Gamma-irradiation synthesis of magnetic iron oxide and gold nanoparticles and their toxicity to HEK 293 cells

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Noble metal and magnetic nanoparticles (NPs) have been used in numerous applications. Gold nanoparticles (AuNPs) are widely used in analytical chemistry, biomedicine (radiosensitization, contrast agents) and catalysis. Magnetic iron oxide NPs have applications as sensors, as contrast agents for MR imaging and for hyperthermia cancer treatments. The applications of NPs depend on many physicochemical parameters such as NPs size, shape, surface charge, chemical composition, coating and subsequent NPs stability. These parameters can be influenced by synthesis conditions (reducing and stabilizing agent etc.). Synthesis in the presence of polymers and small organic molecules can influence NPs size, morphology, stability and dispersivity [1].γ-irradiation is a powerful technique to synthesize NPs of controlled size and shape. In these studies magnetic and gold NPs were synthesized using different methods of radiolytic synthesis. Both magnetite and gold NPs were synthesized by γ-irradiation assisted microemulsion method [2,3,4]. Phase composition, stoichiometry and size of magnetite NPs were controlled by adjusting γ-irradiation dose and dose rate [3,4]. Further, the γ-irradiation of Fe(III) aqueous solution in the presence of DEAE-Dextran produced magnetic δ-FeOOH (feroxyhyte) NPs. This result present the first report of γ-irradiation synthesis of δ-FeOOH and the first report of obtaining δ-FeOOH in nanodisc morphology [5]. AuNPs were synthesized by a citrate-radiolytical method. γ-irradiation of Au(III)/citrate solutions produced well-dispersed and highly concentrated gold colloids in the presence of dissolved oxygen, without adding reducing or stabilizing agents [6]. AuNP size was controlled by saturating gases in the solution. AuNPs synthesized in the presence of air were two times larger than ones synthesized in the presence of nitrogen [2,6]. Feroxyhyte NPs were applied to HEK 293 cells and their viability was studied by MTT cell assay. Feroxyhyte NPs showed no cytotoxic effect to HEK 293 cells.



Figure 1: SEM images of δ-FeOOH magnetic nanodiscs (a) and Au nanoparticles (b) synthesized using γ-irradiation.

# References

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