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

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Keywords:
Laser Light
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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, ranitidine, 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.

دراسة تأثير الليزر على بعض الأصباغ الطبيعية والأدوية والمركبات الكيميائية

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الكلمات المفتاحية:
ضوء الليزر
الطول الموجي
العناصر الثقيلة
المنتجات الطبيعية
الامتصاصية

الملخص

بسبب تغير بعض الأدوية، والمنتجات الطبيعية في المكونات الكيميائية أو التركيب الكيميائي عن طريق تعريضها لشعاع الليزر أو الضوء، وتأثير المعادن الثقيلة التي ربما توجد بها كمكونات فيها، أو كشوائب في بعض الأدوية، والأصباغ الملونة، والمنتجات الطبيعية وقد تمت دراسة وجود الضوء وشعاع الليزر في وقت 40 دقيقة. وهناك تفاعلات كيميائية أو روابط كيميائية قد تتشكل بين أيونات المعادن الأدوية مثل الإيبوبروفين وحمض الفوليك والليبراكس، والرانتيدين، والألبيندازول، وعقار الحديد، باستثناء Ca+2 و Ni+2 نظرًا لامتلاكهما نفس λ max ، أما الصبغات الموجودة في الجزر، والملفوف الأحمر، و البنجر، والكركم ، والمورينجا ، والمرمرية ، باستثناء Ca+2 و Ni+2 نظرًا لوجود نفس λ max ، كان بنجر حمض الفوليك، وايبورفين، والكركم كانوا أكثر تغيرا مع أيونات المعادن ، Cu، Ca، Ag، Ni، Fe، Cr، Cd، Pb ، أيونات الزنك والمنغنيز بعد تعرضها شعاع الليزر. أما أيونات Ca+2 وNi+2 فهما الأيونان الأكثر استقرارًا مع جميع الأدوية، والصبغات المشتقة من المنتجات الطبيعية عن بقية الأيونات الأخرى. وقد ركزت الدراسات السابقة على دراسة تأثير شعاع الليزر على المركبات الكيميائية كلا على حدا أما في هذه الدراسة فإنها اهتمت بتأثير شعاع الليزر على الأدوية والصبغات الطبيعية وأيضا ما قد تحتويه من معادن ثقيلة أو كشوائب وما يحدث معها من تغيرات كيمائية.

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 compassion by light or laser light were studies. 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 hydroxyl radical (OH) generated from $NaNO_2$ 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]. The studied of photochemical formation process of avobenzone (AB; 4-tert-butyl-4′-methoxy dibenzoyl methane) from 1,1-(4-tert-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 nanosecond Laser then the size of the nanospheres decreased gradually due to many of photochemistry reactions at the surface of Ag nanospheres [7]. Converted Sm^{3+} to Sm^{2+} 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} s and 10^{-9} 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 photoconductivity measurement [11]. In an equivalent laminar methane / air flame, photo-fragmentation Laser-induced fluorescence (PFLIF) is for the first time perfect based on 10^{-12} s Laser pulses for detection of ($HO^{\cdot}$) radicals [12]. The observed IR photochemical reaction of C_2F_3Cl induced by transversely excited atmospheric CO_2 (TEA CO_2) Laser [13]. A stibazolium betaine (M) and (MH^+) was studied the dynamical behaviour of in their excited singlet states (S_1) 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 pharmaceuticals in sunlit natural waters may induce photodegradation of coexisting compounds [16]. Phenothiazine (PTH) cation and neutral radical have been described by 10^{-12} s (LFP) in acid and basic acetonitrile [17]. Dye degradation may initiate via direct photolysis (254 nm), photocatalysis (254 or 365 nm), and photosensitized conversions (visible) [18]. Studied of the photochemical reactions of ethyl erythrosine and ethyl eosin with diaryliodonium salts in acetonitrile [19]. Investigated of the photochemical properties of Fe (III) -Aspartate complex (Fe (III)-Asp) and its performance 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 effect 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: Cu $SO_4.5H_2O$ (2.4968g), Ca $(NO_3)_2$. $4H_2O$ (2.6313g) $AgNO_3$ (1.9687g), $NiCl_2.6H_2O$ (2.7371g), Fe $SO_4.7H_2O$ (2.27g), Cr $(NO_3)_3.9H_2O$ (4.006g), Cd $(NO_3)_3.4H_2O$ (3.0848g), $(CH_3COO)_2Pb$ $3H_2O$ (3.7933g), $ZnSO_4.7H_2O$ (1.815g) and 10/ Mn SO_4. H_2O (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, rantidine, 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 $\lambda_{max.}$ 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 $\lambda_{max.}$ of metal ions, extractions and drugs compounds before apply Laser beam, C= (1-ibuprofen, 2-folic acid, 3-librax, 4-rantidine, 5-albendazol, 6-iron drug, 7-carrots, 8-cabbage, 9-beets, 10-turmeric, 11-maringa, and 12-sage).

