STUDIES ON ADSORPTION TIAMFENICOL ON CHITOSANS DEGRADED RADIATION IN PHARMACEUTICAL *IN VITRO* MODEL

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Abstract
Connections of polymers and biopolymers with biologically active compounds are recently the subject of intensive research. Low molecular weight active ingredient combined with a polymer has, in many cases, the modified action. On the other hand, the use of inappropriate polymers can result in incompatibilities drug-polymer. The phenomenon of adsorption of the antibiotic has been studied by the static method in the concentration range generally taken single dose using a pharmaceutical gastrointestinal tract model. The results of measurements bounded drug quantity were used to determine the average percentage of adsorbed dose. The results show that antibiotic tiamphenicol is adsorbed on chitosan in used pH ranges, and the binding ability depends on the variety of chitosan and directly from the environment reaction. It was observed that the average sorption depending on the type of chitosan was within the limit from 82% to 97%.The fact of the lowest adsorption value at pH 6.4 can be explained by chemical properties of chitosan, which shows the load until the pH > 6.7 and the electrostatic adsorption may be exhibit in relation to weak acid medicinal substance. Thus, the specific polymer surface area and its sorption capacity is increased. Based on the above considerations can be stated that between study drug and the polymer an antagonistic interaction exist by involving the adsorption of drugs from this group on chitosan.

Key words: *tiamphenicol, chitosan; absorption.*

1. Introduction

Connections of polymers and biopolymers with biologically active compounds are recently the subject of intensive research. Low molecular weight active ingredient combined with a polymer has, in many cases, the modified action. On the other hand, the use of inappropriate polymers can result in incompatibilities drug-polymer. Particularly important are interactions involving mainly the occurrence of adsorption phenomena and the production of the complex connections that reduce the drug effect.

Therefore the objective of testing was to clarify the mechanism of antibiotic drug tiamphenicol interactions effects with dietary supplements containing chitosan. Thiamphenicol inhibits protein synthesis in bacteria. Thiamphenicol is a broad-spectrum antibiotic, active against both Gram-positive and Gram-negative bacteria and especially effective against anaerobes [1].

2. Materials and method

It takes advantage in work about degree from deacetylation 85% for 95% natural chitosans; from 5 for 30 kGy degrade dose radiation. Fundamental measurement researched of chitosans had determination of ability of bond on purpose by it exhighways of tiamphenicol. Model of pharmaceutical feed wire take advantage for account of amount of tiamphenicol binding capacity by different kind of chitosans [2]. Thiamphenicol(2,2-Dichloro-N[(1R,2R)-2-hydroxy-1-hydroxymethyl-2-(4-methyl-sulphonylphenyl)-acetamide) purris., meets analytical specification of PH. Eur.

Research lead in with water shaking, conditions at behavior of condition in feed wire of person as the most reminiscent. It establishes amplitude of shake and speeds add and temperature of process shaking 37 °C. It weighs for about capacity 5 ml centrifuge vials. The volume corresponded to 0.03 g of chitosan. It add next 2 ml 0.05 N HCl and for disbanding. For getting 2 pH, be in state (condition) respondent reaction of stomach on an empty stomach, it add 0.05 N HCl. Next 0.2 M Na_2CO_3 was added in drops to obtain pH of duodenal juice at pH 6.4 and shaken (300 r.p.m.) for 0.5 hrs. The sample with pH 7.0 - 7.6, corresponding to intestinal juice of the small intestine and the colon was incubated at 37 °C, shaking (300 r.p.m.), for 2.5 hrs.

Match cause peaceful temperature, it heed with their contents centrifuge vials and in by 20 minutes, shaking (2100 r.p.m.). It leave for stabilization on 0.5 hours next and it collect attempts from emerged match with over precipitate 1.5 ml, it transmit for clean test tubes and 2 ml added 1 N NaOH. It heeds empty test tubes and from difference of full mass and contents of substance calculates empty test tubes in attempt. It measures in method after dilution sample spectrofotometric absorbance and amount of unrelated tiamphenicol calculate. It has allowed calculating amount of related tiamphenicol.

