Potential occurrence of veterinary pharmaceuticals in animal by-products

An inventory of authorised substances in non-EU countries that are not allowed within the EU

E.D. van Asselt, M.G. Pikkemaat, R.G. Hobe, N.P. Meijer, H. van Egmond, P. Bikker

WAGENINGEN
UNIVERSITY & RESEARCH

Potential occurrence of veterinary pharmaceuticals in animal by-products

An inventory of authorised substances in non-EU countries that are not allowed within the EU

E.D. van Asselt, M.G. Pikkemaat, R.G. Hobe, N.P. Meijer, H. van Egmond, P. Bikker

This research has been carried out by Wageningen Food Safety Research, institute within the legal entity Wageningen Research Foundation subsidised by the Netherlands Food and Consumer Product Safety Authority (NVWA) (project number WOT-02-004-013).

Wageningen, December 2021

WFSR report 2021.018

WAGENINGEN
UNIVERSITY & RESEARCH

E.D. van Asselt, M.G. Pikkemaat, R.G. Hobe, N.P. Meijer, H. van Egmond, P. Bikker, 2021. Potential occurrence of veterinary pharmaceuticals in animal by-products; An inventory of authorised substances in non-EU countries that are not allowed within the EU. Wageningen, Wageningen Food Safety Research, WFSR report 2021.018. 38 pp.; 1 fig.; 11 tab.; 6 ref.

Project number: 1227186001
BAS-code: WOT-02-004-013
Project title: Juridische eisen met betrekking tot analyse- en bemonsteringsmethoden gebruikt in het opsporingsonderzoek van diervoeders en diervoedergrondstoffen
Project leaders: Esther van Asselt, Paul Bikker

This report can be downloaded for free at https://doi.org/10.18174/558162 or at www.wur.eu/food-safety-research (under WFSR publications).

P.O. Box 230, 6700 AE Wageningen, The Netherlands, T +31 (0)317 48 02 56, E info.wfsr@wur.nl, www.wur.eu/food-safety-research. WFSR is part of Wageningen University & Research.

WFSR report 2021.018

Distribution list:
- Karen Zwaagstra, NVWA
- Max van Brakel, NVWA
- Steven Danneel, NVWA
- Sophia van der Ploeg, NVWA
- Paulien van de Graaff, NVWA
- Sandra Doevendans-de Bruin, LNV
- Heleen van Rootselaar, LNV

Contents

Summary

Veterinary medicinal products (VMPs) are used to treat, prevent or diagnose diseases in animals. Pharmaceutical substances authorised to be used in these VMPs within the EU are indicated in Regulation (EU) 37/2010. However, outside the EU, regulations differ and the list of substances authorised thus deviates from the EU legislation. When animals are treated with substances that are unauthorised in the EU, these substances may end up in animal by-products that are imported into the EU and used in animal feed. The aim of this research was to make an inventory of substances that are authorised for use in food producing species outside the EU but not within the EU. Focus was on relevant countries with significant export towards the Netherlands.

The research gives a summary of relevant EU regulation in order to gain insight in the possible products entailing the group of animal by-products as well as the authorised presence of pharmaceutical substances in these products. Then, the most relevant animal by-products specified by their CN code (Combined Nomenclature for classifying goods as specified in Customs Regulation (EEC) 2658/87) were identified and used to obtain the import volumes for non-EU countries. Subsequently, RASFF data and aquaculture production volumes were used to select the most relevant non-EU countries for import of animal by-products in the Netherlands. This resulted in 20 countries from a wide geographic origin. For these countries, the regulation with respect to Maximum Residue Limits (MRLs) was evaluated assuming this is an indication of the availability of an authorised VMP.

The evaluation resulted in a list of 104 substances for which MRLs have been established in one or more of the included countries, but that are not authorised in the EU. Most of these substances were antiparasitics or antimicrobials. The top 5 countries with considerable number of authorised substances not included in EU legislation are Indonesia (44 substances), China (28 substances), India (28 substances), US (27 substances), and Australia (23 substances). China, in this respect, is the most relevant country as most animal by-products are imported from China (69 kton/y) followed by Brazil (47 kton/y), the US (3 kton/y), New Zealand (1 kton/y) and Indonesia (0.8 kton/y). For some countries, i.e. Chile, Turkey, Vietnam, Ukraine and Uruguay no substances were found that are authorised in these countries but not within the EU. Apparently, these countries have harmonized their legislation with the EU.

Further research is needed to establish whether the identified substances are actually used in the country of origin and whether residues occur in animal by-products entering the EU feed market. It is recommended to extend the national monitoring program for feed with substances for which there is an indication of use in animal production relevant for animal by-products.

1 Introduction

Animal feed primarily consists of raw materials obtained from plant-based origin. However, animal products may also be used as ingredient in animal feed. These are primarily animal by-products from the food industry, such as fish meal or blood plasma. Due to changes in EU legislation regarding the use of animal meal from pigs and poultry, the volumes and origin of animal by-products may change in the coming years. Part of these animal by-products originate from outside the EU. Since legislation regarding the administration of pharmaceutical substances differs per country, residues of these in animal by-products that are not authorised within the EU may be present.

Aim of the project

The aim of this project was to make an inventory of substances that are authorised for use in food producing species outside the EU but not within the EU with a focus on countries with relevant export volumes towards the Netherlands. Residues of these substances may be encountered in animal by-products used within the feed industry. The output of this research may be used to update the National Plan Animal Feed.

Research questions

Based on the aim of the project, the following research questions were defined:

- Which EU legislation is applicable regarding animal by-products and legal limits for pharmaceutical substances?
- Which non-EU countries are most relevant with respect to import of animal by-products for inclusion in feed?
- Which substances are authorised for use in food producing species in non-EU countries that are not authorised within the EU?

2 Material and Methods

2.1 Demarcation

This project aimed at primary animal by-products (i.e. all products from animal origin, not intended for human consumption), which might be used in animal feed, e.g. blood meal, hydrolysed protein, animal fat, eggshells, egg powder etc. *(4)*. Products derived from these by-products (such as phosphate made from animal products) were not incorporated in this project, and neither were by-products intended for technical use.

The project focused on identifying pharmaceutical substances that are unauthorised within the EU, but have authorisations in non-EU countries. Pharmaceutical substances that are not authorised for use in food producing species in any country (e.g. "banned substances") were not incorporated in this project.

