



ASSOCIATION OF CHEMISTRY TEACHERS

NEWS LETTER

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Promoting Excellence in Chemistry Education

Association of Chemistry Teachers

News Letter, May - August 2021

Contents of the News Letter : Issue - 20

1.	From Editorial Desk	02
2.	Members of Editorial Board	02
3.	Honorary Members of ACT	03
4.	Activities of ACT	04
5.	Ingredients in Cosmetic for Sun Protection	06
6.	3D Fluorescence Spectroscopy	09
7.	News, Views and More	13
	■ The Chemistry of Tea	
	■ Waste-to-Energy Model	
8.	List of Members (May-August, 2021)	15
9.	Life Membership Form	16



From Editorial Desk

Prof. Wasudeo Gurnule

Editor

Kamla Nehru Mahavidyalaya,
Nagpur, Maharashtra.



We are happy to inform that the contribution of ACT ranges from International Olympiad, organizing Webinar, Science Exhibition, Workshop, expert invited talks, new Conceptual Science experiments, Conferences, talent search examination, training to faculty and students etc.

ACT proposes some new activities for UG and PG students, Research scholar and teachers as related to research convention to be implemented.

We are bringing in the present issue of the newsletter with the reports on the ACT activities, scientific articles, new trends, views and news. We have included two scientific articles in the present issue. We have also included subject report on National and International Chemistry events. Recent ACT membership was also reported in this issue.

We invite good suggestions and better contributions from the readers to get best output of the future issues.

Members of Editorial Board

- ▶ **Prof. Dr. Brijesh Pare**, Govt. Madhav Science College, Ujjain
- ▶ **Prof. Dr. Damodar V. Prabhu**, Wilson College, Mumbai
- ▶ **Dr. Hemant Khanolkar**, Fr. Conceicao Rodrigues College of Engg., Mumbai
- ▶ **Prof. Dr. M. Swaminathan**, KARE, Krishnankoil
- ▶ **Dr. Subhash P. Singh**, A.N. College, Patna
- ▶ **Dr. Hemant Pande**, Formerly Hislop College, Nagpur
- ▶ **Dr. Rakhi Gupta**, IIS (deemed to be University) Jaipur
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- ▶ **Dr. Mannam Krishnamurthy**, Varsity Education Management Limited, Hyderabad
- ▶ **Dr. Sudesh Ghoderao**, RNC Arts, JDB Commerce and NSC Science College, Nashik Road, Nashik

Honorary Members of ACT

We have great pleasure in bringing the updated list of honorary members of Association of Chemistry Teachers, who are sources of inspiration, guidance and support in activities of ACT.

The editorial board of ACT News Letter is proud of the academic achievements of these legendary honorary members.

Bharat Ratna Prof. C.N.R. Rao, FRS

National Research Professor : Linus Pauling Research Professor,
Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bengaluru - 560 064
E-mail : cnrrao@jncasr.ac.in



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President, Global Research Alliance, National Chemical Laboratory, Pune - 411 008.



Dr. Nitya Anand

Former Director, CSIR-Central Drug Research Institute, Lucknow.
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Prof. R.S. Mali

Former Vice-Chancellor, North Maharashtra University, Jalgaon.
B-2, Surajbun Housing Society, Aundh Road, Pune - 411 007.
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Prof. S. Jayarama Reddy

Former Vice-Chancellor, S.V. University, Tirupati; Chancellor, SCSSV Mahavidyalaya, Kanchi
201, Ameya Towers, Street No. 12, Tarnaka, Hyderabad - 500 017.
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Padma Shri Prof. Jai P. Mittal

Former Director, Chemistry - Isotope Group, BARC, Mumbai - 400 085.
Chairman, Academic Board, UM-DAE Centre for Excellence in Basic Sciences,
University of Mumbai, Kalina, Mumbai - 400 098
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Prof. Mihir K. Chaudhuri

Former Vice-Chancellor, Tezpur University, Tezpur.
Advisor, Education Department of Government of Assam, Gawahati - 781 006
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ACTIVITIES OF ACT

