KRMIVA

THE RISK OF CROSS CONTAMINATION IN COMPOUND FEED PRODUCTION ON THE EXAMPLE OF NARASIN

RIZIK OD MEĐU-KONTAMINACIJE U PROIZVODNJI KRMNIH SMJESA NA PRIMJERU NARAZINA

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SUMMARY

The paper presents an analysis of a technological process in a selected feed manufacturing plant, regarding the probability of transmitting feed additives among the manufactured feed mixtures and the risk of cross-contamination. Threats resulting from the use of coccidiostatics were determined at particular manufacturing stages. A technological model of the plant was made, identifying potential routes of cross-contamination between individual production batches. The cross-contamination effect in manufacturing a feed mixture for poultry was examined, with the maximum acceptable narasin level amounting to 70 mg/kg. A mixture containing narasin was produced, and next three successive series of the feed without any coccidiostatics were mixed on the same technological line, the so-called “collecting mixtures”. No purifying procedures were performed between the successive batches added to the mixer. The contamination level obtained in the first “collecting mixture” amounted to an average of 12%. The coccidiostatic content in the second and third mixture was below the bottom level of the quantifying method, namely below 3%. The results of the study were evaluated in reference to professional opinions in that particular subject area and the latest legal regulations.

Key words: narasin, compound feed production, cross-contamination, evaluation

INTRODUCTION

Feed manufacturing plants offer a wide range of compound feedstuffs. The same production line is used to make different feed mixtures, depending on current orders. During the manufacturing process, different additives are introduced, such as vitamins, microelements or coccidiostatics. This is done directly or by means of a premixture, adding adequate doses to the main mixer or the mixer used to prepare premixtures. When the next product is made, the traces of the previous one are left on the production line and as a result they may be found in the first batches of the successive product. The transfer of substances from one batch of a product to another is called “carry-over” or “cross-contamination”. Cross-contamination may occur at any stage

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of the manufacturing process or feed processing, as well as during storage or transportation (Neumann, 2000; Putier, 2001; Walczyński, 2009; Zednik, 2002). In 2008, following a recommendation by the European Commission, specialized units of European Food Safety Authority (EFSA), i.e. the FEEDAP Panel (the Panel on Additives and Products or Substances used in Animal Feed), and CONTAM (the Panel on Contaminants in the Food Chain) performed an evaluation of the risk concerning animal health and public welfare, resulting from cross-contamination with coccidiostatics (including narasin) occurring in non-target feeds, i.e. in the feeds in which coccidiostatics presence is not permitted. The opinion regarding narasin was published in *The EFSA Journal (2007) 552, 1-35.*

As a consequence of the activities undertaken, the permissible levels of coccidiostatics transferred to feeds other than the targeted ones were established. Commission Directive 2009/8/EC of 10th February 2009 amended Annex I to Directive 2002/32/EC of the European Parliament as regards permissible levels of unavoidable cross-contamination of coccidiostatics and histomonostats in non-target feeds. In the case of narasin the permissible levels are from 0.7 to 2.1 mg/kg depending on the kind of mixture.

The diversity concerning granulometric content of raw materials, their density leads to segregation processes occurring at any stage of the manufacturing process. Some types of segregation pose a serious threat to the safety of feed mixture manufacturing. Increasing uniformity in the size of the particles of all the components results in lower segregation of the mixture particles during their transport in technological routes, favors more precise dosage and adequate mixing, prevents suspension of the material in silo chambers or feeders and thus reduces the cross-contamination effect between different mixtures.

The aim of the study was to carry out analyses of cross-contamination occurring on a typical technological line in a plant manufacturing feed mixtures.

MATERIAL AND METHODS

The research was carried out in an industrial feed manufacturing plant. The object of the study was a part of the production line (Figure 1) along which the feed mixture had to be transported from the moment of leaving the ribbon batch mixer of AMA type, with the maximum batch of 1000 kg, to the site of product packaging. The products were gravitationally poured to the foot of the bucket elevator and were then directed to the container above the packer. The total mass of the produced “contaminated” mixtures and “collecting” mixtures amounted to 1000 kg each, whereas the weight of the primary sample was 0.5 kg. Samples were taken during emptying the packer, at equal time intervals until the packer was completely empty.