2.2 Approach

In order to answer the research questions as described in the introduction, the following tasks were performed within the project:

1. Drafting a summary of EU legislation related to animal by-products and pharmaceutical substances.
   In order to determine which products belong to the group of animal by-products (used in task 2a), EU legislation was consulted such as the animal feed catalogue (Regulation (EU) 68/2013) and Regulations (EC) 999/2001, (EC) 1069/2009, and (EU) 142/2011.
2. Establishing an overview of relevant non-EU countries with respect to animal by-products:
   a. Import volumes with respect to animal by-products were used as a first selection criterion. First, a list of relevant goods, specified as Combined Nomenclature (CN) codes, was established based on Customs Regulation (EEC) 2658/87 and input from WUR experts and experts from the Netherlands Food and Consumer Product Safety Authority (NVWA). Additionally, CN-codes obtained from import data from the NVWA TRACES database were used to obtain a final list of CN-codes. These CN-codes were used in Eurostat for the years 2015-2019 to establish an overview of import volumes per non-EU country. The database 'EU trade since 1988 by HS2-4-6 and CN8 (DS-045409)' was used for the query.
   b. Aquaculture information was obtained from the Food and Agriculture Organization of the United Nations (FAO). The main aquaculture producing countries were obtained from the latest FAO report *(5)*. For those countries from which we import fish by-products (such as fish meal and fish oil), the percentage aquaculture was calculated using the database FishStatJ using the global production workspace (data available until 2018).
   c. RASFF-notifications related to pharmaceutical substances in animal products were retrieved from RASFF up to 13-11-2020. The portal was filtered on residues of VMPs followed by filter on 'unauthorised' and 'prohibited' to find notifications on VMPs that are not authorised for use in the EU. Results were exported to Excel.
3. Establishing an overview of substances (potentially) authorised outside the EU but not within the EU. The Bryant Christie database for veterinary drugs (https://www.bryantchristie.com/) was used as a tool for a first screening to identify substances with a Maximum Residue Limit (MRL) outside the EU. The rationale behind the applied approach was the assumption that the presence of an MRL is an indicator for the availability of an authorised VMP. The database was consulted for the relevant non-EU countries identified in task 2. Based on the list of relevant CN-codes, the following animal products were included in the analysis: fish, chicken, bovine, porcine, ovine, chicken, milk and eggs. The following steps were taken to come to a list of authorised substances in non-EU countries:

- Substances with a default MRL were interpreted as not authorised and removed from the overview.
- Substances with an MRL between 0 and 1 µg/kg were interpreted as unauthorised and removed from the dataset, except for steroids (group A1c).
- The 'published commodity notes' of the EU and non-EU legislation were screened for the words 'not allowed', 'prohibited', 'not permitted', 'not safe', 'should not be detected', 'not recommended' or 'should prevent residues'. Consequently, the substances that are not authorised were excluded from the overview.
- Substances with 'not detected' in the 'residue definition' of the non-EU legislation were interpreted as unauthorised substances and excluded from the overview.
- Substances with an MRL type "general", but without a value for the MRL were screened in more detail. Substances for which it was indicated that they should not be detected or residues should be below the limit of detection were excluded from the overview.
- Substances with MRLs only in non-relevant animal products (e.g. in terrestrial animals for countries that are only relevant for fish imports) were also excluded.

The information obtained from the BC database was checked by consulting the original national legislation for each relevant country (Annex 1) and adapted when needed. Information for countries not available in the database was obtained via the Agriculture Councils. The outcome of these activities was combined and compared with the pharmacologically active substances included in Regulation (EU) 37/2010 for the animal products selected in step 2. The results are presented in this report.

3 Results and discussion

3.1 Legislation related to animal by-products and to substances in these products

3.1.1 Legislation related to animal by-products

Regulation (EC) 1069/2009 provides a definition of animal by-products: "'animal by-products' means entire bodies or parts of animals, products of animal origin or other products obtained from animals, which are not intended for human consumption, including oocytes, embryos and semen". The Regulation classifies animal by-products in three categories, in which category 1 implies a high veterinary risk (e.g. carcasses) and category 3 a low veterinary risk for the presence of TSEs (primarily by-products obtained from processing of animal products). Materials of category 1 and 2 are currently not allowed to be used in animal feed due to the risk that they pose to public and animal health. There are some derogations that permit, under certain circumstances, the feeding of category 1 or 2 materials to e.g. zoo and circus animals (Article 18 of Regulation (EC) No 1069/2009), or for research purposes (ibid., Article 17). Animal proteins derived from Category 1 and/or 2 materials are referred to as 'meat-and-bone meal in point 27 of Annex I of Regulation (EU) No 142/2011. Most category 3 materials may be used in animal feed, depending on the origin and intended purpose. When treated in accordance with the requirements set out in Annex X of Regulation (EU) No 142/2011, animal proteins derived from category 3 material are referred to as 'processed animal protein' ('PAP', point 5 of Annex I of Regulation (EU) No 142/2011) and can be used in animal feed. Other feed materials of animal origin, in addition to PAPs, include: blood products, rendered fats, egg products, fish oil, fat derivatives, collagen, gelatine and hydrolysed proteins, dicalcium phosphate, tricalcium phosphate, milk, milk-based products, milk-derived products, colostrum, colostrum products and centrifuge or separator sludge (point 3 of Annex I of Regulation (EU) No 142/2011).

General restrictions on use for feeding to animals are laid down in Regulation (EC) No 999/2001. Firstly, "*the feeding to ruminants of protein derived from mammals is prohibited*" (Article 7.1). This is known as the 'ruminant feed ban'. Secondly, this prohibition is extended to, in principle, all animals ('extended feed ban', Article 7.2), with a few exceptions. According to the European Commission, "*The purpose of this extension was to manage the risk of presence of prohibited material in ruminant feed through cross-contamination with feed intended for other species (mainly pigs and poultry), at a time when the laboratory methods did not allow to differentiate material originating from ruminants or from other species*." *(3)*. Thirdly, these two bans are supplemented by provisions prohibiting 'intra-species recycling', known as the 'non-cannibalism principle' (Regulation (EC) No 1069/2009, Article 11.1; *(3)*). In September 2021, the extended feed ban was partly lifted: PAPs of porcine origin in poultry feed and of PAPs of poultry origin in the feed of porcine animals were re-authorised, under strict requirements for collection, transport and processing to avoid any risk of cross-contamination with prohibited ruminant protein and intra-species recycling (Regulation (EU) 2021/1372). This change could be implemented because methods to detect and differentiate between porcine and poultry materials were validated, which enabled the control of the prohibition on intra-species recycling.

Restrictions and exemptions to the rules that prohibit the feeding of animal by-products to other animals are laid down in Regulations (EC) No 999/2001, (EC) 1069/2009, and (EU) 142/2011. These additional rules include, for instance, a provision on the type of category 3 animal by-products that may be fed to insects, which includes: fishmeal, blood products from non-ruminants, di and tricalcium phosphate of animal origin, hydrolysed proteins from non-ruminants, hydrolysed proteins from hides and skins of ruminants, gelatine and collagen from non-ruminants, eggs and egg products, milk, milk based-products, milk-derived products and colostrum, honey, and rendered fats. The previously mentioned Regulation (EU) 2021/1372, which permitted the use of porcine PAPs in poultry feed, and poultry PAPs in porcine feed also allowed the use of ruminant gelatine in feed for non-ruminant farmed

animals and insects to be fed to pigs and poultry. More information on the relevant legislation for feeding insects is provided in publications by Derrien, C. and A. Boccuni *(2)* and Bosch, G., H. H. E. van Zanten *(1)*. A more detailed description of the legislative framework on animal by-products in feed can be found on the website of the European Commission *(4)* and van Raamsdonk, L. W. D., T. W. Prins *(6)*.