National Webinar on Recent Advances in Solid State Chemistry and Allied Sciences

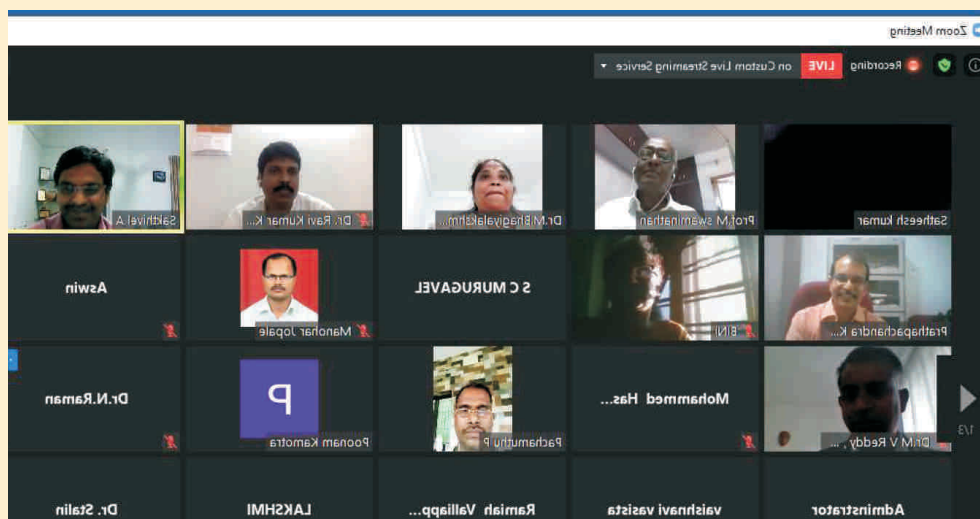
Jointly organized by

**Department of Chemistry, School of Physical Sciences
Central University of Kerala (CU-Kerala)**

In association with

**Association of Chemistry Teacher (ACT) &
Indian Solid State Chemistry and Allied Scientist (ISCAS)
16-17th August 2021**

Two-day national webinar on Recent Advances in Solid State Chemistry and Allied Sciences was conducted by the Department of Chemistry, School of Physical Sciences, the Central University of Kerala In association with the Association of Chemistry Teachers (ACT) and Indian Association of Solid State Chemistry and Allied Scientists (ISCAS) on 16th and 17th August 2021. About 200 research scholars, scientist, college teachers from all over India has participated. The program started with the university anthem. Prof. (Dr.) A. Sakthivel, the organizing Convenor of the webinar, gave the program's welcome address and introductory remarks. Prof. Dr. M. R. Prathapachandra Kurup, Dean, School of Physical Sciences, Central University of Kerala, inaugurated the webinar. Prof. M. Swaminathan, President, ISCAS, gave the presidential address. Prof. Brijesh Pare, President, Association of Chemistry Teachers (ACT), and Prof. D.V. Prabhu, General Secretary, ACT, gave the felicitation. Dr. M.Bhagiyalakshmi, Co-Convenor, expressed the vote of thanks.



The lecture session started with a keynote lecture of Prof. Dr. A. K. Tyagi, FRSC, FNASc, FASc, Associate Director, Chemistry Group, BARC-Mumbai. He delivered the lecture on the topic 'Pyrochlore based functional materials: Rich examples of structure-driven properties.' In his talk, he discussed the structure and catalytic application of pyrochlore-based materials. The next keynote lecture was given by Prof. (Dr.) A. K. Ganguli (Deputy Director, IIT-Delhi, Professor, Department of Chemistry, & Department of Materials Science & Engineering, IIT-Delhi) on the topic 'Complex metal chalcogenide-based superconducting solids'. He explained superconductors, Bismuth sulfur, and Bismuth selenium materials.

Technical session 3 was given by Prof. (Dr.) S. Sampath (Professor, Department of Inorganic & Physical Chemistry, IISc-Bangalore) on the topic 'Solid State Electrolytes'. He enlightened the session with electrolyte materials.

The next keynote lecture was on 'Solar Energy Conversion through Photocatalysis with specially designed nanomaterials' by Dr. C. S. Gopinath (Head, Catalysis Division, NCL Pune). He explained photocatalyst materials that can generate hydrogen through a water-splitting reaction.

An invited talk by Dr. Swapna Nair followed the session, Department of Physics, the Central University of Kerala on the topic 'Nano energy harvesters for next-generation implantable sensors.' She explained about the nanosensors, nano energy harvesters, and implantable sensors.

The second day of the webinar started with the lecture given by Prof. Ajayan Vinu, Global Innovation Chair Professor and Director, the University of Newcastle, Australia, on the topic 'Functionalized Nanocarbon Based Materials for Energy and Environmental Applications. Prof. P Ramasami gave the second lecture, Department of Chemistry, the University of Mauritius on Computational Chemistry Methods as Applied to Solid State. He explained very well on various computational methods.

The next lecture was given by Prof. P. Selvam, who delivered a talk on 'The Principle and practice of the Solid State Chemistry. He explained the basics of solid-state chemistry.

Prof. M. V. Reddy, Institute of Research Hydro-Quebec, Canada. Prof. Vijay Shankar delivered a lecture on 'Recent Advances in Microscopy for Solid-State Materials.' He explained the basics and working of Electron Microscope, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM),

The valedictory function started at 5 pm. Prof. M. Swaminathan, President of ISCAS, and Prof. M.R. Prathapchandra Kurup gave their remarks about the two-day webinar. They gave their feedback very well and commented positively about the webinar. The faculty members of the Central University of Kerala, Dr. Ravikumar, Dr. Bhaghiyalakshmi, and Dr. Bini George, gave their feedbacks. After that, the participants also gave feedback. Dr. Bhaghiyalakshmi announced the six best oral presentations. Finally, a Vote of thanks and concluding remarks were expressed by Prof. (Dr.) A. Sakthivel, Professor & Head, Department of Chemistry, CUK, convenor of the webinar.