C	λ_{max} Mn^{2+}	λ_{max} Zn^{2+}	λ_{max} Pb^{2+}	λ_{max} Cd^{3+}	λ_{max} Cr^{3+}	λ_{max} Fe^{2+}	λ_{max} Ni^{2+}	λ_{max} Ag^{+}	λ_{max} Ca^{2+}	λ_{max} Cu^{2+}	λ_{max} Drugs
1	512	475	512	998	999	591	360	361	358	789	686
2	380	381	400	368	443	385	361	414	375	367	534
3	361	361	358	346	357	361	343	320	360	348	361
4	361	361	365	361	371	361	361	381	361	363	361
5	367	447	447	370	416	423	361	502	361	412	376
6	367	387	361	362	361	361	366	597	342	350	361
7	361	369	382	369	361	356	340	350	344	341	360
8	361	361	361	361	361	361	361	360	358	359	361
9	320	322	321	323	320	320	326	325	361	325	540
10	348	356	361	327	349	351	341	350	361	376	670
11	420	361	361	384	361	435	361	361	361	361	361
12	361	361	368	361	361	428	361	361	361	361	420

Table 2. Measurements of max. wavelength $\lambda_{max.}$ of metal ions, extractions and drugs compounds after apply Laser beam for 40 minutes, C= (1-ibuprofen, 2-folic acid, 3-librax, 4-rantidine, 5-albendazol, 6-iron drug, 7-carrots, 8-cabbage, 9-beets, 10-turmeric, 11- maringa, and 12-sage).

C	λ_{max} Mn^{2+}	λ_{max} Zn^{2+}	λ_{max} Pb^{2+}	λ_{max} Cd^{3+}	λ_{max} Cr^{3+}	λ_{max} Fe^{2+}	λ_{max} Ni^{2+}	λ_{max} Ag^{+}	λ_{max} Ca^{2+}	λ_{max} Cu^{2+}	λ_{max}
1	476	439	450	998	999	485	360	453	345	390	686
2	361	375	361	361	361	375	361	414	369	367	534
3	361	361	361	361	361	361	361	354	360	351	361
4	361	361	365	361	361	380	361	361	361	363	361
5	367	361	361	361	361	361	361	361	361	361	376
6	367	370	402	365	411	379	340	300	342	337	361
7	361	369	382	369	361	356	340	345	344	341	360
8	361	388	361	361	361	361	361	360	358	359	354
9	361	322	321	323	320	320	340	340	320	321	540
10	348	356	361	327	349	361	361	350	361	351	361
11	361	361	361	392	377	435	361	361	415	361	361
12	361	361	368	361	361	437	361	361	361	361	420

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 λ_{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 $\lambda_{max.}$ value, we expect that a chemical bond is formed and that needs more studies. For Ca^{2+} and Ni^{2+} the same λ_{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 $\lambda_{max.}$ 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 λ_{max} they need more studies.

In Fig. 5. Shows the chemical reactions between metal ions and ranitidine, due to the differences between $\lambda_{max.}$ value, we expect the formation of chemical bond and that its needs more studies. For Ca^{2+} and Ni^{2+} the same λ_{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 λ_{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^{1+} 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 $ZnSO_4.7H_2O$.

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 $\lambda_{max.}$ 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 λ_{max}.

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

In Fig. 13. Shows that there are chemical reactions, or chemical bonds may be formed between metal ions and compounds in sage with Fe^{2+} & Pb^{2+} because it has different $\lambda_{max.}$

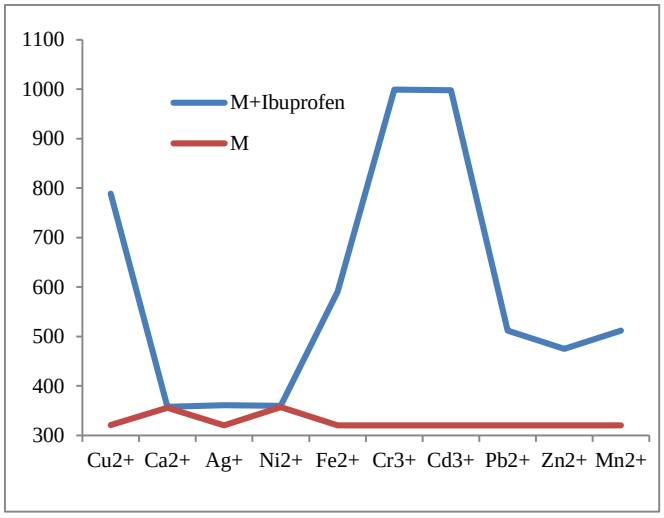

Fig. 2. Show the relation between $\lambda_{max.}$ of M^{n+} and metal ibuprofen complexes it may be formed.

