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PEGylated galactosylated cationic liposomes for hepatocytic gene delivery

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The efficiency of liposome-mediated gene delivery is greatly enhanced by appropriate decoration of vehicles with cell-specific targeting ligands. However, liposome-DNA complexes may still be opsonized in serum thus ablating any advantage gained. A stealth aspect may therefore be conferred on complexes by poly(ethylene glycol) (PEG) grafting. Here, we examined the effect that degree of PEGylation has on physicochemical properties, cytotoxicity and transfection activity of lipoplexes containing the Chol-T cytofectin 3β-[N-(N', N'-dimethylaminopropane)-carbamoyl] cholesterol, the neutral co-lipid dioleoylphosphatidylethanolamine (DOPE), the asialoglycoprotein receptor (ASGP-R) targeted cholesteryl-β-D-galactopyranoside (Chol-β-Gal) ligand, and plasmid DNA in ASGP-R-negative (HEK293) and receptor-positive (HepG2) human cell lines. Lipoplexes were characterized by hydrodynamic sizing, electron microscopy, band shift, ethidium bromide (EtBr) intercalation and nuclease digestion assays. Cryo-TEM and DLS studies revealed that PEGylation generated smaller and more densely aggregated lipoplexes than their non-PEGylated counterparts. MTT and AB reduction studies showed that the lipoplexes elicited a dose-dependent cytotoxic effect in both cell lines, with cell viability remaining above 65% (MTT) and 50% (AB). The *Ricinus communis* (RCA_{120}) agglutination test confirmed that the galactosyl residues on the targeted lipoplexes were well exposed and accessible. Transgene activity increased by 63% and 77% when HepG2 was confronted by the 2 and 5mole% PEGylated lipoplexes, respectively, compared to their non-PEGylated counterparts. Furthermore, Chol-T Chol-β-Gal 5% PEG complexes were able to achieve a 164% increase in transfection level in the ASGP-R positive cell line (HepG2) compared to HEK293 (ASGP-R negative). Results strongly indicate that PEGylation potentiates the activity of ASGP-R-targeted lipoplexes, highlighting their gene delivery potential.

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Magnetite coated metallic foams as electro-Fenton catalysts for methylene blue degradation

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The possibility of prepared one-body catalyst was investigated for electro-Fenton reaction by coating magnetite nanoparticles powder on metal foams (Fe-Cr-Al foams). Up to 10 wt% magnetite could be coated onto metal foams with strong enough adhesion. An electro-Fenton system with a magnetite nano-particles' wash-coated Fe-Cr-Al foam as cathode and graphite as anode was successfully applied for the discoloration of methylene blue in aqueous solution for the first time. The effects of pH, applied voltage, supporting electrolyte, electrode inner space, and catalyst dosages were investigated and optimized. Using this cathode, methylene blue was removed with >99.8% removal rate at 10 ppm after 60 min and with >95.2% at 50 ppm after 120 min of reaction. Furthermore, those cathodes could be reused at least three times without performance degradation. Due to high degradation capability, simple recovery and high reusability, magnetite nanoparticles' wash-coated metal foams can be an effective cathode of electro-Fenton systems for the abatement of dyes in wastewater.

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