Ingredients in Cosmetic for Sun Protection



Dr. Ketki S. Misar,

Assistant Professor & Head, Department of Cosmetic Technology,
Kamla Nehru Mahavidyalaya, Sakkardara, Nagpur



Sunscreens are ingredients that intend to prevent the harmful U.V radiations in sunlight from penetrating the skin layers both physically and chemically. These are the ingredient that absorbs, reflects, or scatters radiation in the ultraviolet range at wavelengths of 290 to 400 nanometers. Added to cosmetic formulations, they protect the skin from sunburns and other damages caused by harmful UV radiations. Sunscreens can be classified as physical and chemical sunscreens. While physical sunscreens reflect light in the visible and U.V spectrum, chemical sunscreens act by absorbing the U.V light.



The ultraviolet spectrum influencing man's health on the earth's surface is divided into two segments:

1. UVB (290-320nm)
2. UVA (320-400nm)

Shorter wavelengths (UVC) do not reach the earth's surface because they are absorbed by stratospheric ozone. The radiation energy decreases as the wavelength increases. This means that UVA, is the least energetic radiation while UVC is the most energetic. However, the opposite is true as regards skin penetration; UVA penetrates the deepest (even

down to the dermis), while UVC does not even penetrate the stratum corneum, in spite of its high energy. Hence, UVA radiation has been implicated in DNA damage, aging, and

wrinkling and other long term effects. The solar UV energy reaching the earth's surface is 99.5% UVA; UVB accounts for 0.56%, while UVC is absent due to ozone absorption. Nevertheless, UVB accounts for all skin cancers and erythemas resulting from sun exposure.

Following materials are commonly used sunscreen agents:-

- **AMINOBENZOIC ACID (INCI NAME PABA)**

This ingredient has been used for many years and actually predates most of the other sunscreens. It is a para disubstituted material widely known as PABA, and has a maximum absorption at 283 nm, which limits its ability to adequately cover the erythral range (290-320 nm) and thus its effectiveness in achieving high SPFs. Questions about its safety, its poor oil solubility, and inadequate performance as a sunscreen have reduced its usage.

- **TITANIUM DIOXIDE**

This inorganic sunscreen has been used in makeup products for many years, but only recently it has achieved measures of popularity in the sunscreen arena. The UV absorption curve for titanium dioxide is principally in the UVB region. When used in sunscreen formulations, care must be taken to ensure good suspension, particularly at elevated temperatures. Titanium dioxide is noncomedogenic, gentle thus can be a great choice for those with sensitive skin.



- **ZINC OXIDE**

This is one of the popular inorganic sunscreen, commonly used in makeup products as a skin protectant. The UV curve for zinc oxide, while principally in the UVB region, extends well into the UVA region also. Thus it can be used to provide broad spectrum protection.

- **TROLAMINE SALICYLATE (INCI NAME TEA SALICYLATE)**

It is salicylate sunscreen (ortho disubstituted), it too exhibits rather poor absorption in the UV range. It is rarely if ever used as the sole sunscreen due to its absorptivity. It is made by neutralising salicylic acid (ortho hydroxy benzoic acid) with triethanolamine. The resulting sunscreen is water soluble.

- AVOBENZONE (INCI NAME BUTYL METHOXY DIBENZOYLMETHANE)**
This is a off-white powder with limited oil solubility exhibits excellent UVA absorbance. Questions have been raised concerning its photostability; these investigations are continuing. Due to its limited absorption in the erythematous range, avobenzone does not contribute significantly to the SPF (Sun Protection Factor). Avobenzone can be used alone or in combination with the other sunscreens.
- DIOXYBENZONE (INCI NAME BENZOPHENONE 8)**
It is an organic compound derived from Benzophenone that is used as a sunscreen agent. It is used to block UVB and short-wave UVA (ultraviolet) rays. It is used to boost the SPF.
- HOMOSALATE**
This is an ortho substituted sunscreen (salicylate derivative) that has (like the other salicylate sunscreens) a very low extinction coefficient (4,600) and a lambda maximum of 306 nm, this sunscreen is used as the SPF standard in the United States. While it was used for many years, it was considered to be very inefficient and is thus rarely used.
- MERADIMATE (INCINAME MENTHYLANTHRANILATE)**

The only liquid UVA sunscreen available for use, this is ortho disubstituted sunscreen (with an amino group acting as the electron donating group). It can help to boost the SPF when virtually all the UVB energy has been absorbed by other more efficient UVB sunscreens.
- OCTOCRYLENE**
This diphenyl acrylate sunscreen has a rather broad curve due in part to the presence of two benzene rings, and has been used to boost the SPF and enhance water resistancy.
- OCTISALATE (INCI NAME OCTYL SALICYLATE)**
This is another salicylate type of sunscreens (ortho disubstituted) exhibits rather poor absorption in the UV range. It is rarely if ever used as the sole sunscreen due to its absorptivity. It is often used in combination with oxybenzone, where it assists in solubilising it.
- PADIMATE O (INCI NAME OCTYLDIMETHYL PABA)**
This is para disubstituted sunscreen with excellent UVB absorbance. At the present time its usage is quite limited, in spite of the fact that it is one of the most efficient UVB sunscreens available and is approved as a sunscreen around the world. It has good oil solubility and is most effective when combined with other sunscreens to achieve high SPFs. Its excellent absorptivity is due to the presence of a very good electron-donating group (amino) in the para position (relative to the electron-withdrawing carbonyl group).