Small amounts of products have caused, that it process method of meaning for 30 mg sample, from 50 mg which scratch tiamphenicol. It perform measurements three samples, it calculate average results from which. It subject gotten data discerning statistic estimate. Ratio defines for researched attempt relativity index, defining repeatability measurement, after previous assignment of statistic error.

Measurements were led at use in constant temperature 25 °C automatic Ubbelohde viscometer. Water solution of 0.1 M acetic acids was employ and it filter solution for separating insoluble fraction 0,2 M sodium chloride. For all solutions and time of outflow gauge them three with solutions of viscometer.

At least five measurements execute for each concentrating. Since the Mark-Houwink parameters used to recalculate intrinsic viscosity into viscosity-average molecular weight are known for chitosan in this solvent composition ($K = 1{,}81 \times 10^{-6}$ dm3 g^{-1}, $\alpha = 0{,}93$) [3]. It present results in ***Table 1*** and ***Figure 2***.

Table 1. *Influence on bond of exhighway of tiamphenicol by important viscosity-average of chitosans.*

Kind chitosans (ionizing radiation of kGy)	$[\eta]^*$, dm^3g^{-1} (Intrinsic Viscosity)	$M_{[\eta]}$, kDa (viscosity-average molecular weight)	Average mass, g of tiamphenicol bound by 1 g of chitosan	SD Standard deviation S, ±g	Wz Relativity coefficient, %
Primex fg 85 (0)	0.2852	388	1.530	0.0223	1.45
Primex fg 85 (5)	0.2545	343	1.385	0.0087	0.64
Primex fg 85 (10)	0.2282	293	1.392	0.0108	0.77
Primex fg 85 (15)	0.2057	270	1.493	0.0152	1.02
Primex fg 85 (20)	0.1872	242	1.484	0.0065	0.44
Primex fg 85 (30)	0.1576	205	1.488	0.0090	0.61
Chito-Clear fg 95 (0)	0.5100	725	1.368	0.0475	3.47
Chito-Clear fg 95 (5)	0.4172	584	1.398	0.0178	1.27
Chito-Clear fg 95 (10)	0.3297	453	1.421	0.0262	1.84
Chito-Clear fg 95 (15)	0.3042	416	1.534	0.0147	0.96
Chito-Clear fg 95 (20)	0.2213	295	1.616	0.0135	0.83
Chito-Clear fg 95 (30)	0.2550	344	1.526	0.0080	0.52
Chitosan type 343 fg 95 (0)	0.6402	925	1.422	0.0146	1.03
Chitosan type 343 fg 95 (5)	0.4588	647	1.438	0.0191	1.33
Chitosan type 343 fg 95 (10)	0.3858	537	1.366	0.0132	0.97
Chitosan type 343 fg 95 (15)	0.3348	461	1.382	0.0154	1.11
Chitosan type 343 fg 95 (20)	0.2307	309	1.394	0.0185	1.33
Chitosan type 343 fg 95 (30)	0.2700	366	1.390	0.0161	1.16
Chitosan type 352 fg 95 (0)	0.2117	282	1.428	0.0166	1.16
Chitosan type 352 fg 95 (5)	0.1949	258	1.460	0.0093	0.64
Chitosan type 352 fg (10)	0.1696	222	1.514	0.0374	2.47
Chitosan type 352 fg (15)	0.1639	214	1.448	0.0269	1.81
Chitosan type 352 fg (20)	0.1375	177	1.459	0.0372	2.55
Chitosan type 352 fg (30)	0.1497	194	1.392	0.0045	0.32
Chitosan HUASU (0)	0.7437	1087	1.414	0.0560	3.96
Chitosan HUASU (5)	0.5843	839	1.421	0.0236	1.66
Chitosan HUASU (10)	0.5185	738	1.386	0.0262	1.89
Chitosan HUASU (15)	0.3717	612	1.391	0.0289	2.08
Chitosan HUASU (20)	0.3303	454	1.449	0.0210	1.40
Chitosan HUASU (30)	0.2986	407	1.399	0.0155	1.11