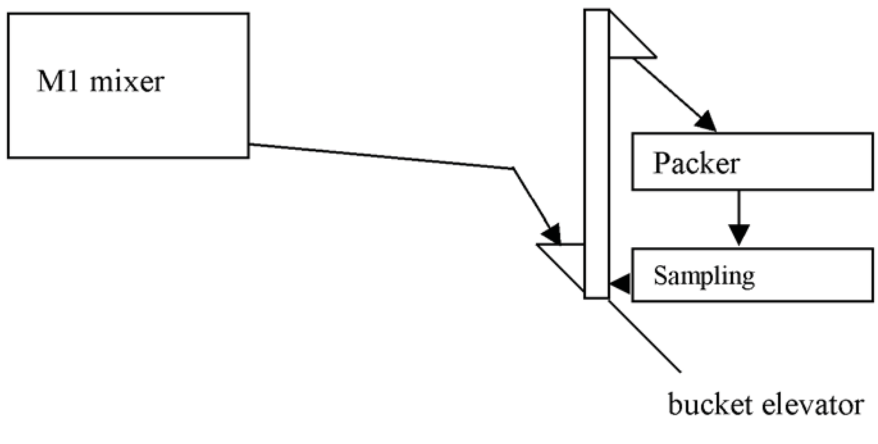

Figure 1. A part of the analyzed technological line
Slika 1. Dio analizirane tehnološke linije

Premixes which are most commonly used in production were analyzed in order to determine their basic physical properties which affect their lingering in transportation routes in the plant.

The narasin content was determined by means of high performance liquid chromatography (HPLC), with the use of post-column derivatization, in compliance with ISO 14183:2004(E) "Animal feeding stuffs - Determination of monensin, narasin and salinomycin contents - Liquid chromatographic method using post-column derivatization". Quantification limit for narasin is 2 mg/kg.

RESULTS AND DISCUSSION

An analysis of the technological process was performed regarding a possibility of carrying over feed additives among different mixtures produced, as well as the risk of cross-contamination. Threats were determined, concerning the particular stages of the manufacturing process, resulting from using registered feed additives, primarily coccidiostatics. A technological model of the plant was made, with potential ways of cross-contamination between manufacturing batches marked on it. The possibilities of the cross-over effect occurring in this particular feed manufacturing plant result mainly from the method of adapting the production line to the existing manufacturing rooms. The technological arrangement is of horizontal type, so the transport of raw materials, finished loose mixtures and granulated and cooled mixtures is done by selected augers, bucket elevators and redlers. Each of these machines is lined with the remains of the mixture after the production of a given batch has been completed. This is a consequence of some technical limitations concerning the meticulous emptying of there machines.

An additional agent contributing to the fact that feed remains to linger on the production line is high diversification among the sizes of premixture particles containing feed additives and the particles of other components of feed mixtures. A list of physical properties in selected premixtures and feed mixtures used in the analyses is presented in Table 1 and Table 2.

Table 1. Selected physical properties of some feed premixtures used in the studied feed manufacturing plant
Tablica 1. Izabrana fizikalna svojstva nekih krmnih predsmjesa korištenih u istraživanoj tvornici

Premixture /coccidiostatic Parameter	1/ Semduramycin sodium 10,000 mg/kg	2/ Monensin 20,000 mg/kg	3/ none	4/ Narasin 20,000 mg/kg Nicarbasin 20,000 mg/kg
Granulometric composition Remains on sieve [%]:				
1.0 mm	1.196	2.747	1.265	1.012
0.8 mm	2.032	3.276	2.287	1.697
0.5 mm	9.184	11.213	10.449	9.084
0.3 mm	21.580	20.465	20.072	32.922
0.1 mm	47.535	50.740	50.038	43.128
0.056 mm	7.651	7.668	6.820	6.362
pan	9.677	3.477	7.154	4.456
Bulk density [kg/m^3]	804.26	768.91	1057.01	1109.73

1 – premixture DKA-G 0.25% (Aviax)
2 – premixture DKM-1 0.5% (Elancoban)
3 – premixture DKA-F 0.25% (-)
4 – premixture DKA-S 0.25% (Maxiban)

Table 2. Basic physical properties of studied feed mixtures
Tablica 2. Osnovna fizikalna svojstva ispitivanih krmnih smjesa

Mixture Smjesa	Humidity Vlaga	Sieve Sito	Remains on sieve Ostaje na situ	Mean size of particle Srednja veličina čestice	Bulk density Rasipna gustoća
-	%	mm	%	mm	kg/m^3
No 1	10.32	2.5	3.21	0.89	625.3
		1.6	24.89		
		1.0	25.46		
		0.5	24.77		
		0.125	21.04		
		pan	-		
No 2	9.48	2.5	6.24	0.91	670.4
		1.6	27.24		
		1.0	23.64		
		0.5	20.07		
		0.125	19.53		
		pan	-		

The results of studying narasin cross-over effect between different mixtures are presented in Figure 2.