The information obtained from the mentioned regulations was used to identify relevant products from the Customs Regulation ((EEC) No 2658/87) in order to determine import volumes via Eurostat (see section 3.2.1).

3.1.2 Legislation related to pharmacologically active substances in animal by-products

Pharmacologically active substances that are authorised to be used in food producing animals within the EU are listed in Table 1 of the Annex of Regulation (EU) No 37/2010. Apart from a direct administration as VMPs, pharmacological substances may also be administered via medicated feed. When filing for a VMP registration, its intended administration needs to be indicated. Regulation (EU) 2019/4 further specifies the manufacture, placing on the market and use of medicated feed. The production of medicated feed may result in the carry-over or cross-contamination of substances in non-target feed. By January 2023, maximum levels of cross contamination for certain antimicrobial active substances (as listed in Annex II of Regulation (EU) 2019/4) in non-target feed will be established at EU level. In the Netherlands, the feed industry no longer produces medicated feed since 2012. Directive 2002/32/EC on undesirable substances in animal feed includes a section on the presence of coccidiostats as a result of unavoidable carry-over. The regulated coccidiostats are decoquinate, diclazuril, halfuginone, lasalocid, maduramicin, monensin, nicarbazin, robenidine, salinomycin and semduramycin.

Once VMPs are administered, a withdrawal period should be respected to ensure that the administration of the VMPs does not lead to harmful levels of residues in the food chain (Regulation (EU) 2019/6). In Annex Table 1 of Regulation (EU) No 37/2010, MRLs for target tissues such as muscle, fat, skin, liver, kidney, milk and eggs are specified. There are no MRLs specific for animal by-products used in animal feed. Pharmacological substances included in Table 2 of the Annex of this regulation as well as substances not included in Table 1 of the Annex are not allowed to be used in food producing animals resulting in a zero tolerance for residues of most of these substances in animal products. For some of these substances (chloramphenicol, medroxyprogesterone acetate, nitrofuran metabolites and the sum of malachite green and leucomalachite green), MRPLs (maximum required performance limits) are set for analytical methods used in the official control in Annex II of Decision No 2002/657/EC. Most of these MRPLs will be replaced by RPAs (Reference points for action) from November 28, 2022 (Regulation (EU) 2019/1871). The presence of residues of authorised or unauthorised substances influences the classification of animal by-products as indicated below.

Animal by-products derived from animals which have been submitted to illegal treatment are classified as Category 1 materials in the context of Article 8(c) of Regulation (EC) No 1069/2009, referring to Article 1(2)(d) of Directive 96/22/EC and Article 2(b) of Directive 96/23/EC. Directive 96/22/EC prohibits the use of certain substances having a hormonal or thyrostatic action and of beta-agonists in food producing farming; Directive 96/23/EC concerns the monitoring of such substances in live animals and animal products. The latter monitoring directive has been repealed by Regulation (EU) 2017/625, and references to Directive 96/23/EC must be construed as references to that Regulation (Article 146). Although the new Regulation does not have a correlating article to Article 2(b) of Directive 96/23/EC, to define the term 'illegal treatment' – Delegated Regulation (EU) 2019/2090 supplementing Regulation (EU) 2017/625 does offer such a definition: "'illegal treatment' means the use in food producing animals of — prohibited or unauthorised substances or products, or — substances or VMPs authorised under Union legislation for purposes or under conditions other than those laid down in the said legislation or, where appropriate, in national legislation" (Article 2(c)).

Also listed as category 1 animal by-products are those "*containing residues of other substances and environmental contaminants listed in Group B(3) of Annex I to Directive 96/23/EC, if such residues*

exceed the permitted level laid down by Community legislation or, in the absence thereof, by national legislation" (Article 8(d) of Regulation (EC) No 1069/2009). As mentioned, Directive 96/23/EC has in principle been repealed by Regulation (EU) 2017/625, but Article 150 of that Regulation provides for transitional measures specific to this Annex; stating that competent authorities are to "*continue to perform the official controls necessary to detect the presence of the substances and groups of residues listed in Annex I to Directive 96/23/EC, in accordance with Annexes II, III and IV to that Directive, instead of the corresponding provisions of this Regulation, until 14 December 2022*". The substances listed in group B(3) of Annex I of Directive 96/23/EC are 'other substances and environmental contaminant', consisting of: (a) Organochlorine compounds including PCBs; (b) Organophosphorus compounds; (d) Chemical elements; (d) Mycotoxins; (e) Dyes, and; (f) Others, including unlicensed substances which could be used for veterinary purposes. A draft Implementing Regulation (SANTE 11987-2017) for the control on residues of relevant substances as indicated in article 19 section 3a and 3b of Regulation (EU) 2017/625, that will replace the annexes of Directive 96/23/EC for which transitional measures exist until 14 December 2022, is currently being prepared. The focus of substances to be monitored in this draft Implementing Regulation has shifted away from the contaminants listed in group B(3) of Annex I of Directive 96/23/EC, and now exclusively focuses on pharmacologically active substances. Only dyes (group B(3)(e) in Directive 96/23/EC, which will be group A(3)(a) in the Implementing Regulation, are still included.

Animal by-products containing residues of authorised substances or contaminants exceeding the permitted levels are classified as certain category 2 animal by-products, in the context of article 9(c) of Regulation (EC) No 1069/2009. All measures to be taken in case of (suspicion of) non-compliance are now defined in the aforementioned Regulation (EU) 2019/2090 that supplements Regulation (EU) 2017/625. In principle, uncompliant products are declared unfit for human consumption and must be disposed of – both in the case of illegal treatment (Article 6 of Regulation (EU) 2019/2090) and in case of residues of pharmacologically active substances authorised in VMPs or as feed additives, exceeding the applicable maximum residue limits or maximum levels (Article 5). In addition, when illegal treatment has been confirmed, all animals or products from the same batch will be considered to have also been subject to this illegal treatment unless the competent authority, at the expense and request of the operator, can ascertain that this was not the case.

3.2 Overview of relevant non-EU countries for animal by-products

3.2.1 Import data

Relevant CN-codes were selected from Customs Regulation (EEC) No 2658/87. Codes from the 23-category containing animal products were selected as these are used in animal feed. Additionally, codes from the other categories were selected that both contained animal products and might be used in animal feed (e.g. since the custom duty was free). The established list was discussed with WFSR experts and NVWA experts and checked with the NVWA TRACES database. A final list was established (see Annex 2) that was used to obtain import data from Eurostat. For the top 10 products with largest import volume, the most relevant import countries were established both for the 23-codes (Table 1) and the additional codes (Table 2). It should be noted that although the CN-codes in Table 2 were seen as relevant for animal feed, a possible use in human food cannot be excluded.