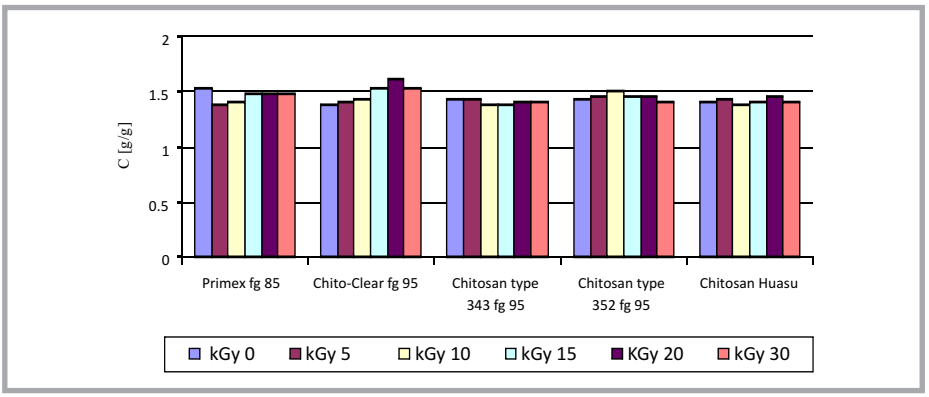

Figure 1. *Amount of related tiamphenicol by depending on degree of degradation bound by 1g of chitosan.*

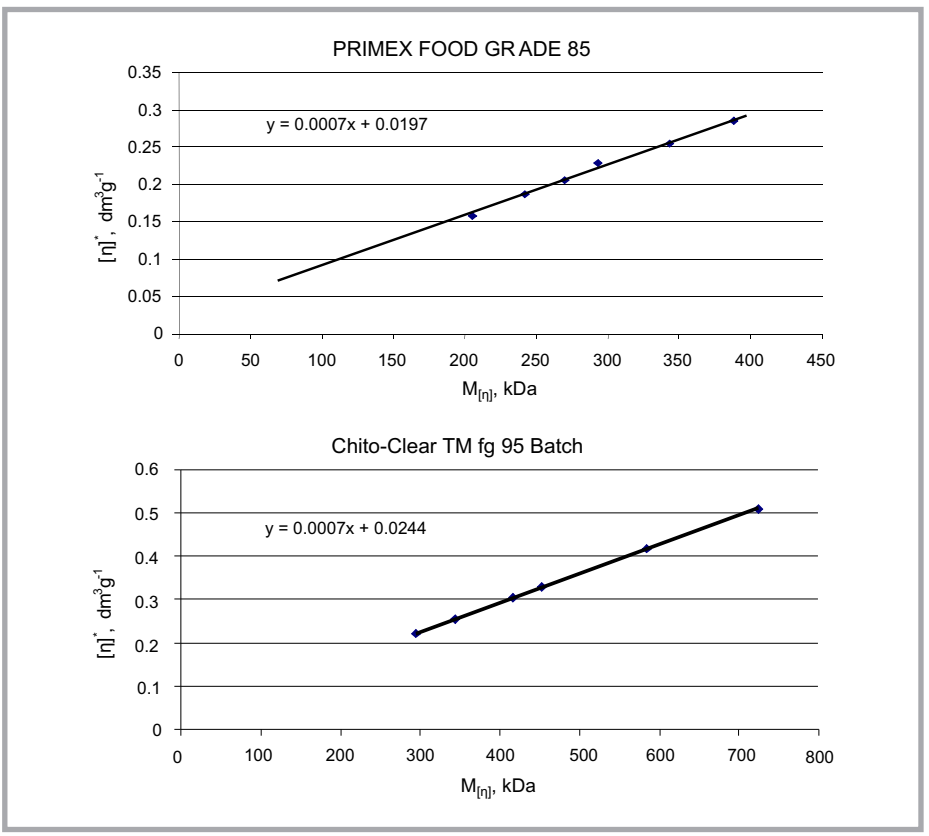

Figure 2. *Dependence from average weight important viscosity [M_η] chitosans from intrinsic viscosity [η].*

