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Influence of monthmorillonite adsorbents on the efficacy of removing of pharmaceuticals from water

E V Rozhina [1] S N Batasheva [1] A O Rozhin [1] M A Kryuchkova [1] R F Fakhrullin [1]
1: Kazan Federal University

Hydrophobic montmorillonite modified with trimethyl stearyl ammonium and untreated montmorillonite were used to adsorb carbamazepine, ibuprofen and paracetamol. The efficiency of adsorption was investigated under static conditions depending on the pH of the solution, temperature, contact time, the initial concentration of pharmaceuticals and the mass ratio of adsorbents. In the course of the experiments, the optimal conditions for the use of adsorbents were selected. Of the adsorbents tested, untreated montmorillonite is less effective than hydrophobic montmorillonite, which has a higher adsorption capacity to pharmaceuticals in the following order: carbamazepine → ibuprofen → paracetamol. In the course of the experiments, the optimal conditions for the use of adsorbents were selected. Within the concentration range of 10-50 μg / ml, the most optimal mass ratio of adsorbents is a ratio of 1:67, in the pH range of 6, at a temperature of 25 ° C, the contact time is not less than 24 hours. Hydrophobic montmorillonite is the most promising adsorbent for further research on the removal of organic pollutants from wastewater. The research was funded by the Russian Science Foundation grant No. 21-74-10034.

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pH-responsive multicomponent system for charge masking of cationic nanoparticles for gene delivery

J I Solomun [1] P Mapfumo [1] F Richter [1] E Amro [3] S Tuempel [3] K L Rudolph [3] A Traeger [1 2]
1: Laboratory of Organic and Macromolecular Chemistry (IOMC), Friedrich Schiller University Jena 2: Jena Center for Soft Matter (JCSM), Friedrich Schiller University Jena 3: Leibniz Institute for Age Research, Fritz Lipmann Institute Jena

Cationic non-viral gene vectors have been extensively studied and show great potential in overcoming the physiological barriers of the gene delivery process. However, the prevention of cytotoxic effects and non-specific interactions following systemic application remains a challenge. By the introduction of “stealth” polymers such as polyethylene glycol (PEG), biocompatibility and circulation time can be enhanced. However, this often impairs transfection efficiency by impeding cellular uptake and intracellular trafficking. Within this study, a multicomponent polymer-based gene delivery system was developed comprising highly transfecting cationic hydrophobic particles (P(*n*BMA-*co*-MMA-*co*-DMAEMA), (PBMD)) and the pH-responsive block copolymer poly((4-acryloylmorpholine)-*b*-(2-(carboxy)ethyl acrylamide)) ($P(NAM_{74}$-*b*-$CEAm_{74})$, PNC). While the anionic PCEAm block interacts with the PBMD polymer, PNAM serves as “stealth” moiety. PNC-masked particles stably encapsulated pDNA at diameters below 200 nm and showed reduced interaction with human erythrocytes at extracellular conditions (pH 7.4, blood) whereas acidic conditions (pH 6, endosome) resulted in membrane leakage. Both, adherent (HEK293T) and difficult-to-transfect suspension cells (K-562) expressed reporter genes comparably or even better if treated with pDNA-loaded PNC-masked particles compared to linear polyethylenimine (LPEI). Cytotoxicity was significantly reduced by PNC-masking in K-562 cells and erythrocytes. Preliminary *in vivo* studies further showed transfection of bone marrow blood cells in mice