Table 1 *Most relevant countries for the top 10 CN 23-codes imported from outside the EU (in parenthesis the average import volumes in ton/year)*

23099031	23091011	23011000	23099051	23091031	23012000	23091090	23099041	23099010	23091051
Preparations, incl. premixes, for animal food, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup but containing no starch or no milk products or containing <= 10% starch and < 10% by weight of milk products (excl. dog or cat food put up for retail sale)	Dog or cat food, put up for retail sale, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup but containing no starch or no milk products or containing <= 10% starch and < 10% by weight of milk products	Flours, meals and pellets, of meat or offal, unfit for human consumption; greaves	Preparations, incl. premixes, for animal food, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 30% of starch and no milk products or < 10% by weight of milk products (excl. dog or cat food put up for retail sale)	Dog or cat food, put up for retail sale, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 10% but <= 30% of starch and no milk products or < 10% by weight of milk products	Flours, meals and pellets of fish or crustaceans, molluscs or other aquatic invertebrates, unfit for human consumption	Dog or cat food put up for retail sale, containing no starch, glucose, maltodextrine or maltodextrine syrup, nor milk products	Preparations, incl. premixes, for animal food, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 10% but <= 30% of starch and no milk products or < 10% by weight of milk products (excl. dog or cat food put up for retail sale)	Fish or marine mammal solubles, to supplement feeding stuffs produced in the agricultural sector	Dog or cat food, put up for retail sale, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 30% of starch and no milk products or < 10% by weight of milk products
China (58107)	US (3433)	New Zealand (3192)	China (1419)	US (1889)	Chile (808)	China (503)	US (556)	Japan (355)	US (261)
Brazil (35056)	China (2707)	Australia (958)	US (1192)	China (358)		Canada (171)	China (383)		China (116)
United States (12058)	Thailand (1325)	US (751)				Thailand (159)			
Indonesia (5855)		Mexico (552)							
		South Africa (244)							

Table 2 *Most relevant countries for the top 10 other CN-codes containing animal by-products with a possible use in animal feed imported from outside the EU (in parenthesis the average import volumes in ton/year)*

15220099	15042090	35030010	04041002	04022118	04051019	15060000	35040010	15021010	04059010
Residues from treatment of fatty substances or animal and vegetable waxes (excl. those containing oil with characteristics of olive oil, oil foots and dregs and soap stocks)	Fish fats and oils and liquid fractions, whether or not refined (excl. chemically modified and liver oils)	Gelatine, whether or not in square or rectangular sheets, whether or not surface-worked or coloured, and derivatives thereof (excl. impure gelatines)	Whey and modified whey, in powder, granules or other solid forms, without added sugar or other sweetening matter, of a protein content "nitrogen content x 6.38" of <= 15% by weight and a fat content, by weight, of <= 1,5%	Milk and cream in solid forms, of a fat content by weight of <= 27% but > 1,5%, unsweetened, in immediate packings of > 2,5 kg or put up otherwise	Natural butter of a fat content, by weight, of >= 80% but <= 85% (excl. in immediate packings of a net content of <= 1 kg, and dehydrated butter and ghee)	Other animal fats and oils and their fractions, whether or not refined, but not chemically modified (excl. pig fat, poultry fat, fats of bovine animals, sheep and goats, fats of fish and other marine animals, lard stearin, lard oil, oloestearin, oleo-oil, tallow oil, wool grease and fatty substances derived therefrom)	Concentrated milk proteins with a protein content > 85% by weight, calculated on the dry matter	Tallow of bovine animals, sheep or goats, for industrial uses (excl. for manufacture of foodstuffs, and oil and oleostearin)	Fats and oils derived from milk, of a fat content, by weight, of >= 99,3% and of a water content, by weight, of <= 0,5%
Malaysia (5371)	Morocco (853)	Brazil (4913)	Belarus (984)	New Zealand (2136)	Ukraine (1230)	US (1847)	New Zealand (1451)	Uruguay (998)	New Zealand (1003)
Indonesia (1880)	Peru (827)		Canada (719)		New Zealand (603)			Argentina (399)	
Ghana (1001)	Turkey (564)		US (433)						
	Ukraine (500)		New Zealand (210)						
	Japan (493)								
	Canada (479)								

For CN-code 15220099, it is unclear whether the import volumes originate from animal or vegetative wax. Since Malaysia is a large palm oil producer, it can be assumed that the large import volumes for Malaysia are related to vegetative oil waste.

For codes related to fish (i.e. 15042090, 23012000 and 23099010), it is unclear whether these products originate from wild fish or from aquaculture. Therefore, FAOSTAT was consulted to identify the major aquaculture producing countries, which were in 2018: China (47.6 million tonnes), India (7.1 million tonnes), Indonesia (5.4 million tonnes) and Vietnam (4.1 million tonnes). Furthermore, the percentage of aquaculture in the major countries for the main fish-related CN-codes (i.e. 15042090 and 23012000) showed that more than 10% of fish from Turkey, Ukraine, Japan, Canada and Chile is produced via aquaculture. These countries were, therefore, also seen as relevant countries to include in the analysis.

3.2.2 RASFF notifications

The RASFF-portal showed that in the last 5 years, 193 notifications were related to unauthorised or prohibited VMP residues in animal products of which 147 originated from outside the EU. These notifications do not necessarily include animal by-products.

The products in the product groups with most notifications were:

- Crustaceans and products thereof (60 notifications): shrimps (56 notifications) and prawns (3 notifications)
- Meat and meat products (other than poultry) (46 notifications): horse (17 notifications), beef/bovine/veal/cow (10 notifications), pig/hog/pork/casings (9 notifications), rabbit (6 notifications), sheep (6 notifications)
- Fish and fish products (42 notifications): *Pangasius* spp./catfish (12 notifications), trout (7 notifications), catfish (*Clarias* spp.) (6 notifications), tilapia (5 notifications)

Around half of these notifications related to nitrofurans (74 notifications). Overall, the most relevant countries for all reported unauthorised or prohibited substances (193 notifications) were: India (47 notifications), Vietnam (37 notifications), China (14 notifications) and Ukraine (9 notifications). A detailed list can be found in Annex 3.

3.2.3 Final list of relevant countries

The information described in sections 3.2.1 and 3.2.2 was used to draft a final list of relevant countries for which the authorisations for pharmaceutical substances were investigated (see section 3.3). The list with countries together with relevant CN-codes and other motivations to include the country as well as the animal origin of the imported products (fish, terrestrial or both) is indicated in Table 3.