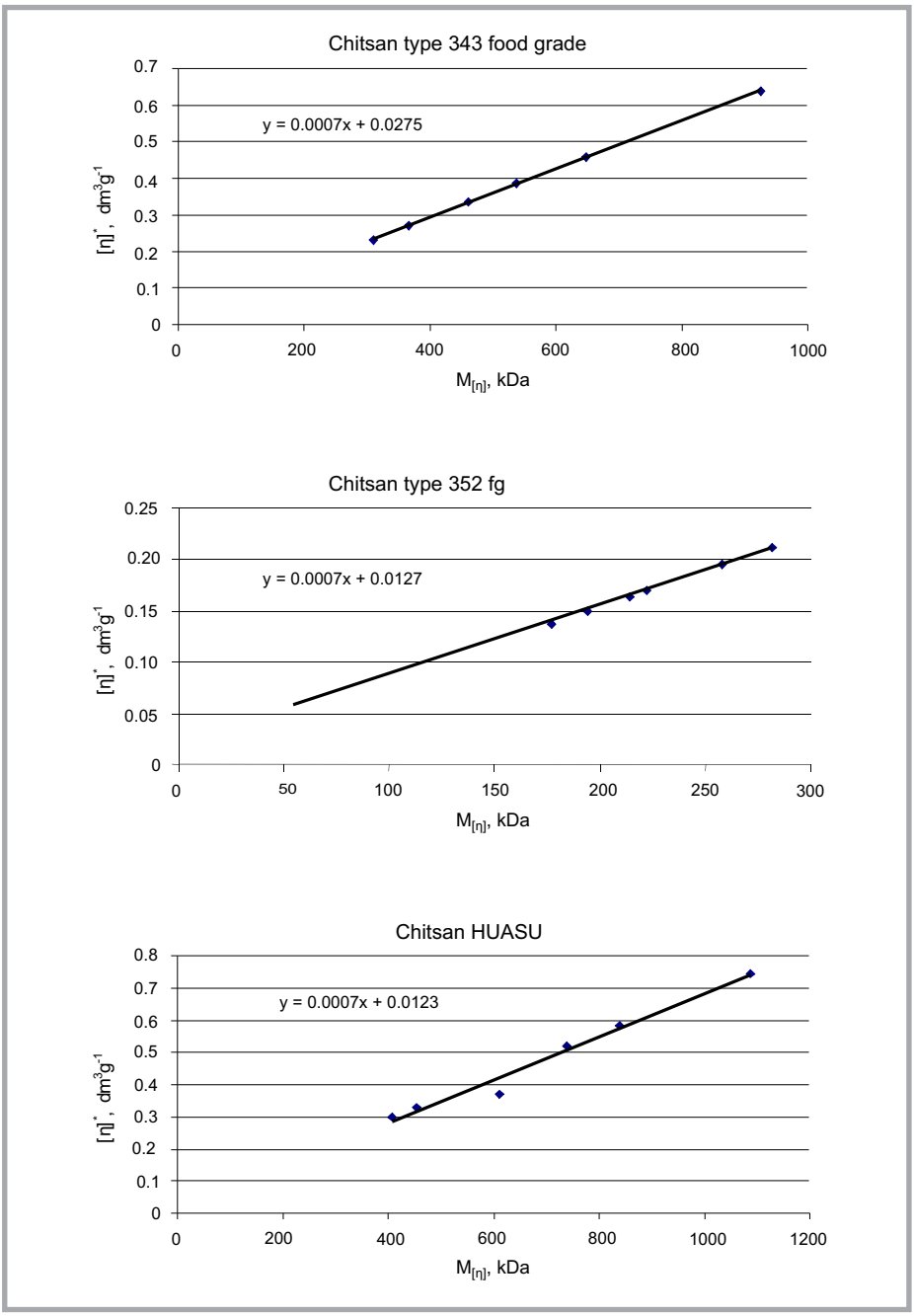

Figure 2 continued. *Dependence from average weight important viscosity [M_η] chitosans from intrinsic viscosity [η].*

3. Results and discussion

3.1. Influence of degree of degradation ascertain on amount of related tiamphenicol

Degree of radiation degradation effects amount of tiamphenicol to very differentiated manner by individual tied of chitosans. It ascertain on base of carried research, that it has related from among chosen amount of tiamphenicol biggest Chito Clear, it use dose for which (who) degradation 20 kGy of chitosans. They will achieve similar result about dose 15 kGy and 5 kGy of Chito Clear. It has related the least of tiamphenicol about dose of radiation 10 kGy of chitosan (343), and insignificantly more same not subjected degradation chitosan.

It observe in case chitosan Primex 85, that it diminishes along with incrementation of dose of radiation for 5 kGy amount tiamphenicol, it grows next and it diminishes again. Incrementation of amount writes down at radiation 20 kGy tiamphenicol binding and decreases at 30 kGy again. Determined incrementation exerted at degradation 10 kGy chitosan (352), however, amount of related tiamphenicol fluctuated at in smallest range doses remaining. Sample of degraded dose has related biggest amount in case 20 kGy chitosan (HUASU), but the least of sample of unsubjected degradation. Greatest was featured in ability of bond of tiamphenicol considerably of chitosan (343). Amount grew initially tiamphenicol binding by chitosan, it diminished next, it grew again and at dose 15 kGy, 20 kGy and it fluctuated 30 kGy insignificantly.

3.2. Influence of degree of degradation ascertain on important viscosity of chitosans