- ENSULIZOLE (INCI NAME PHENYLBENZIMIDAZOLE SULFONIC ACID)**
 This sunscreen is sold as a white powder in the acid form and is insoluble in water or oil. It must be neutralised before use with an appropriate material to make it water soluble (pH range 6.8-8.0). It exhibits excellent UVB absorbance and is actually the most efficient sunscreen available for use. This sunscreen is rarely used in water-resistant products due to its water solubility. It is widely used in sunscreen gels.
- SULISOBENZONE (INCI NAME BENZOPHENONE 4)**
 This is one of the benzophenones available as sunscreens; this sunscreen is seldom used as the only sunscreen. Because of its short wavelength UVA absorption it is used to boost the SPF and achieve high SPFs. This sunscreen is water-soluble due to the presence of a sulfonic group.
 Before selecting any of the above sunscreen agents for incorporation in cosmetic formulation, the permitted use levels, compatibility with other ingredients of the formulation, advantages and disadvantages of the particular sunscreen agent must be taken into consideration thoroughly by the formulator to avoid any potential risk factors.



3D Fluorescence Spectroscopy

Prof. M. Swaminathan

Nanomaterials Laboratory,
 International Research Centre,
 Department of Chemistry,
 Kalasalingam Academy of Research and Education,
 Krishnankoil-626126



Basic concepts of 3D fluorescence spectroscopy and the difference between normal 2D and 3D fluorescence are described in this article. Fluorescence is a light emission observed, when an excited molecule loses its energy from excited singlet state to ground state by radiation. Fluorescence spectroscopy has widespread applications because of its high sensitivity, versatility and speed. There are several fluorescence spectroscopy methods like steady state and time-resolved fluorescence, synchronous and excitation emission matrix-EEM, which are used extensively for monitoring bioprocesses, protein-ligand and interactions, dynamics and kinetics of protein folding reactions. In a common steady state fluorescence spectrum, a molecule is electronically excited by an excitation wavelength and the emission is recorded over a range of wavelengths that are generally in the visible range. This is a two dimensional (2D) spectrum with intensities of emission (y-axis) at different wavelengths (x-axis). A common fluorescence spectrum of 2-AMINO-6-FLUOROBENZOTHIAZOLE at different pH is shown in figure 1.

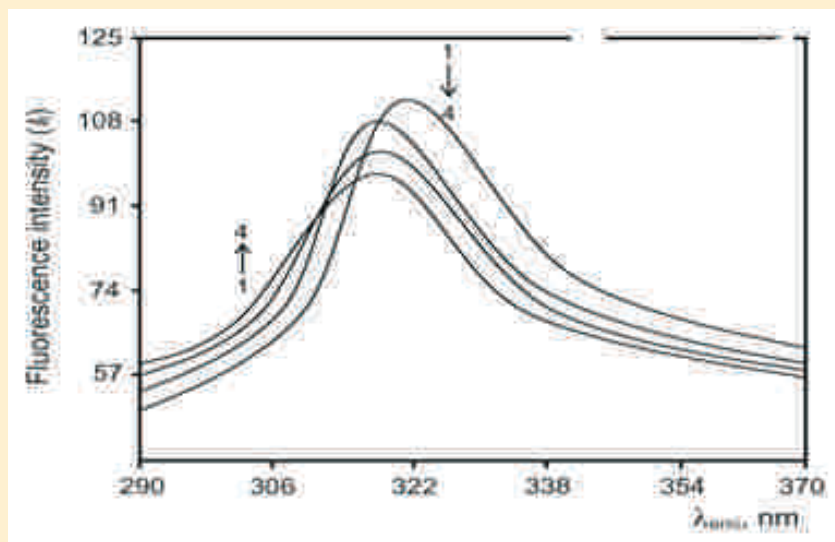


Fig.1- Fluorescence spectra of 2-AMINO-6-FLUOROBENZOTHAZOLE at different pH values: 1- 4.0, 2- 3.6, 3- 3.2, 4- 2.8 ($\lambda_{\text{exi}} = 271 \text{ nm}$).

When these recordings are made for several excitation wavelengths, placement of fluorescence spectra of different excitation wavelengths side by side forms a three-dimensional representation of the fluorescence intensities detected (x: emission; y: excitation; z: fluorescence intensity). These are referred to as 3D spectra or an excitation emission matrix (EEM). 3D fluorescence spectroscopy is also known as emission–excitation fluorescence spectroscopy.