Table 3 *Final list of countries to be explored for authorisations for pharmaceutical substances*

Country	Relevant CN-codes:	Other motivation:	Fish or terrestrial products?
China	• 23099031 (premix) • 23099051 (premix) • 23091090 (dog or cat food) • 23091051 (dog or cat food)	• Largest aquaculture producer • RASFF notifications	Both
Brazil	• 23099031 (premix) • 35030010 (gelatine)		Terrestrial
US	• 04041002 (whey powder, <1.5% fat) • 15060000 (animal fat) • 23099031 (premix) • 23091011 (dog or cat food) • 23011000(animal meal) • 23099051 (premix) • 23091031 (dog or cat food) • 23099041 (premix) • 23091051 (dog or cat food)		Terrestrial
New Zealand	• 04022118 (milk powder, > 1.5% fat) • 04051019 (natural butter, 80-85% fat) • 35040010 (concentrated milk proteins, >85%) • 04059010 (milk fat) • 23011000 (animal meal)		Terrestrial
Indonesia	• 15220099 (waste from animal or vegetative wax) • 23099031 (premix)	• Large aquaculture producer	Both
Malaysia	• 15220099 (waste from animal or vegetative wax)		Terrestrial
Thailand	• 23091011 (dog or cat food) • 23091090 (dog or cat food)		Terrestrial
Ukraine	• 15042090 (other fish oil)	• High percentage of fish from aquaculture (18%) • RASFF-notifications	Fish
Canada	• 04041002 (whey powder, <1.5% fat) • 23091090 (dog or cat food) • 15042090 (other fish oil)	• High percentage of fish from aquaculture (18%)	Both
Uruguay	• 15021010 (tallow of bovine animals, sheep or goats)		Terrestrial
Belarus	• 04041002 (whey powder, <1.5% fat)		Terrestrial
Australia	• 23011000 (animal meal)		Terrestrial
Japan	• 15042090 (other fish oil) • 23099010 (fish solubles)	• High percentage of fish from aquaculture (24%)	Fish
Chile	• 23012000 (fish meal)	• High percentage of fish from aquaculture (35%)	Fish
Turkey	• 15042090 (other fish oil)	• High percentage of fish from aquaculture (43%)	Fish
Mexico	• 23011000(animal meal)		Terrestrial
South Africa	• 2301100 (animal meal)		Terrestrial
Argentina	• 15021010 (tallow of bovine animals, sheep or goats)		Terrestrial
India		• Large aquaculture producer • RASFF notifications	Fish
Vietnam		• Large aquaculture producer • RASFF notifications	Fish

The selection of countries indicated in Table 3 also ensures a representative geographic distribution.

3.3 Authorised substances in non-EU countries

The Bryant Christie database was screened followed by a consultation of the relevant national legislation as well as additional information obtained from the Agriculture Council in the selected non-EU countries (Table 3) to derive pharmaceutical substances authorised in non-EU countries that do not have an authorisation within the EU. Unfortunately, national legislation for Uruguay was not available. However, this country is a member of MERCOSUR, the South American trade bloc between Argentina, Brazil, Paraguay and Uruguay. It was, therefore, assumed that the MRLs as established by MERCOSUR were also applied by Uruguay. Combining all available information resulted in lists of substances that have an MRL in animal products in the country of origin but are unauthorised within the EU. The substances were categorised based on the classification as indicated in the latest draft Implementing Regulation (SANTE 11987-2017) for the control on residues of relevant substances as indicated in article 19 section 3a and 3b of Regulation (EU) 2017/625, that will replace the annexes of Directive 96/23/EC. This Implementing Regulation classifies substances in two groups: group A includes the unauthorised substances and group B the authorised substances.

The results are indicated in Tables 4-10 below categorised per substance group. An overview of all authorised substances ranked from most to least frequently found outside the EU is given in Annex 4.

Table 4 *Unauthorised steroids (group A1c[1]), resorcylic acid lactones (RALs; Group A1d[1]) and beta-agonists (group A1e[1]) that are authorised in non-EU countries[2]*

Substance	Category	Total	Argentina	Australia	Brazil	Canada	China	India	Indonesia	Japan	Malaysia	Mexico	New Zealand	South Africa	Thailand	United States
Estradiol	Steroids	7	x		x	x	x				x			x		x
Testosterone	Steroids	7			x	x	x		x		x			x		x
Trenbolone	Steroids	7		x		x					x	x		x	x	x
Melengestrol acetate	Steroids	5			x	x			x			x				x
Nandrolone	Steroids	2					x	x								
Clostebol	Steroids	1								x						
Proligestone	Steroids	1						x								
Zeranol	RALs	9		x		x			x	x	x	x		x	x	x
Ractopamine	Beta-agonists	8		x	x	x					x	x	x	x		x
Zilpaterol	Beta-agonists	5			x	x						x		x		x
Lubabegron	Beta-agonists	1														x

[1]Classification according to the draft Implementing Regulation (SANTE 11987-2017)

[2]Regulation used can be found in Annex 1

Table 5 *Prohibited substances listed in Table 2 of the Annex to Regulation (EU) No 37/2010 (group A2[1]) that are authorised substances in non-EU countries[2]*

Substance	Total	China	Indonesia	Japan	Malaysia	New Zealand
Dimetridazole	4	x	x		x	x
Metronidazole	1	x				
Ronidazole	1		x			
Nifurstyrenate	2		x	x		
Furaltadone	1		x			
Furazolidone	1		x			
Nitrofurazone	1		x			
Chloramphenicol	1		x			
Chlorpromazine	1	x				
Dapsone	1		x			

[1]Classification according to the draft Implementing Regulation (SANTE 11987-2017)

[2]Regulation used can be found in Annex 1

Chloramphenicol and nitrofurans are also most frequently reported for animal products in the RASFF database, primarily related to marine products.

Table 6 shows the antiparasitics that do not have an MRL in Regulation (EU) No 37/2010. Some of these substances do have a default MRL for animal products ensuing Regulation (EC) No 839/2008 on maximum residue levels of pesticides. These substances are indicated with an asterisk in the Table.

Table 6 *Unauthorised antiparasitics (group A3b[1]) that are authorised in non-EU countries[2]*

Substance	Total	Argentina	Australia	Belarus	Brazil	Canada	China	India	Indonesia	Japan	Malaysia	Mexico	New Zealand	South Africa	Thailand	United States
Trichlorfon	10	x	x	x	x		x		x	x		x	x		x	
Dichlorvos	9	x	x	x		x	x		x			x	x			x
Diminazene	6	x			x		x				x			x	x	
Fenthion	6			x			x		x	x		x				x
Isometamidium	6				x		x		x		x			x	x	
Malathion*	5		x	x			x					x	x			
Temephos	4		x	x					x				x			
Carbofuran	3								x	x		x				
Fluvalinate*	3						x		x				x			
Haloxon	3							x	x							x
Lindane	3								x			x	x			
Propetamphos	3		x	x			x									
1,2-Dichlorobenzene	2		x					x								
Cambendazole	2								x			x				
Famphur	2								x							x
Naphthalophos	2		x						x							
Niclosamide	2		x					x								
Chlordimeform	1								x							
Cymiazole	1								x							
Diethylcarbamazine	1							x								
Fenchlorphos	1											x				
Fenobucarb	1									x						
Milbemectin*	1		x													
Nitroscanate	1							x								
Pyraclofos	1		x													
Quinapyramine	1							x								
Suramin	1							x								
Tetrachlorvinphos	1		x													

