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ВЛИЯНИЕ МУЛЬТИСЛОЙНЫХ ОБОЛОЧЕК (ПОЛИМЕР/ПОЛИФЕНОЛ)$_n$ НА РАСТВОРЕНИЕ МИКРОКРИСТАЛЛОВ САХАРОЗЫ

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Цель работы — получение на основе фенольных соединений, а именно таниновой кислоты (ТК) и поли(4-винилфенола) (ПВФ), и полимеров (полиэтиленимина (ПЭИ), поли(4-винилпиридина) (ПВПр), блок сополимера полиоксиэтилена и полиоксипропилена Плюроника F-68 и поливинилпирролидона (ПВП)) методом послойной сборки из этилового спирта мультислойных пленок и оболочек, пролонгирующих высвобождение водорастворимых соединений.

С помощью метода кварцевого микровзвешивания доказан линейный рост толщины плёнок в пределах от 1 до 5 бислоёв с толщиной бислоя 1,3 ± 0,4 нм, 1,2 ± 0,6 нм и 2,8 ± 0,2 нм для пленок (ПЭИ/ТК)$_n$, (ПВПр/ТК)$_n$ и (ПВПр/ПВФ)$_n$ соответственно. Толщина мультислойных пленок и шероховатость их поверхности зависят от размеров частиц полимеров в органическом растворителе. ПЭИ и ПВПр с наибольшим среди исследованных полимеров среднечисловым диаметром в этиловом спирте, формируют с ТК и ПВФ толстые пленки с высокой шероховатостью поверхности.

Показано, что оболочки (ПВПр/ТК)$_5$, (ПВПр/ПВФ)$_5$ и (ПЭИ/ТК)$_5$, набухающие в воде не более чем на 42%, замедляют растворение сахарозы из инкапсулированных микрокристаллов в воде при 25 ± 1 ºС до 30 мин, 15 мин и 5 мин соответственно, в то время как микрокристаллическая сахароза полностью растворяется за 1 мин.

Новые системы с пролонгированным высвобождением в воде на основе покрытых полимерной оболочкой микрочастиц востребованы в фармацевтической, пищевой, косметической промышленности.

Ключевые слова: метод послойной сборки в неводной среде, мультислойные полимерные покрытия, таниновая кислота, поли(4-винилфенол), пролонгированный релиз, микрокристаллическая сахароза.

INFLUENCE OF LAYER-BY-LAYER (POLYMER/POLYPHENOL)$_n$ SHELLS ON DISSOLUTION OF SACCHAROSE MICROCRYSTALS

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Purpose of this work: to obtain multilayer films and shells that prolong the release of water-soluble compounds on the basis of phenols, namely tannic acid (TA) and poly(4-vinylphenol) (PVPh), and polymers (polyethyleneimine (PEI), poly(4-vinylpyridine) (PVPr), block copolymer polyoxyethylene and polyoxypropylene Pluronic F-68 and polyvinylpyrrolidone (PVP)) by the layer-by-layer assembly method from ethyl alcohol.

Using the quartz crystal microbalance technique, the linear growth of films was proved within the range from 1 to 5 bilayers with bilayer thicknesses of 1.3 ± 0.4 nm, 1.2 ± 0.6 nm, and 2.8 ± 0.2 nm for the films of (PEI/TA)$_n$, (PVPr/TA)$_n$, and (PVPr/PVPh)$_n$, respectively. The thickness of the multilayer films and the

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roughness of their surface depend on the size of polymer particles in organic solvent. PEI and PVPr with the largest number average diameter among the studied polymers in ethyl alcohol, form thick films with a high surface roughness with TA and PVPh.

It has been shown that (PVPr/TA)$_5$, (PVPr/PVPh)$_5$, and (PEI/TA)$_5$ shells that swell in water less than 42%, prolong the dissolution of sucrose from the encapsulated microcrystals in water at 25 ± 1 ºC to 30 min, 15 min and 5 min, respectively, while microcrystalline sucrose dissolves completely for 60 s.

New systems with prolonged release in water based on polymer-coated microparticles are perspective in the pharmaceutical, food, and cosmetic industries.

Keywords: layer-by-layer assembly in non-aqueous medium, multilayer polymer coatings, tannic acid, poly(4-vinylphenol), prolonged release, microcrystalline sucrose.

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