As observed in Jablonski diagram, for a single fluorescent molecule, fluorescence spectrum will be the same, when excited with different excitation wavelengths. But depending upon the absorbance at different excitation wavelengths, the intensities of emission will be different as the emission intensity is related the absorbance at excitation wavelength according the equation given below.

$$I_f = I A \phi \dots\dots\dots(1)$$

I - Intensity of Excitation light, A - Absorbance at λ_{exi} , ϕ - Quantum yield.
This is illustrated in the figure 2.

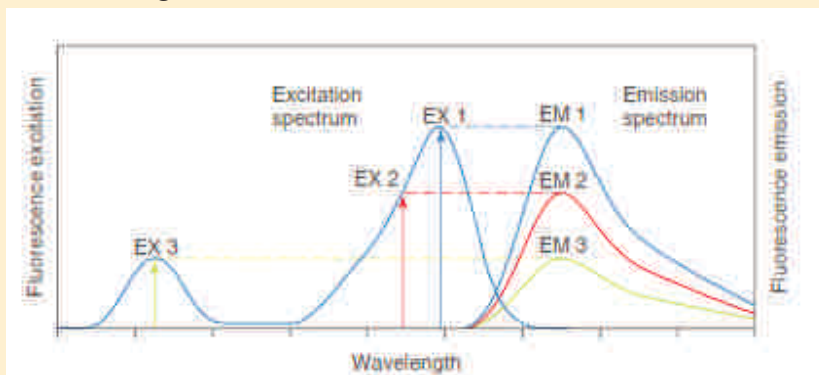


Fig.2. Excitation of a fluorophore at three different wavelengths (EX 1, EX 2, EX 3) does not change the emission profile but does produce variations in fluorescence emission intensity (EM 1,EM2,EM3) that correspond to the amplitude of the excitation spectrum. (From-Encyclopedia of Analytical Chemistry in 2018 by JohnWiley & Sons, Ltd.DOI: 0.1002/9780470027318.a9540)

For example 2D,3D and contour plot of fluorescence spectrum of a single molecule Tryptophan is given below and compared(Fig.3).

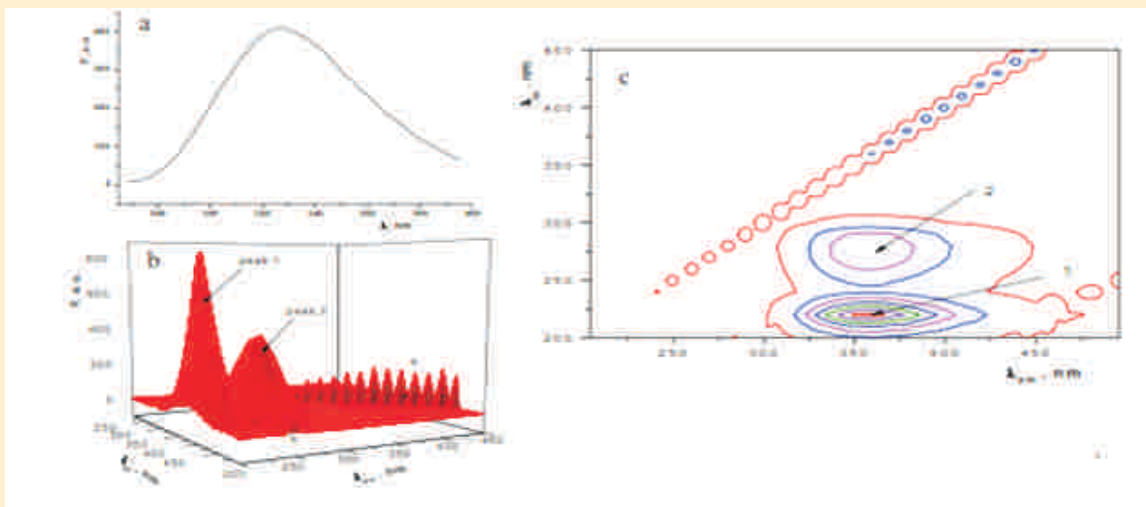


Fig.3- (a) 2D fluorescence spectra of Tryptophan(Trp) in aqueous solution, (b) 3D fluorescence spectra of Trp in aqueous solution and projection of the 3D spectrum in xy plane, (c) excitation-emission contour plots of Trp. (From-Grigoryan K. R., Shilajyan H. A. Fluorescence 2D and 3D Spectra Analysis of Tryptophan, tyrosine and phenylalanine, Proc. of the Yerevan State Univ. Chemistry and Biology, 2017, 51(1), p. 3–7.)

Tryptophan(Trp) has the fluorescence maximum at 357 nm as shown in Fig.1a 2D spectrum. In Fig.2b, 3D EEM spectrum is given with two different excitation wavelengths 220 and 280 nm and it shows the same maximum with difference in intensities of emission. The fluorescence intensity is much stronger at $\lambda_{ex}=220$ nm(peak 1) than at $\lambda_{ex}=280$ nm(peak 2) and the ratio of fluorescence intensity is approximately 2.1:1 (220/360 -833.2; 280/360 - 395.8). The maximum with two different intensities is also reflected in the excitation-emission contour plots of Tryptophan as two circles denoted as 1 and 2. The method of making of a contour plot with a single fluorophore is depicted in figure 4. The bottom part of the diagram shows some contour lines with a straight line running through the location of the maximum value. The curve at the top represents the values along that straight line. Maximum is represented by a circle.