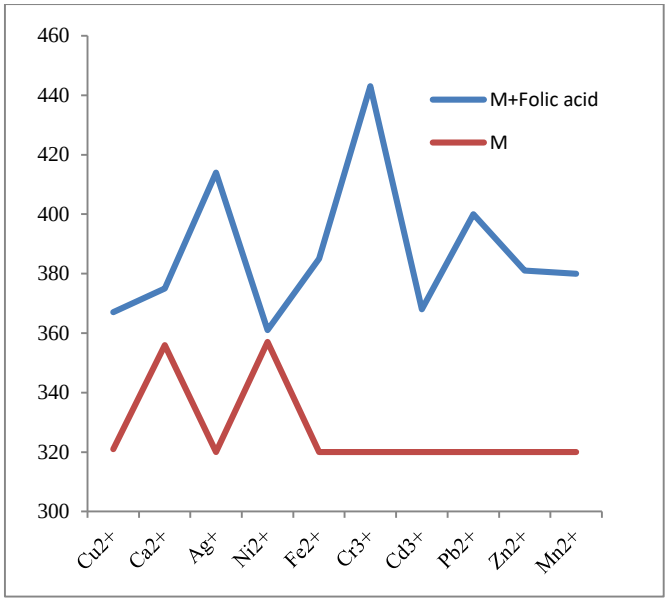

Fig. 3. Show the relation between $\lambda_{max.}$ of M^{n+} and metal folic acid complexes it may be formed.

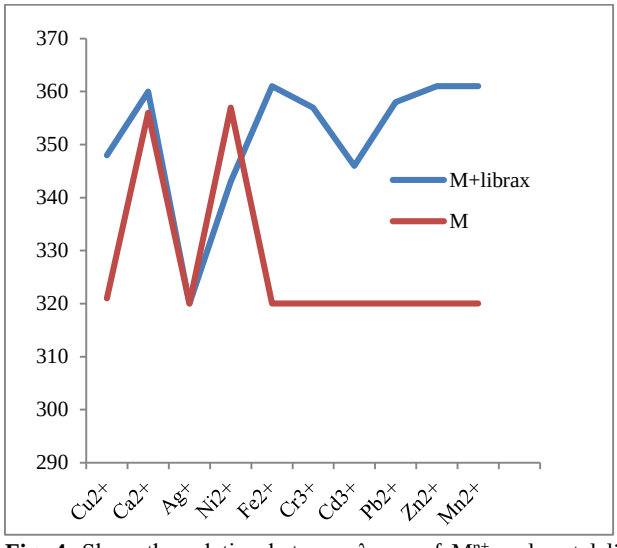

Fig. 4. Show the relation between $\lambda_{max.}$ of M^{n+} and metal librax (chlorodiazoepoxide + bromodeclidinium) complexes it may be formed.

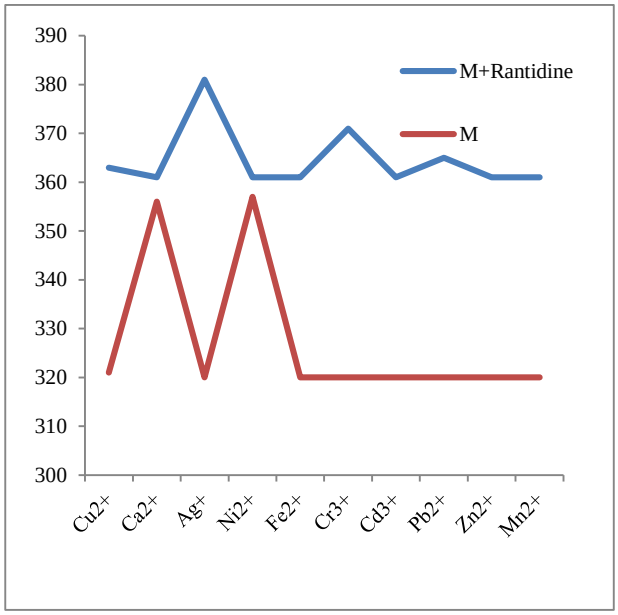

Fig. 5. Show the relation between λ max. of M^{n+} and metal ranitidine complexes it may be formed.

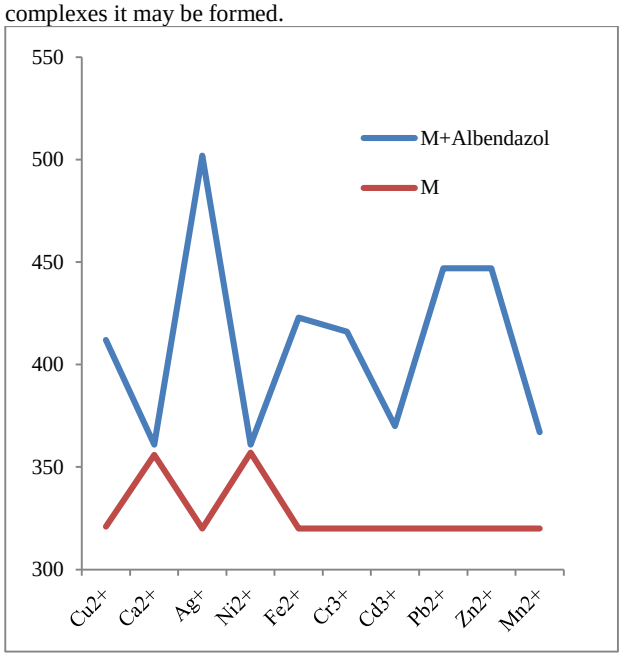

Fig. 6. Show the relation between λ max. of M^{n+} and metal albendazol complexes it may be formed.

