International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 4 Volume No.6 July – 2022
DOI:10.46647/ijetms.2022.v06i04.0017 ISSN: 2581-4621

Nuclear characterization of Quantum Dots

Dr Rohini V. S. [1] , S. Boregowda [1,2]
1. Dr Rohini V S,Assosciate prof,dept of physics, Nrupatunga university,NT road,Bangalore-560001,Karnataka,India
2. S. Boregowda,Assistant prof.,dept of physics,SAC college,Nagamangala,Mandya-571432,Karnataka,India
Corresponding author Dr Rohini V S[1] ,**neelarohini@gmail.com**

Abstract:
Quantum dots are a new phase/allotropic form of carbon exhibiting various peculiar properties like photo luminence,radio activity,laser coherent scattering etc .Typical size of the QDs estimated less than 10nm[1] (ie a subnano particle) such that it can be defined as constituent/sub particle of a nano particle falling in a special range between nuclear and nano regions.
Here is a case study of carbon QDs prepared from organic samples. The QDs show βactivity with half life ranging from 141 to 408 secs.

1.Theory

The radioactivity decay law is

$$N_t = N_0 e^{-\lambda t}$$

$$\ln (N_t / N_0) = \ln (e^{-\lambda t})$$

$$\ln N_t - \ln N_0 = -\lambda t$$

$$\ln N_t = -\lambda t + \ln N_0$$

This eqn is of the type

$$Y = m X + C, \quad Y = \ln Nt, \quad \text{slope} = \lambda, \text{intercept} = \ln N_0$$

Thus by plotting ln N_t vs t decay constant λ can be calculated.
The half life of the sample is given by

$$T_{1/2} = 0.693 / \lambda$$

$$\text{Initial radioactivity} = N_0 = e^{\text{intercept}}$$

Thus by determining λ of the sample, it's half life,initial acivity can be determined and hence the radioactive isotope can be identified.

2.Methodology

Organic materials are crushed and subjected to carbonization at a high temperature such that carbon sample is extracted. The carbon particles of different sizes are seperated out and subjected to radio activity analysis Table 1 shows the β emission of this sample.Various radioactive decaying series can be identified with different decay constants (λ)

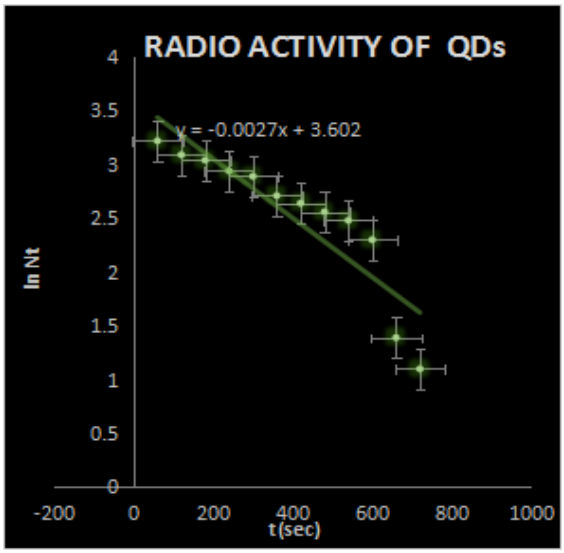
Sample 1:

International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 4 Volume No.6 July – 2022
DOI:10.46647/ijetms.2022.v06i04.0017 ISSN: 2581-4621