It ascertain on base of analysis of influence of radiation degradation on important viscosity of chitosans, that along with decrease of average weight chitosans, it falls off also important viscosity. Biggest decrease about value influenced by radiation from 0 - 30 kGy degrading growing, it write down in case chitosan (HUASU). Smallest decrease observe during research viscosity chitosan (352), but he has totaled 0.0884 dm^3g^{-1}. Standard deviations were contained in borders from 0.0065 for 0.0560 g. Ratio calculate from exemplar relativity coefficient:

$$\mathbf{Wz = SD \cdot 100\% / SP}$$

where: SD- Standard deviation, SP- Average measurement.

Employed method of bond of tiamphenicol gives repeatable results in pharmaceutical model by chitosans, ratios confirm that 5% totaling below.

Received results prove, that tiampenicol undergo adsorption by different kind significant of this polymers confirms chitosans, what on bioavailability of tiamphenicol in organism of man. Average size of adsorption of tiamphenicol by 1 g chitosan in dependence from pH of environment is comprised 1 g to 1.616 g in borders from 1.366. The highest adsorption rate is observed above pH 7. Height of degree of degradation no always height of quantity of connected tiamphenicol attracts behind itself [3 - 11].

4. Conclusion

Tiamphenicol undergo adsorption by different kind of chitosans, that confirms significant this influence on bioavailability of tiamphenicol in organism of person. Radiation degradation has influence on ability of bond of tiampenicol of chitosans. It does not involve incrementation of degree of degradation incrementation of amount of related tiamphenicol always. It introduces in case researched to manner-differentiated chitosans. Modification effects change through degradation radiation important chitosans viscosity, which diminishes along with decrease of average weight of chitosans. Dependence has linear character from average weight important viscosity.

5. References

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