[1]Classification according to the draft Implementing Regulation (SANTE 11987-2017)

[2]Regulation used can be found in Annex 1

*Substance with default EU pesticide MRLs in animal products ensuing Regulation (EC) No 839/2008

Table 7 *Unauthorised antimicrobials (group A3c[1]) that are authorised in non-EU countries[2]*

Substance	Total	Argentina	Australia	Belarus	Brazil	Canada	China	India	Indonesia	Japan	Malaysia	New Zealand	United States
Carbadox	4								x		x	x	x
Flavomycin	4		x	x				x					x
Kitasamycin	4	x	x				x		x				
Olaquindox	3		x				x		x				
Avoparcin	2								x		x		
Cefuroxime	2	x	x										
Clindamycin	2			x					x				
Hygromycin B	2						x		x				
Norfloxacin	2			x					x				
Oleandomycin	2		x						x				
Polymyxin B	2					x			x				
Bicozamycin	1									x			
Destomycin A	1						x						
Efrotomycin	1												x
Fosfomycin	1									x			
Halquinol	1				x								
Josamycin	1	x											
Ofloxacin	1			x									
Pefloxacin	1			x									
Sulfomyxin	1								x				
Tribromsalan	1								x				

[1]Classification according to the draft Implementing Regulation (SANTE 11987-2017)

[2]Regulation used can be found in Annex 1

Table 8 *Unauthorised coccidiostats (group A3d[1]), protein and peptide hormones (group A3e[1]) and sedatives and non-steroidal anti-inflammatory drugs (NSAIDs) (group A3f[1]) that are authorised in non-EU countries[2]*

Substance	Category	Total	Argentina	Australia	Brazil	Canada	China	India	Indonesia	Japan	Malaysia	New Zealand	United States
Ethopabate	coccidiostats	7	x	x			x	x	x		x		x
Clopidol	coccidiostats	6	x			x	x		x			x	x
Dinitolmide (Zoalene)	coccidiostats	5		x		x	x	x					x
Ormetoprim	coccidiostats	4				x			x	x			x
Nequinate	coccidiostats	3		x					x				x
Arsanilic acid	coccidiostats	2	x				x						
Buquinolate	coccidiostats	2				x			x				
Buparvaquone	coccidiostats	1						x					
Glycalpyramide	coccidiostats	1								x			
Laidlomycin	coccidiostats	1											x
Roxarsone	coccidiostats	1					x						
Gonadotropin	Protein and peptide hormones	3					x	x					x
Acepromazine	Sedatives	2	x					x					
Metoserpate hydrochloride	Sedatives	2							x				x
Pentobarbitone	Sedatives	2	x					x					
Promazine hydrochloride	Sedatives	2	x					x					
Chloral hydrate	Sedatives	1						x					
Diazepam	Sedatives	1					x						
Lithium antimony thiomalate	NSAIDs	1						x					
Nimesulide	NSAIDs	1						x					
Propofol	Sedatives	1						x					

[1]Classification according to the draft Implementing Regulation (SANTE 11987-2017)

[2]Regulation used can be found in Annex 1

Table 9 *Authorised antiparasitics (group B1b[1]) and NSAIDs (group B1d[1]) in non-EU countries[2]*

Substance	Category	Total	Argentina	Australia	Belarus	Brazil	Canada	China	India	Indonesia	Malaysia	Mexico	New Zealand	South Africa	Thailand	United States
Coumaphos[3]	Antiparasitics	7		x	x	x				x		x	x			x
Pyrantel[4]	Antiparasitics	3					x			x						x
Antipyrine	NSAIDs	1							x							

[1]Classification according to the draft Implementing Regulation (SANTE 11987-2017)

[2]Regulation used can be found in Annex 1

[3]Coumaphos has an MRL for honey in Regulation (EU) No 37/2010, but it does not have MRLs for other animal species and products

[4]Pyrantel has an MRL for Equidae in Regulation (EU) No 37/2010, but it does not have MRLs for other animal species and products

Table 10 *Unauthorised substances with no obvious categorization in Implementing Regulation (SANTE 11987-2017) that are authorised in non-EU countries*[1]

Substance	Total	China	India	United States
Kaolin	2	x	x	
Berberine	1	x		
Carboprost tromethamine	1		x	
Chlorpyridazine	1		x	
Dexcloprostenolum	1		x	
Fenprostalene	1			x
Mepyramine	1		x	
Methyl hydroxybenzoate	1		x	
Scopolamine	1	x		
Tripelennamine	1			x

[1]Regulation used can be found in Annex 1

Tables 4-10 show that in total 104 substances were found for which MRLs were indicated in national legislation, which are not authorised within the EU. As expected, the majority of substances (around 88%) can be classified as A-group substances, i.e. the prohibited substances. Some remarks need to be made with respect to the results presented:

- The fact that a substance has an MRL in animal products does not necessarily imply that the substance is actually used. Whether or not a substance is used will depend on whether a VMP based on the substance is registered for use in food producing animals. These VMP registrations were not checked in this study as these cannot easily be found for all the countries included in this study. Furthermore, it might be that the substance was used in the past but is no longer used or available and the legislation has not been adapted since.
- Some compounds, such as chloramphenicol, berberine and scopolamine can originate from natural sources. Thus, potential residues in animal by-products are not necessarily the result of veterinary drug use.
- It was assumed that when an MRL for animal products such as meat, kidney or eggs exists, the substance may also be found in animal by-products such as blood meal or fish meal or eggshells. This will, however, depend on the route of administration, pharmacokinetics and the deposition of residues in specific matrices.
- The substances presented in Tables 4-10 were found in one or more of the included animal products (fish, bovine, porcine, ovine, chicken, milk and eggs). It was too complex to differentiate to animal species. The list of substances is thus potentially longer in case substances are authorised in a certain animal species that is not included in the EU legislation. For example, albendazole is authorised in China in all food producing species, whereas in the EU it is only authorised in ruminants. This substance is now not included in Table 9.
- Finally, it is to be noted that there are some pharmaceutical substances that are approved as feed additives only. In many cases, these do not appear in veterinary pharmaceutical legislation establishing MRLs and thus may be lacking from lists of substances retrieved with the approach that was followed in this project. An example of this is enramycin, which is a common antimicrobial feed additive in Asia. In some cases, the absence of residue limits is legitimized with the argument that the substance has no or limited uptake from the gastro-intestinal tract, but it should be noted that the scientific underpinning of such an assumption is often very limited and based on (out)dated information. Furthermore, these substances may be present in products like feather meal.

Figure 1 summarises the number of substances per country that are unauthorised in the EU. This shows that Indonesia has most deviations from the EU legislation. However, the legislation on MRLs in Indonesia is very rudimentary. Matrix differentiation is limited to meat, egg and milk, and it has not been updated over the last 20 years. When compared to the import volumes, Indonesia is not the most relevant country. Most animal by-products are imported from China (69 kton/y) followed by Brazil (47 kton/y), the US (3 kton/y), New Zealand (1 kton/y) and Indonesia (0.8 kton/y).