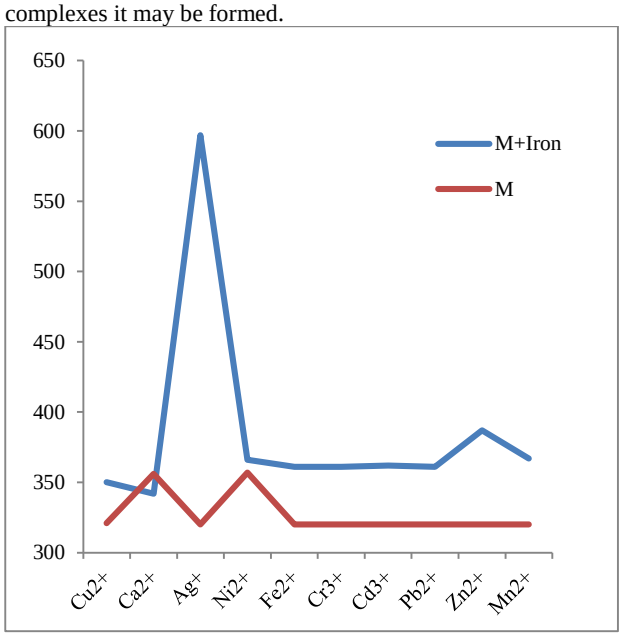

Fig. 7. Show the relation between λ max. of M^{n+} and metal iron drug complexes it may be formed.

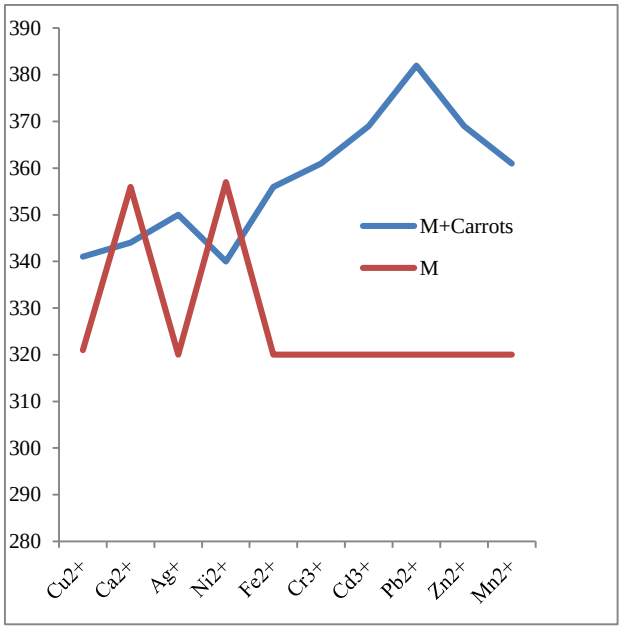

Fig. 8. Show the relation between λ max. of M^{n+} and metal carrots dye complexes it may be formed.

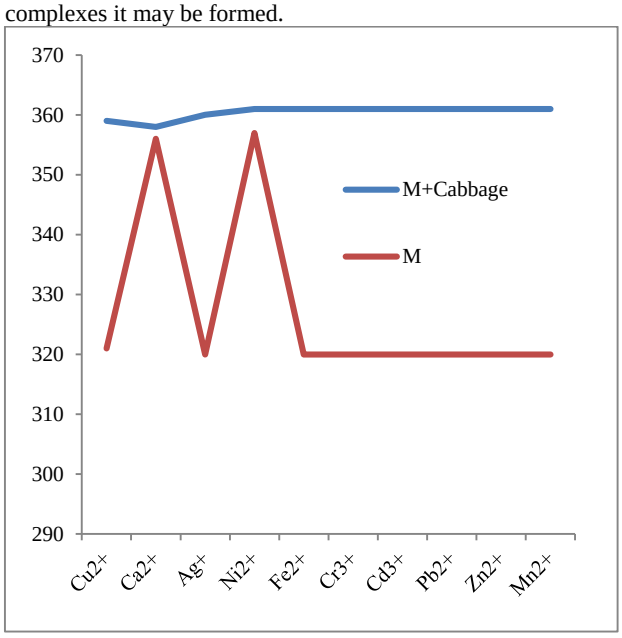

Fig. 9. Show the relation between λ max. of M^{n+} and metal red cabbage dye complexes it may be formed.

