A study into the binding effects of DNA and Lanthanides

Using Lanthanide metals as a method of detection for specific base pairs.

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Introduction:

Early detection of colorectal cancer is vital to give patients the greatest chance of recovery.

As chemists this can be done by analysing gene mutations in single base pairs.

In this project different type of DNA were bound to various lanthanide ions to see if there was evidence for preferential binding to any of the 4 bases that make up a DNA stand which would present itself as a difference in the fluorescence emission which would be a cheap and quick testing method.

Aims:

To show the difference in binding of the different lanthanides to DNA made up of different base pairs

To determine whether the different bas pairs have a better binding affinity to the metal ion than others thus showing if there are any base pair miss match mutations in a gene sequence.

To see if there are any clear changes than can be seen in the fluorescence data when the different DNA and lanthanide ion solutions are mixed.

Results:

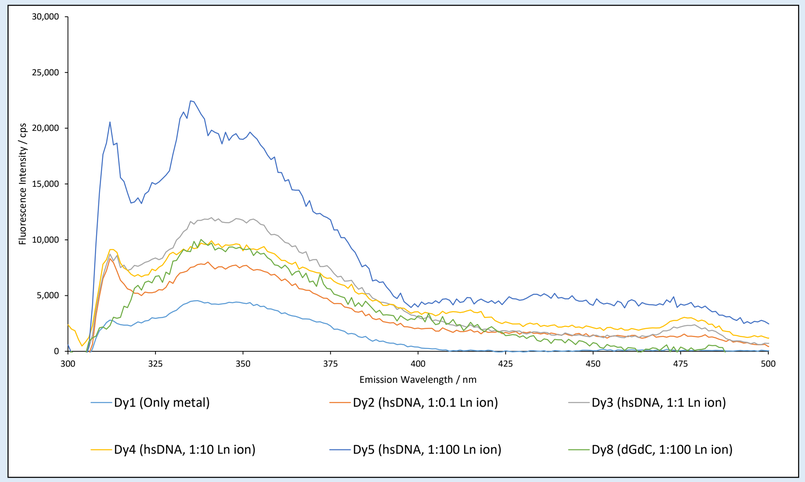

Fig 1: Fluorescence spectra showing the effects of Dy ions binding to various types of DNA at different concentrations

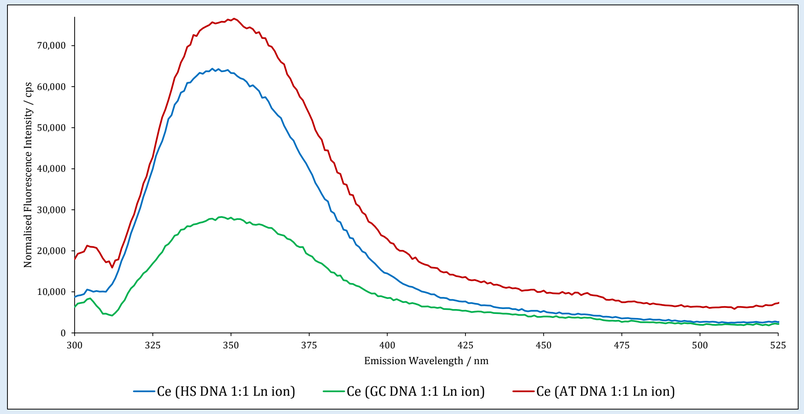

Fig 2: Fluorescence spectra showing the effects of different types of DNA binding to Ce ion at the same concentration.

HS (Herring sperm) DNA – Random base pairs
GC DNA – only GC base pairs
AT DNA – only AT base pairs
All spectra taken at an excitation λ of 280 nm

Conclusions:

As shown by using Dy as an example graph the metal did not show any significant change when introduced to the strands of DNA, the majority of the lanthanide ions testes behaved this way

However Ce showed significant changes in the fluorescence emission spectra giving different intensities for the HS, AT and GC DNA possibly showing a stronger binding affinity for the AT base pairs as GC fluoresced the least and AT the most in the spectra that were ran.

Further research into the binding effects on these lanthanides would be required to prove that they have a greater binding affinity for GC base pairs including using single stranded DNA which would then give the lanthanide ions the ability to bind to different parts if the DNA and not just the backbone of the double stranded DNA

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57 La Lanthanum 138.91	58 Ce Cerium 140.12	60 Nd Neodymium 144.24	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	70 Yb Ytterbium 173.05