Fig1,2,3,4

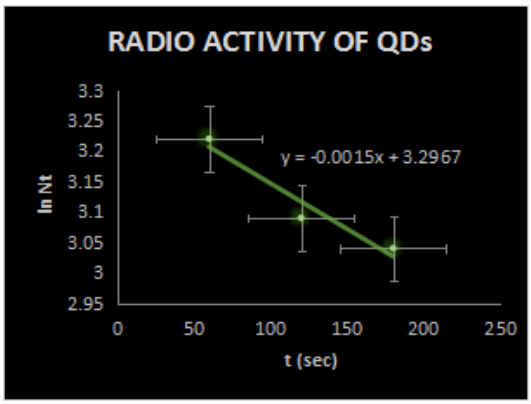
Table I:

sno	t(sec)	N_t	ln N_t
1	60	25	3.218875825
2	120	22	3.091042453
3	180	21	3.044522438
4	240	19	2.944438979
5	300	18	2.890371758
6	360	15	2.708050201
7	420	14	2.63905733
8	480	13	2.564949357
9	540	12	2.48490665
10	600	10	2.302585093
11	660	4	1.386294361
12	720	3	1.098612289



sno	t(sec)	$\ln N_t$ (trunkated)
1	60	3.22
2	120	3.09
3	180	3.04
4	240	2.94
5	300	2.89
6	360	2.71
7	420	2.64
8	480	2.56
9	540	2.48
10	600	2.30
11	660	1.39
12	720	1.099

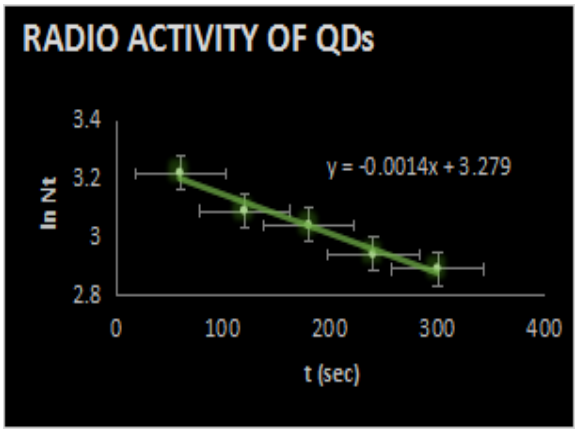
Graph1 **table 1**



sno	t(sec)	lnNt (trunkated)
1	60	3.22
2	120	3.09
3	180	3.04

Graph2 **table2**

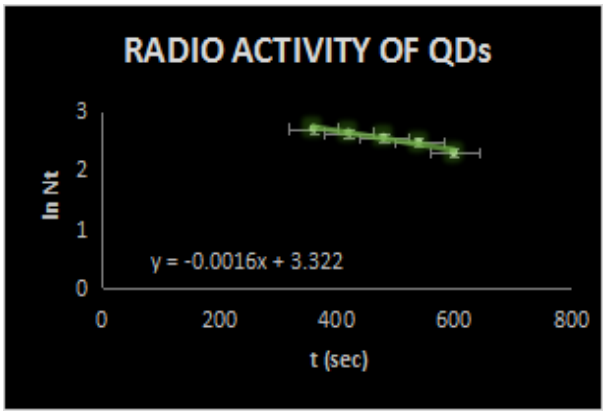
International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 4 Volume No.6 July – 2022
DOI:10.46647/ijetms.2022.v06i04.0017 ISSN: 2581-4621



Graph3

sno	t(sec)	lnNt (trunkated)
1	60	3.22
2	120	3.09
3	180	3.04
4	240	2.94
5	300	2.89

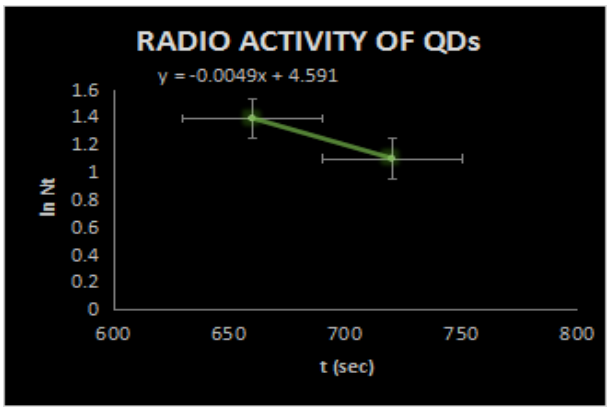
table3



Graph4

sno	t(sec)	lnNt (trunkated)
6	360	2.71
7	420	2.64
8	480	2.56
9	540	2.48
10	600	2.30