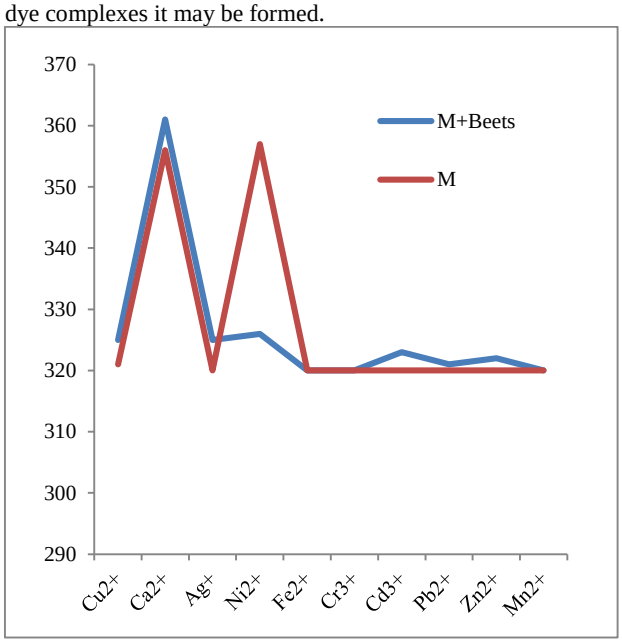

Fig. 10. Show the relation between λ max. of M^{n+} and metal beet dyes complexes it may be formed.

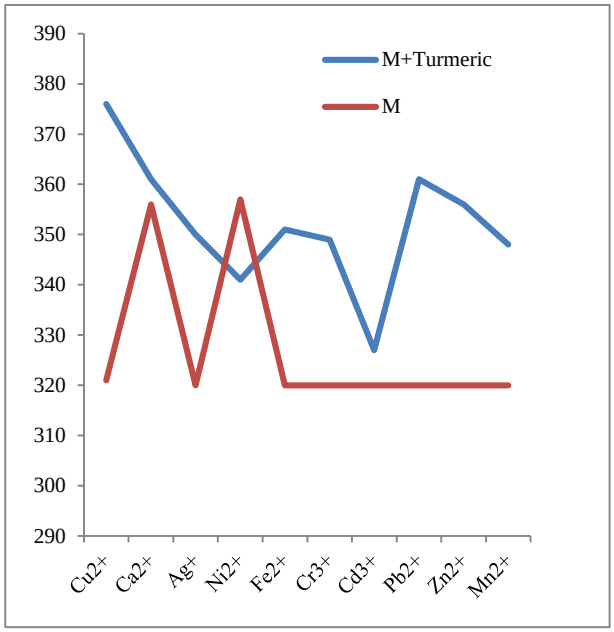

Fig. 11. Show the relation between $\lambda_{max.}$ of M^{n+} and metal turmeric dyes complexes it may be formed.

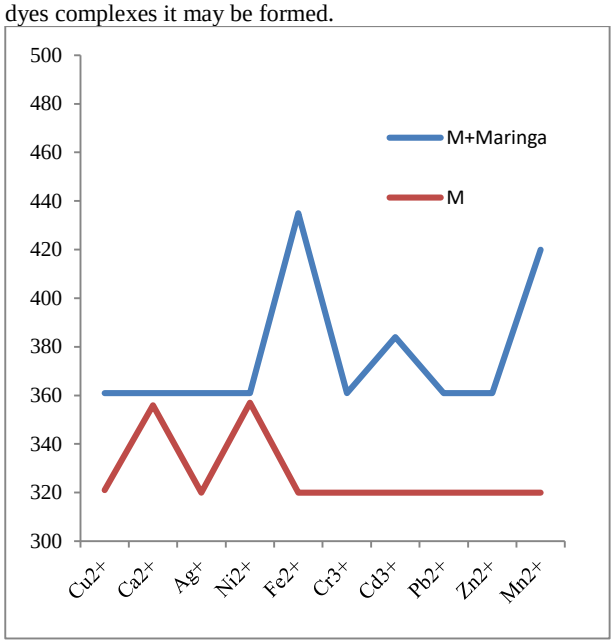

Fig. 12. Show the relation between $\lambda_{max.}$ of M^{n+} and metal maringa complexes it may be formed.

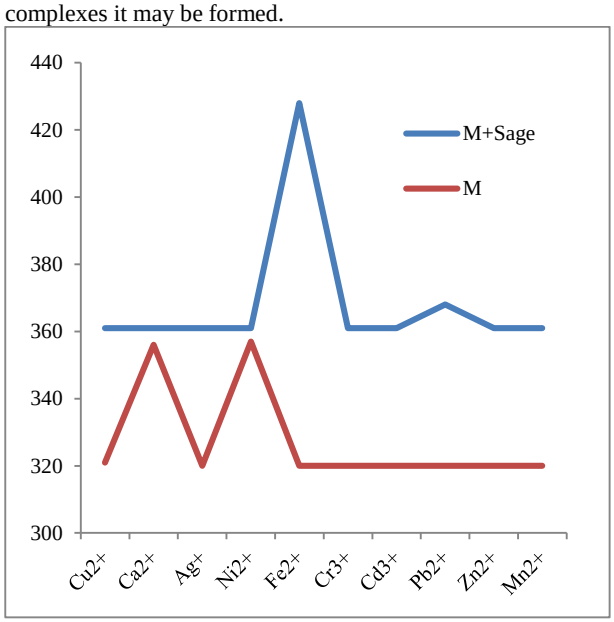

Fig. 13. Show the relation between $\lambda_{max.}$ of M^{n+} and metal sage complexes it may be formed.