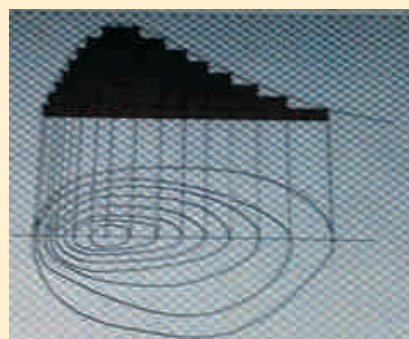


Figure-4-Contour plot of a single fluorophore with one maximum.

Hence for a single fluorophore, 3D spectrum is not much useful. But with a mixture of fluorophores, they will have different absorption and emission, EEM will reflect the emission of the each component with different excitation wavelength. Hence 3D EEM spectrum of a mixture of fluorophores is much useful to get the information of the presence of individual components and their concentration. EEM spectrum of three amino acids, Tryptophan, Tyrosine(Tyr) and phenylalanine(Phe) are given below.

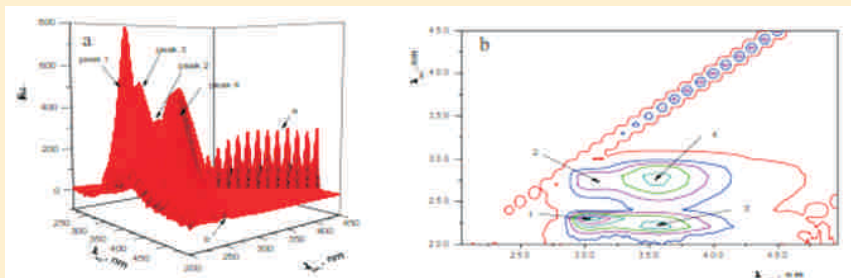


Fig. 5 - a) 3D Spectrum (fluorescence intensity distribution); b) excitation-emission contour plots of Trp-Tyr-Phe mixture in physiological solution at T = 293 K.

The 3D spectra and excitation emission contour plots of Trp-Tyr-Phe mixture in physiological solution and the intensities of fluorescence peaks are given in Fig. 5. From the analysis of fluorescence 3D spectrum of the mixture and 2D spectra of individual amino acids it can be concluded that the 4 peaks appearing in 3D spectrum refer to Tyrosine (peak 1 and peak 2) and to Tryptophan (peak 3 and peak 4). The characteristic peaks of Phenylalanine are not seen due to low quantum yield and intensity. EEM spectrum gives full details of emission of all the components in a mixture at all excitation wavelengths in a single figure. 3D fluorescence enables the detection of different fluorophores present in samples. Because the total fluorophore composition of the sample is unknown, a 3D spectrum over a wide range of excitation and emission wavelengths makes it possible to obtain a spectral fingerprint of the sample. This method is mainly used for the analysis of multi-fluorophore components in a single solution. Excitation-emission contour plots of Trp-Tyr-Phe mixture are displayed in fig.5 b, which also reflects the peaks of tyrosine (peaks 1,2) and tryptophan (peaks 3,4).

3D front-face fluorescence spectra moroccan olive oil (Fig.6) and contour plot of 3D fluorescence spectra canola oil (Fig.7) are shown below. Contour map uses contours or color-coded regions help us to visualize 3D data in two dimensions.

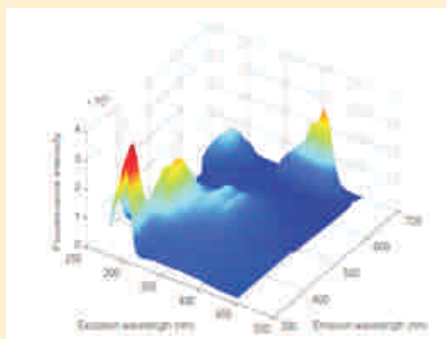


Fig.6.3D front-face fluorescence spectra Moroccan olive oil (3D view)

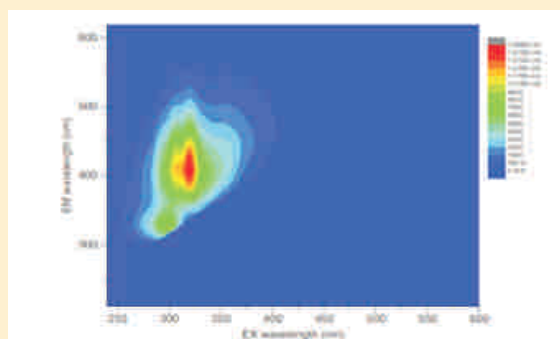


Fig.7. 3D fluorescence spectra canola oil (contour map)