table4



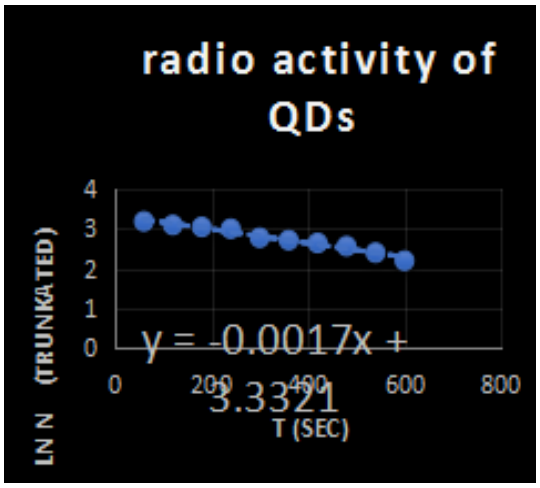
Graph5

sno	t(sec)	lnNt (trunkated)
11	660	1.39
12	720	1.099

table5

International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 4 Volume No.6 July – 2022
DOI:10.46647/ijetms.2022.v06i04.0017 ISSN: 2581-4621

Sample 2:



Graph6

sno	t(sec)	N	ln N	ln N trunkated
1	60	24	3.17805383	3.18
2	120	22	3.091042453	3.09
3	180	21	3.044522438	3.04
4	240	20	2.995732274	2.996
5	300	16	2.772588722	2.77
6	360	15	2.708050201	2.71
7	420	14	2.63905733	2.64
8	480	13	2.564949357	2.56
9	540	11	2.397895273	2.398
10	600	9	2.197224577	2.197

table6

3.Result

sno	Sample	Linear fit	Decay constant (λ / sec)	Initial activity (N_0)	$T_{1/2}$ (sec) Radioactive isotope identifed	remark	Nuclei identified
1	**I**	Y=-0.0049X+4.591	0.0049	99	141	Agreegate activity	82-Pb-215
2	**I**	**Y=-0.0027X+ 3.602**	0.0027	37	257	individual	?
3	**I**	Y=-0.0014X+3.279	0.0014	28	173	individual	86-Radon(Rn)-205
4	**I**	Y=-0.0015X+3.2967	0.0015	27	462	individual	83-Bismath(Bi)-215
5	**I**	Y=-0.0016X+3.322	0.0016	28	433	individual	93-Neptunium(Np)-240
6	**II**	Y=-0.0017X+3.3321	0.0017	28	408	individual	96-Curium(Cm)-236

4.Author's note

There is no conflict of interest regarding publication of this article.Author confirms that this paper is free from plagiarism

5. Conclusions

Decay series identified as

^{96}Cm $_{236}$(-3 β)→ ^{93}Np $_{240}$(-3α-1β)→^{86}Rn $_{205}$ (-1α-1β)→ ^{83}Bi $_{215}$ (-1β)→^{82}Pb $_{215}$

New isotopes identified are

$$^{96}Cm_{236}\ ,^{93}Np_{240}\ ,^{86}Rn_{205}\ ,\ ^{83}Bi_{215}\ ,^{82}Pb_{215}$$

6.Reference:

1. Optical characterization of carbon quantum dots-Dr Rohini V S,IJSR,vol10,issue 8,Aug 2021,DOI10.21275/SR21808215518,paper Id:SR1808215518
2. A study of nano structures-CQDs,Dr Rohini V S,International seminar proceedings,02/02/2021,BGS Auditorium,SACcollege,Nagamangala,Mandya-571432,Karnataka,India-ISBN978-93-88956--41-3
3. An experimental study of carbon dust-Dr Rohini V S,IJSR,vol3,issue 7,july 2014,DOI 10.21275/SR14708111434