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 $\lambda_{max.}$ 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 $\lambda_{max.}$ 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 $\lambda_{max.}$ 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, iron drug, 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 $\lambda_{max.}$ 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, sage 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 $\lambda_{max.}$ 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 in Chromium metal complexes or Chromium metal ligands compounds may be formed by observed the change of $\lambda_{max.}$ 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 in Cadmium metal complexes or Cadmium metal ligands compounds may be formed by observed the change of $\lambda_{max.}$ 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, sage, 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 $\lambda_{max.}$ 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 it may be formed by observed the change of $\lambda_{max.}$ 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, albendazol, 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 $\lambda_{max.}$ 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, sage, folic acid, beets, and Turmeric and others not changed.

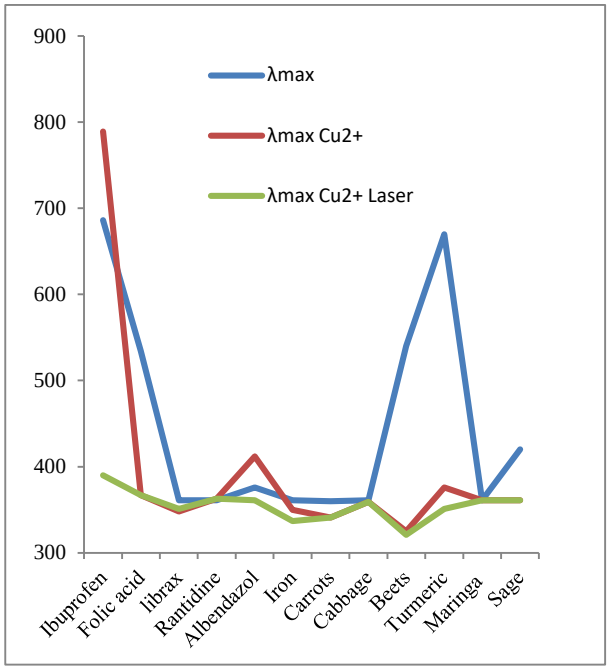

Fig. 14. Show the effect of laser in copper metal complexes or copper metal ligands compounds it may be formed or change of bond formation which may be occur.

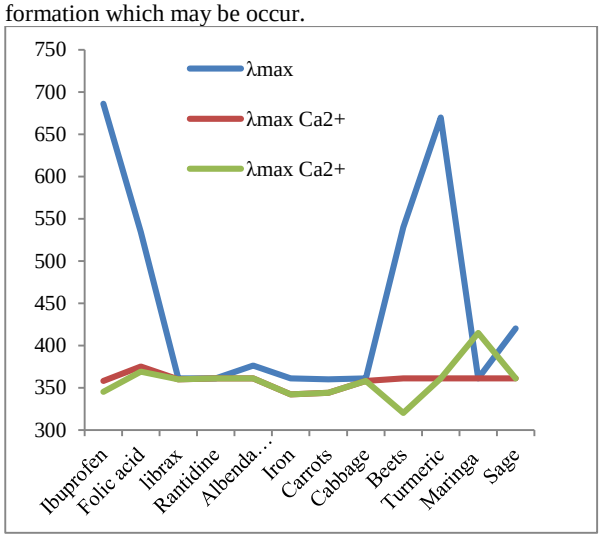

Fig. 15. Show the effect of laser in calcium metal complexes or calcium metal ligands compounds it may be formed or change of bond formation which may be occur.

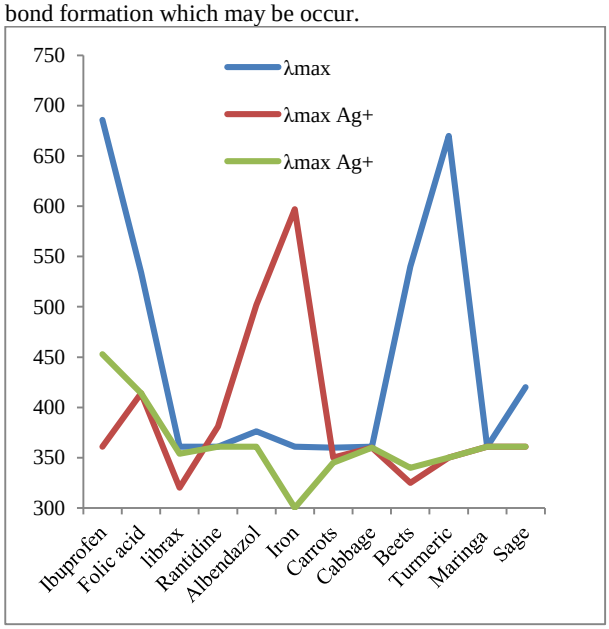

Fig. 16. Show the effect of laser in silver metal complexes or silver metal ligands compounds it may be formed or change of bond formation which may be occur.

