting of Laser. Meany of these compounds are changed due to change in bond formation specially ibuprofen, folic acid, beets, and Turmeric and others not changed.
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Fig. 14. Show the effect of laser in copper metal complexes or copper metal ligands compounds it may be formed or change of bond formation which may be occur.

Fig. 15. Show the effect of laser in calcium metal complexes or calcium metal ligands compounds it may be formed or change of bond formation which may be occur.

Fig. 16. Show the effect of laser in silver metal complexes or silver metal ligands compounds it may be formed or change of bond formation which may be occur.

Fig. 17. Show the effect of laser in nickel metal complexes or nickel metal ligands compounds it may be formed or change of bond formation which may be occur.

Fig. 18. Show the effect of laser in iron metal complexes or Iron metal ligands compounds it may be formed or change of bond formation which may be occur.

Fig. 19. Show the effect of laser in chromium metal complexes or chromium metal ligands compounds it may be formed or change of bond formation which may be occur.
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4. Conclusion

The monitoring of some drugs like Ibuprofen, Folic acid, ranitidine, albendazol, and Iron. and natural products such as carrots, cabbage, beets, turmeric, maringa, and sage reacted with 10 metal ions, beet, folic acid, ibuprofen, and, turmeric had the most changes with metal ions, Cu, Ca, Ag, Ni, Fe, Cr, Cd, Pb, Zn, and Mn ions. The Ca$^{2+}$, and Ni$^{2+}$ ions are the most stable ions with all drugs, and pigments extracted from natural products than the rest of the other ions.

We study the effect of Laser beam of the formations by measuring the absorbance’s and λ$\text{max}$, wavelength $\lambda$ of products. the change of $\lambda$ $\text{max}$. inducts that bond formation of drugs and natural products with heavy metals may be formed which means that a photochemical reaction was happened and new compounds are formed by the effecting of Laser light.

Recommendation: Drugs and natural dyes in foodstuffs such as carrots, beets, red cabbage and others should not be exposed for long time by light or laser beam, because this may change their chemical composition and may lose their nutritional value as well as drugs may lose their effectiveness, so we recommend further study to know and separate these new compounds which may result from exposure of these drugs and natural pigments to light and laser beams.

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acids and bases.

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