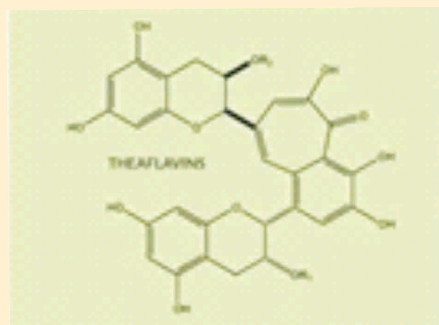
3D fluorescence spectrum is complex and can be interpreted only by using a mathematical tool, Chemometrics. Chemometrics can be defined as the discipline that combines data analysis and analytical chemistry. It gathers and develops a set of mathematical tools that can be used to extract structured and interpretable information from chemical data. 3D fluorescence spectrum or its contour plot is mainly useful to identify food adulterants and fluorophores in the environment (Dissolved organic matter). The use of 3D fluorescence fingerprinting is more suitable for recognition, classification or detection processes where rapidity and sensitivity are crucial.

NEWS / VIEWS & MORE

CHEMISTRY OF TEA

Polyphenols in Tea

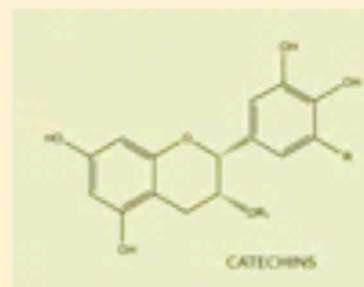
A strong cup of tea usually contains around 180-240mg of polyphenol compounds. Compounds called catechins are the building blocks of black tea polyphenols. They are oxidized to form theaflavins and theabigems. Theaflavins comprise 3-5% of black tea and are responsible for its red-orange appearance.



Theabigems are the term for a wide range of polyphenols whose structure remains largely unknown but they are also thought to contribute to tea's colour and taste.

The Effect Tea on Polyphenols

The compounds in tea derived from catechins can have antioxidant effects on the body. Research has shown these could have beneficial effects on cardiovascular health. It has been suggested that casein protein in milk could bind to polyphenols and as a result prevent their antioxidant effects but research on this subject remains conflicted.



Waste-to-Energy Model

Recently resolution passed by United Nations that adopt Indore's model of waste-to-energy model. In cleanliness, Indore leads rest of the world follows. Following the footsteps of clean city 72 Asian and African countries are now replicating the bio-methenation model for treatment of wet waste into bio-CNG.



A resolution in this regards was passed in a Conference of international Forum for sustainable Asia and Pacific held recently in Tokyo. The Conference was hosted jointly by United Nations and Government of Japan on Sustainable Technologies.

Indore Municipal Corporation waste management consultant Asad Warsi was invited as a technical expert to give a presentation about technical features of bio-methenation plant that was set up in Indore for producing bio-CNG out of wet waste generated in city daily.

“A resolution has been passed by UN and it has been decided that the model of Indore's biomethenation plant will be replicated in 72 countries of Asia Pacific Region”. Warsi told TOI. Countries like Bhutan, Nepal, Bangladesh Japan, Malaysia, Iraq, Maldives, Oman, South Korea are on the list. Warsi Said that at least one biomethenation plant with 50 tonne capacity each would be set up in each of these countries by UN with help of the Japanese Government.

Speaking about major features that prompted the international forum to pass the resolution. Warsi said that Indore's biomethenation model was found to be one of the most sustainable, cost effective and zero waste model for wet waste management. Besides, its operation and monitoring are also foolproof.

UN with the help of Japan Government, will install one plant of 50 tonne capacity in each country.

List of ACT Life Members During May to August 2021

Sr. No.	LM No.	Name of the Member	Institute
1.	2352	Dr. S. Jothivel	Dept. of Chemistry, C.K.N College for Men, Anna Nagar (East), Chennai, Tamil Nadu 600102
2.	2353	Dr. Anoop P. Fartode	K.D.K College of Engineering, Great Nag road, Nandanvan, Nagpur 440009
3.	2354	Dr. Naseem Ahmad	Dept. of Chemistry, Integral University, Dasauli, Kursi road, Lucknow, Uttar Pradesh 226026
4.	2355	Dr. Manju Baghmar	S.S.Jain Subodh PG Mahila Mahavidyalaya, Rambagh, Jaipur, Rajasthan 302004
5.	2356	Dr. Naveen Kumar	Dept. of Chemistry, KL DAV (PG) College, Roorkee, Haridwar, Uttarakhand 247667
6.	2357	Dr. Priyabrat Dwivedi	MIE Dept., National University of Science & Technology, Oman Al Hail, Seeb, Oman 111
7.	2358	Dr. Shyam Vir Singh	Dept. of Chemistry, SGRR (PG) College, DehraDun, Uttarakhand 248001
8.	2359	Shri Vaishnav Vidyapeeth Vishwavidyalaya	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore Ujjain road, Indore 453111
9.	2360	Dr. P(Pamarthi) Gangadhar	Bharat Institute of Engineering & Technology, Mangalpally, Ibrahimpatnam Rangareddy, Telangana 501510
10.	2361	Anjum Begum	Lords Institute of Engineering & Technology, Survey no. 32, Himayath Sagar, Hyderabad, Telangana 500091
11.	2362	Anjum Afrooze	Lords Institute of Engineering & Technology, Survey no. 32, Himayath Sagar, Hyderabad, Telangana 500091