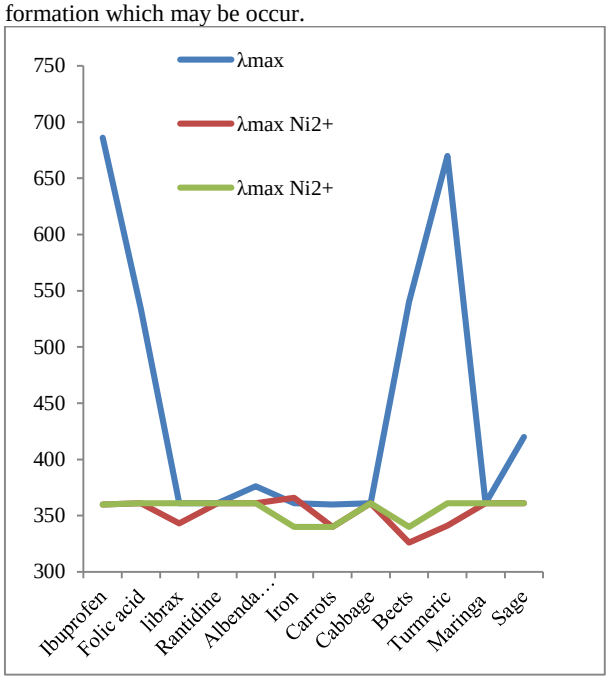

Fig. 17. Show the effect of laser in nickel metal complexes or nickel metal ligands compounds it may be formed or change of bond formation which may be occur.

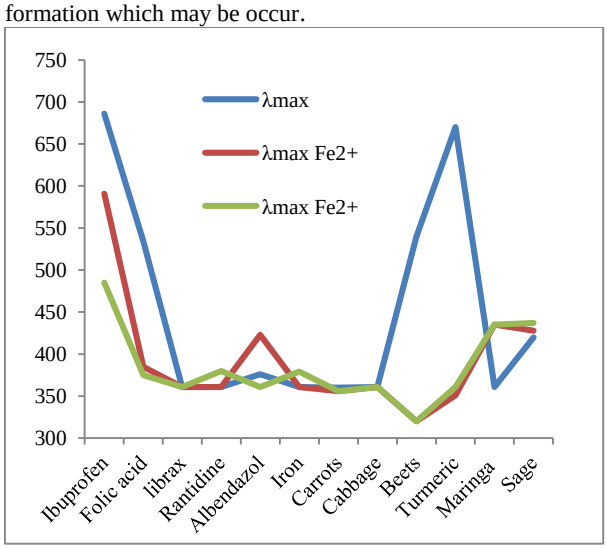

Fig. 18. Show the effect of laser in iron metal complexes or Iron metal ligands compounds it may be formed or change of bond formation which may be occur.

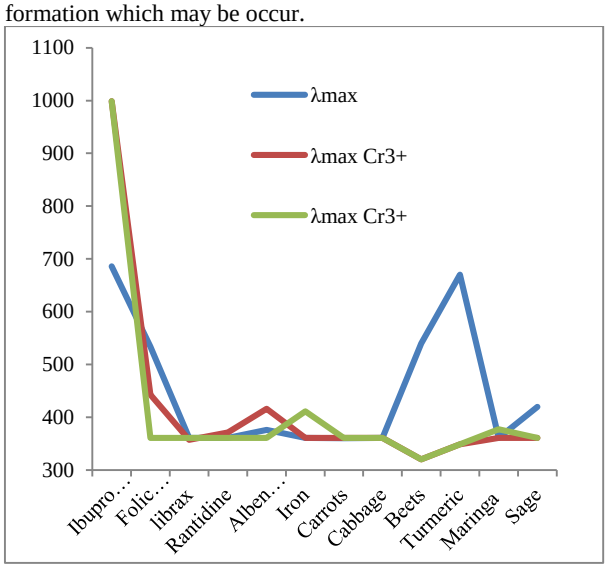

Fig. 19. Show the effect of laser in chromium metal complexes or chromium metal ligands compounds it may be formed or change of bond formation which may be occur.

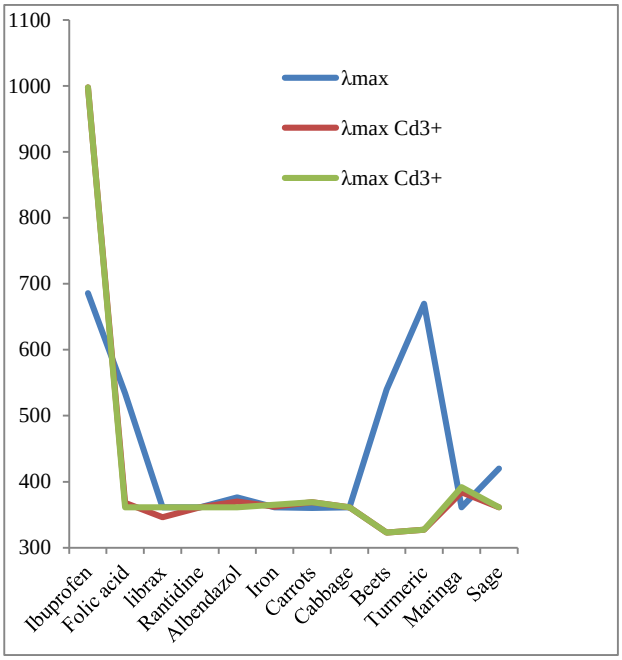

Fig. 20. Show the effect of laser in cadmium metal complexes or Cadmium metal ligands compounds it may be formed or change of bond formation which may be occur.

