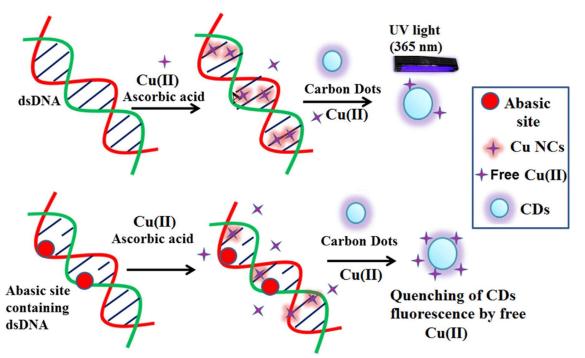**Biosensing of solitary and clustered abasic site DNA damage lesions with copper nanoclusters and carbon dots**

A simple and cost-effective fluorescence based method for detection of abasic sites in dsDNA is demonstrated. DNA was used as a template for cop-per nanoclusters (Cu NCs) formation. Presence of abasic sites in DNA hinder the formation of Cu NCs resulting in increased presence of Cu(II) in solution. These free copper ions were traced quantitatively by fluorescence quenching of carbon dots (CDs) in solution that report the presence of abasic sites in those DNA samples. Apart from fluorescence properties, binding of Cu NCs are markedly different for normal and abasic sites containing DNA. To demonstrate the inclusiveness of Cu NCs and CD based biosensing of abasic sites, oligomeric DNA, plasmid DNA in linear and condensed form and DNA extracted from onion and HeLa cells were tested and respond sensitively to the presence of abasic sites in nano molar range of those DNA that is visually noticeable with UV light. The detection strategy works very well for clustered abasic sites DNA damage also, where multiple abasic sites lesions are present in close proximity in DNA and easily detectable by this method through visual inspection under UV light.

Scheme 1. CDs aided estimation of Cu NCs formation on DNA template with and without clustered Abasic sites.
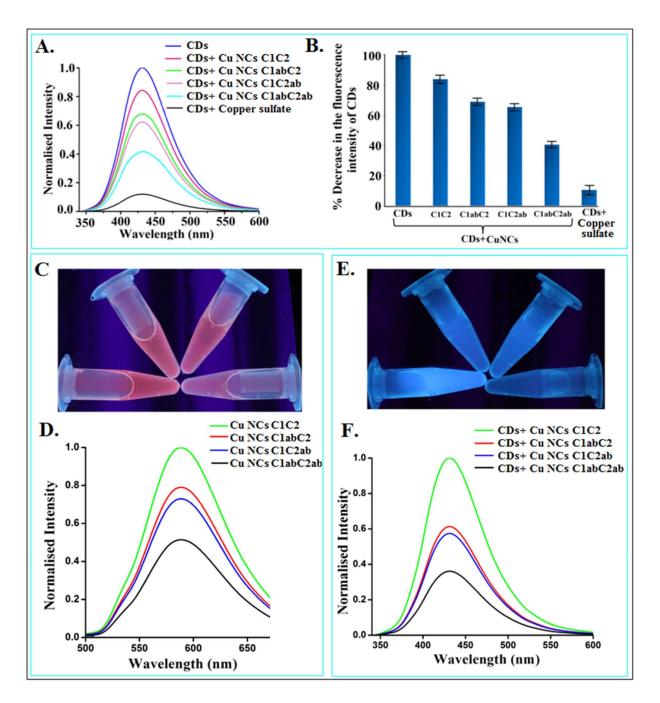
Fig. 1 A. Quenching of fluorescence intensity of CDs (_ex = 330 nm) due to free copper ions in Cu NCs reaction mixture B. Plot of % decrease in fluorescence intensity ofCDs in presence of abasic sites in DNA C. Visual comparison showing fluorescence of Cu NC in C1C2, C1ab-C2, C1-C2ab and C1ab-C2ab from left to right & D. Correspondingfluorescence spectra of the Cu NCs samples E. Visual comparison showing fluorescence of same solution after addition of CD indicating fluorescence quenching of CDs in CuNCs samples and F. Corresponding fluorescence spectra of the CDs.

This method offers a fast, economical and reliable biosensing platform for abasic site DNA damage lesions that could be researched further for detection of other types of DNA damage lesions.