L.M./IM No.: _____

Receipt No. _____



ASSOCIATION OF CHEMISTRY TEACHERS (ACT)

Homi Bhabha Centre for Science Education
Tata Institute of Fundamental Research
103, NIUS Bldg., V.N. Purav Marg, Mankhurd, Mumbai-400 088.
(Regd.No. Maharashtra Government, Mumbai 922,2010 G.B.B.S.D. dated 08/04/2010)
Website: www.associationofchemistryteachers.org

Date: _____

To,
The General Secretary,
Association of Chemistry Teachers,
HBCSE(TIFR), Mumbai-400 088.



Dear Sir,

I/We wish to take the Life/Institutional Membership of A.C.T.

[Fees: Life Rs.1500/- and Institutional (one time payment) Rs.15,000/-]

A cheque/Demand Draft No. _____ dated _____ of Rs. _____
drawn on _____ Bank, payable at par at Mumbai, in favour of "Association
of Chemistry Teachers" is enclosed. (Outstation members should remit through demand draft only.)

1. Name : _____
2. Membership Sought : Life/Institutional
3. Qualifications : _____
4. Designation : _____
5. Date of Birth : _____
6. **Office address** : _____

Telephone : _____ Fax: _____ Email: _____
7. **Residential address** : _____

- Mobile: _____ Landline: _____ Email: _____
8. Area of teaching/research interest: _____

I am aware of the objective, rules and regulations of ACT and shall abide by them.

Place _____

Yours sincerely,

Date: _____

(Signature)

All correspondence should be made to the General Secretary, Association of Chemistry Teachers, 103, NIUS Bldg., Homi Bhabha Centre for Science Education (TIFR), V.N. Purav Marg, Mumbai -400 088.

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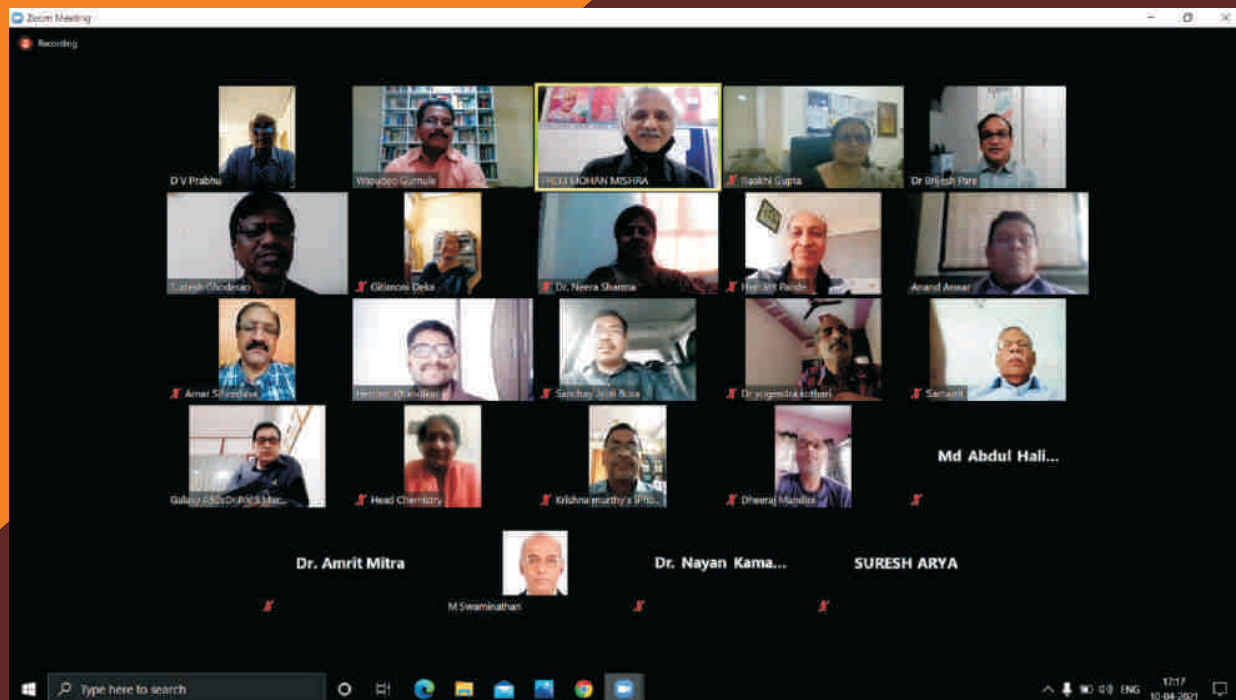
ASSOCIATION OF CHEMISTRY TEACHERS

(Promoting Excellence in Chemistry Education)

C/o. Homi Bhabha Centre for Science Education (HBCSE, TIFR)

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