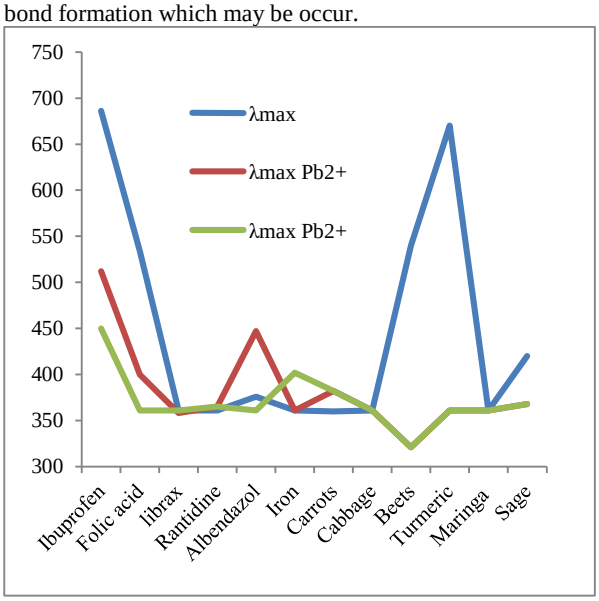

Fig. 21. Show the effect of laser in lead metal complexes or Lead metal ligands compounds it may be formed or change of bond formation which may be occur.

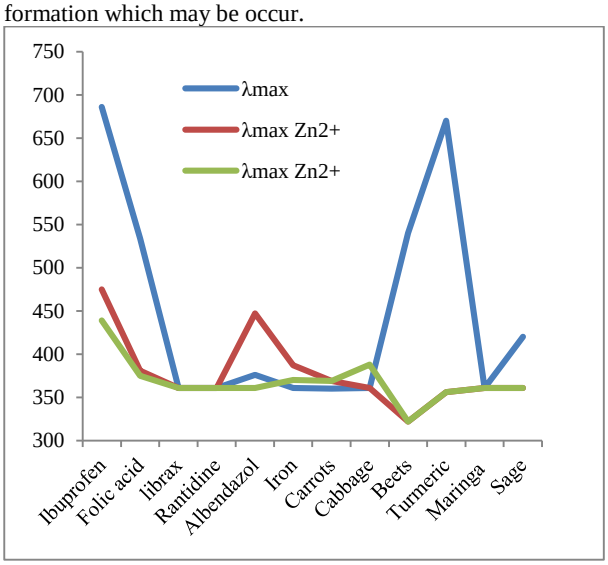

Fig. 22. Show the effect of laser in zinc metal complexes or zinc metal ligands compounds it may be formed or change of bond formation which may be occur.

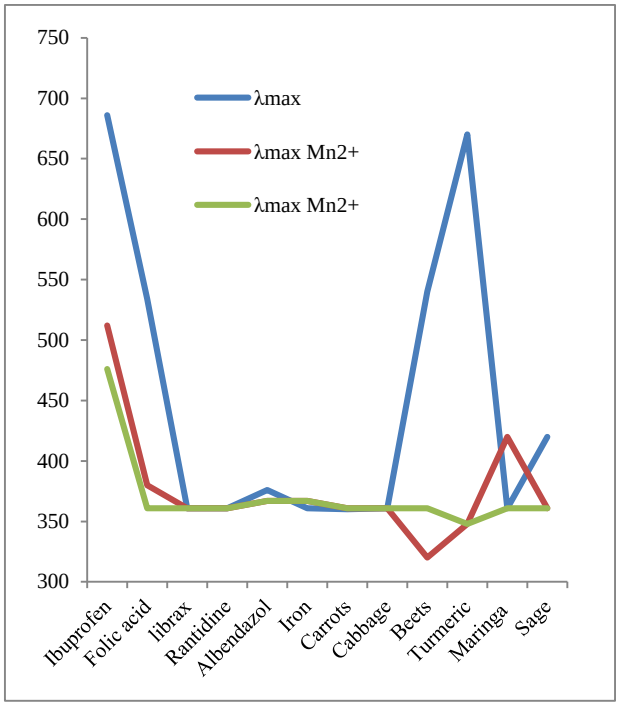

Fig. 23. Show the effect of laser in manganese metal complexes or Manganese metal ligands compounds it may be formed or change of bond formation which may be occur.

4. Conclusion

The monitoring of some drugs like Ibuprofen, Folic acid, librax, rantidine, 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 $\lambda_{max.}$ wavelength $\lambda_{max.}$ of products. the change of $\lambda_{max.}$ 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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