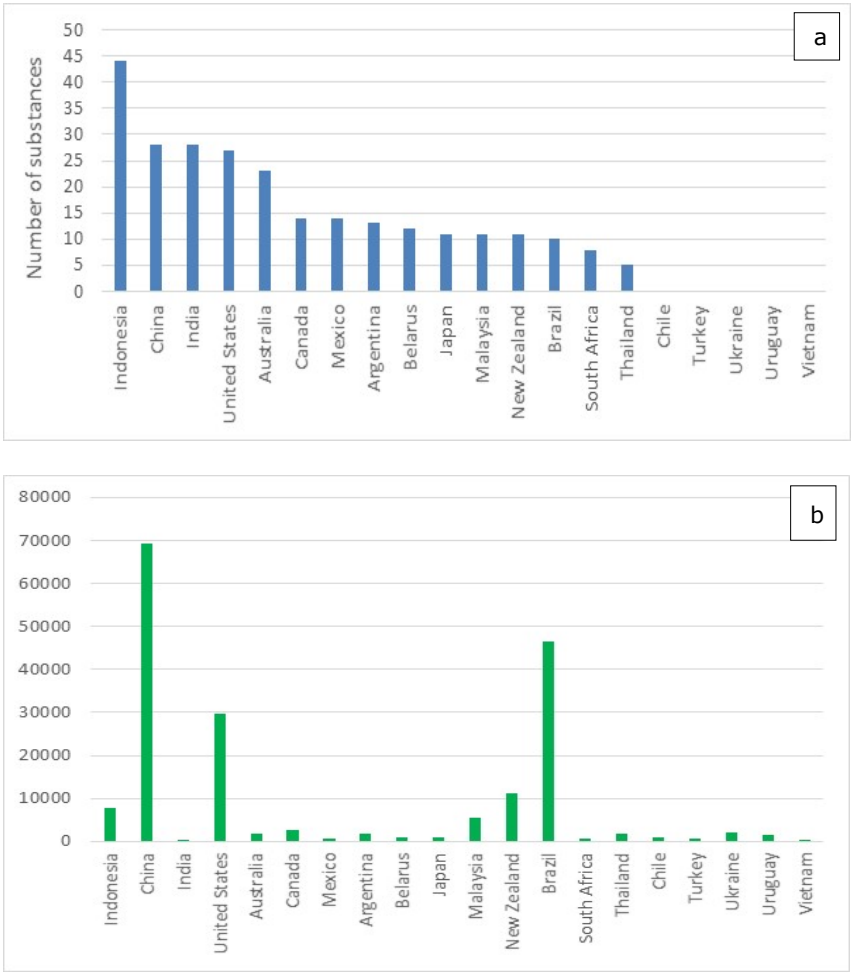

Figure 1 *a. Number of authorised substances in non-EU countries that are not included in Regulation (EU) No 37/2010 and b. Import volume in ton/year (average of 2015-2019) into the Netherlands for the CN-codes indicated in Annex 2*

Apart from national legislation, some countries, such as Malaysia and Turkey, also refer to the Codex legislation. Substances that are not included in their national legislation, but are included in the Codex are also allowed to be used in these countries. For that reason, Table 11 shows substances that are authorised in the Codex regulation and might be used in aquatic or terrestrial animals, but that are unauthorised within the EU. The only additional substance reflected in Table 11 is porcine somatotropin (pST), a growth hormone for pigs. The Codex refers to the JECFA evaluation of this substance, which indicates that human health risks are not to be expected when pST is used in pigs and consequently MRLs are not specified for edible tissues in pigs.

Table 11 *Authorised substances in the Codex[1] that are unauthorised within the EU*

Substance	Category
Estradiol	Steroids
Melengestrol acetate	Steroids
Testosterone	Steroids
Trenbolone	Steroids
Zeranol	RALs
Ractopamine	Beta-agonists
Diminazine	Antiparasitics
Isometamidium	Antiparasitics
Trichlorfon	Antiparasitics
Porcine somatotropin	Protein and peptide hormones

[1]Regulation used can be found in Annex 1

4 Conclusions

A systematic approach was followed to identify pharmaceutical substances that are authorised for medical treatment of food producing animals outside the EU but not within the EU. Based on import data from Eurostat, RASFF notifications and aquaculture production volumes, a total of 20 non-EU countries was selected that were considered relevant with respect to import of animal by-products into the Netherlands. For each of these countries, the substances represented in national legislation with a maximum residue limit (MRL) were screened for their presence in Regulation (EU) No 37/2010. This resulted in a list of 104 substances for which MRLs have been established in one or more of the included countries, but that are not authorised in the EU. Most of these substances were antiparasitics (group A3b, n = 28) or antimicrobials (group A3c, n = 21). Some countries, i.e. Chile, Turkey, Vietnam, Ukraine and Uruguay apparently have harmonized their legislation with the EU as no substances were found that are authorised in these countries but not within the EU. The top 5 countries with considerable number of authorised substances not included in EU legislation are Indonesia (44 substances), China (28 substances), India (28 substances), US (27 substances), and Australia (23 substances). However, for the Netherlands, the most relevant countries of import are China (69 kton/y) and Brazil (47 kton/y) followed by the US (3 kton/y), New Zealand (1 kton/y) and Indonesia (0.8 kton/y). Further research is needed to establish whether the substances are actually used in the country of origin and whether residues occur in products entering the EU market. For the most relevant countries, research on VMP registrations and internet searches on the availability of VMPs containing the specified substances should be performed to get an indication of possible use. The identified substances can subsequently be taken up in the scope of methods applied for the national monitoring program for animal feed.

Acknowledgements

Karen Zwaagstra, Steven Danneel and Max van Brakel (NVWA) are kindly acknowledged for the valuable discussions that contributed to this research. Josha Jager (WFSR) is acknowledged for contributing with his expertise on hormone substances. Marieta Turkensteen and Rinus Gerlofsma (NVWA) are kindly acknowledged for providing us the import data on animal products and further discussions on this topic. Leo van Raamsdonk, Maryvon Noordam, Theo Prins and Caroline Dirks (WFSR) are kindly thanked for critically reading (part of) this report.