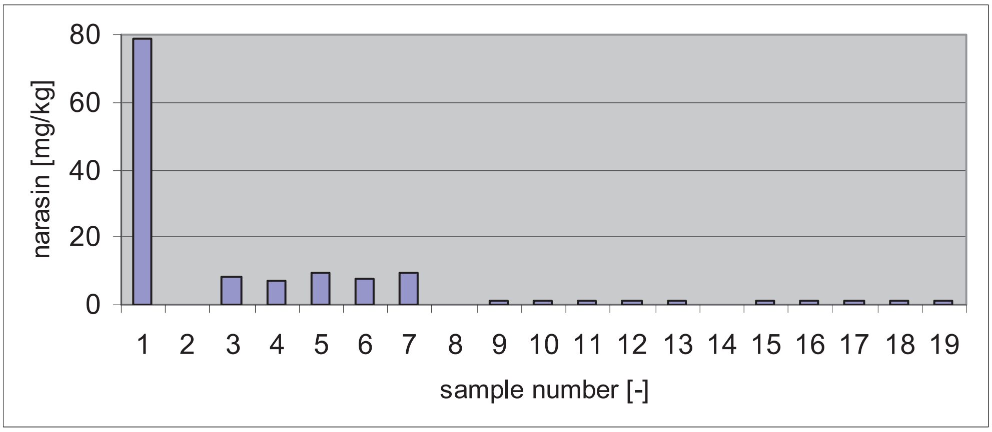

Figure 2. Narasin content (mg/kg) in collected mixture samples
Slika 2. Sadržaj narazina (mg/kg) u sakupljenim uzorcima smjese

The level of narasin determined in "contamined" mixture (sample 1) was 78 mg/kg. The mean value for coccidiostatic cross-over in the first "collecting" mixture was 12% (samples 3-7). In the successive doses of "collecting" mixtures values below 3% of contamination (samples 9-13, 15-19) were noted, which was below quantification limit for the HPLC method applied to quantify narasin.

In the present study one „collecting" mixture reduced the risk of negative effects in animals which are not supposed to consume narasin. The level of the cross-contamination effect was below 10% and did not exceed the recommended values quoted in the EFSA Report.

CONCLUSIONS

The effect of narasin cross-over authorized as a feed additive was 12% for the first „collecting" mixture. The coccidiostatic content in the second and third mixture was below the bottom level of the quantifying method, namely below 3%. The validation of sensitive instrumental methods used to study the remains of coccidiostatics in feeds should be extended so that it becomes possible to examine their share in a low concentration range, consistent with the EU legal regulations in this area. While developing manufacturing program, it is absolutely necessary to use purifying procedures on the technological line (purifying batch, removing the remains manually, etc.) in order to reduce the risk of cross-contamination.

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SAŽETAK

Rad prikazuje analizu tehnološkog procesa u odabranoj tvornici za proizvodnju krmnih smjesa u vezi s mogućnošću prenošenja krmnih aditiva među proizvedene krmne smjese i rizika od među-kontaminacije. Određena je moguća opasnost od upotrebe kokcidiostatika u konkretnim proizvodnim fazama. Načinjen je tehnološki model tvornice označavanjem mogućih puteva kontaminacije među pojedinim proizvodnim partijama. Ispitivano je djelovanje među-kontaminacije za vrijeme proizvodnje krmne smjese za perad s najvećom prihvatljivom razinom narazina od 70 mg/kg. Proizvedena je smjesa koja je sadržavala narazin, a na istoj tehnološkoj liniji načinjene su sljedeće tri uzastopne serije smjese bez kokcidiostatika, tzv. "sabirne smjese". Nisu načinjeni nikakvi postupci pročišćavanja među uzastopnim partijama ubačenim u mikser. Razina kontaminacije u prvoj "sabirnoj smjesi" iznosila je prosječno 12%. Sadržaj kokcidiostatika u drugoj i trećoj smjesi bio je ispod donje razine kvantitativne metode, tj.ispod 3%. Rezultati rada ocijenjeni su u odnosu na stručna mišljenja na tom području te na najnoviju zakonsku regulativu.

Ključne riječi: narazin, proizvodnja krmnih smjesa, među-kontaminacija, ocjena