References

1. Bosch, G., H. H. E. van Zanten, A. Zamprogna, M. Veenenbos, N. P. Meijer, H. J. van der Fels-Klerx, and J. J. A. van Loon. 2019. Conversion of organic resources by black soldier fly larvae: Legislation, efficiency and environmental impact*. Journal of Cleaner Production*. 222:355-363.
2. Derrien, C., and A. Boccuni. 2018. Current Status of the Insect Producing Industry in Europe*.* p. 471-479. *In* A. Halloran, et al. (ed.), Edible Insects in Sustainable Food Systems Springer, Cham.
3. European Commission. Date 2020. Petition No. 0154/2020 by Ursula and Franz-Jürgen Roth (German), on the ban on feeding animal meal to pigs and poultry. Available from: https://www.europarl.europa.eu/doceo/document/PETI-CM-657342_EN.pdf. Accessed 19-03-2021.
4. European Commission. Date n.d. Animal by-products. Available from: https://ec.europa.eu/food/safety/animal-by-products_en. Accessed 19-03-2021.
5. FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. p. 224 p. *In*, Rome.
6. van Raamsdonk, L. W. D., T. W. Prins, N. Meijer, I. M. J. Scholtens, M. G. E. G. Bremer, and J. de Jong. 2019. Bridging legal requirements and analytical methods: a review of monitoring opportunities of animal proteins in feed*. Food Additives & Contaminants: Part A*. 36:46-73.

Consulted EU legal documents

- Commission Regulation (EU) 2021/1372 of 17 August 2021 amending Annex IV to Regulation (EC) No 999/2001 of the European Parliament and of the Council as regards the prohibition to feed non-ruminant farmed animals, other than fur animals, with protein derived from animals
- Commission Implementing Regulation (EU) 2021/1371 of 16 August 2021 amending Annex I to Implementing Regulation (EU) 2021/605 laying down special control measures for African swine fever
- Regulation (EU) 2019/4 of the European Parliament and of the Council of 11 December 2018 on the manufacture, placing on the market and use of medicated feed, amending Regulation (EC) No 183/2005 of the European Parliament and of the Council and repealing Council Directive 90/167/EEC
- Regulation (EU) 2019/6 of the European Parliament and of the Council of 11 December 2018 on veterinary medicinal products and repealing Directive 2001/82/EC
- Commission Regulation (EU) 2019/1871 of 7 November 2019 on reference points for action for non-allowed pharmacologically active substances present in food of animal origin and repealing Decision 2005/34/EC (Text with EEA relevance)
- Commission Delegated Regulation (EU) 2019/2090 of 19 June 2019 supplementing Regulation (EU) 2017/625 of the European Parliament and Council regarding cases of suspected or established non-compliance with Union rules applicable to the use or residues of pharmacologically active substances authorised in veterinary medicinal products or as feed additives or with Union rules applicable to the use or residues of prohibited or unauthorised pharmacologically active substances (Text with EEA relevance)
- Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products, amending Regulations (EC) No 999/2001, (EC) No 396/2005, (EC) No 1069/2009, (EC) No 1107/2009, (EU) No 1151/2012, (EU) No 652/2014, (EU) 2016/429 and (EU) 2016/2031 of the European Parliament and of the Council, Council Regulations (EC) No 1/2005 and (EC) No 1099/2009 and Council Directives 98/58/EC, 1999/74/EC, 2007/43/EC, 2008/119/EC and 2008/120/EC, and repealing Regulations (EC) No 854/2004 and (EC) No 882/2004 of the European Parliament and of the Council, Council Directives 89/608/EEC, 89/662/EEC, 90/425/EEC, 91/496/EEC, 96/23/EC, 96/93/EC and 97/78/EC and Council Decision 92/438/EEC (Official Controls Regulation)

- Commission Regulation (EU) No 68/2013 of 16 January 2013 on the Catalogue of feed materials
- Commission Regulation (EU) No 142/2011 of 25 February 2011 implementing Regulation (EC) No 1069/2009 of the European Parliament and of the Council laying down health rules as regards animal by-products and derived products not intended for human consumption and implementing Council Directive 97/78/EC as regards certain samples and items exempt from veterinary checks at the border under that Directive
- Commission Regulation (EU) No 37/2010 of 22 December 2009 on pharmacologically active substances and their classification regarding maximum residue limits in foodstuffs of animal origin
- Regulation (EC) No 1069/2009 of the European Parliament and of the Council of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 (Animal by-products Regulation)
- Commission Regulation (EC) No 124/2009 of 10 February 2009 setting maximum levels for the presence of coccidiostats or histomonostats in food resulting from the unavoidable carry-over of these substances in non-target feed
- Commission Regulation (EC) No 839/2008 of 31 July 2008 amending Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards Annexes II, III and IV on maximum residue levels of pesticides in or on certain products
- Regulation (EC) No 1831/2003 of the European Parliament and of the Council of 22 September 2003 on additives for use in animal nutrition
- Directive 2002/32/EC of the European Parliament and of the Council of 7 May 2002 on undesirable substances in animal feed
- Regulation (EC) No 999/2001 of the European Parliament and of the Council of 22 May 2001 laying down rules for the prevention, control and eradication of certain transmissible spongiform encephalopathies
- Council Directive 96/22/EC of 29 April 1996 concerning the prohibition on the use in stockfarming of certain substances having a hormonal or thyrostatic action and of beta-agonists, and repealing Directives 81/602/EEC, 88/146/EEC and 88/299/EEC
- Council Directive 96/23/EC of 29 April 1996 on measures to monitor certain substances and residues thereof in live animals and animal products and repealing Directives 85/358/EEC and 86/469/EEC and Decisions 89/187/EEC and 91/664/EEC. No longer in force. Repealed and replaced by Regulation (EU) 2017/625.
- Council Regulation (EEC) No 2658/87 of 23 July 1987 on the tariff and statistical nomenclature and on the Common Customs Tariff

Annex 1 Non-EU legislation consulted

The following legislation was used to obtain MRLs in pharmaceutical substances not authorised within the EU (access date 09-07-2021):

- Argentina: Resolución 559/2011: Apruébanse los Límites de Residuos en Alimentos de Origen Animal. Available at: https://www.argentina.gob.ar/normativa/nacional/resoluci%C3%B3n-559-2011-185988/texto
- Australia: Australia New Zealand Food Standards Code – Schedule 20 – Maximum residue limits. Available at: https://www.legislation.gov.au/Details/F2017C00941
- Belarus: Decision of Board of the Eurasion Economic Commision of February 13, 2018 No. 28. Available at: http://extwprlegs1.fao.org/docs/pdf/kyr185130.pdf
- Brazil: Instrução Normativa nº 51. Available at: https://www.in.gov.br/en/web/dou/-/instrucao-normativa-n-51-de-19-de-dezembro-de-2019-235414514
- Canada: List of Maximum Residue Limits (MRLs) for Veterinary Drugs in Foods. Available at: https://www.canada.ca/en/health-canada/services/drugs-health-products/veterinary-drugs/maximum-residue-limits-mrls/list-maximum-residue-limits-mrls-veterinary-drugs-foods.html
- Chile: Resolución No. 1560 Exenta de 2019: Fija Límites Máximos de Residuos de Medicamentos Veterinarios en Alimentos para Consumo Humano. Available at: https://www.bcn.cl/leychile/navegar?idNorma=1135977
- China: GB-31650-2019: Maximum Residue Limits for Veterinary Drugs in Foods. Available at: https://www.fas.usda.gov/data/china-china-publishes-maximum-residue-limits-veterinary-drugs-food
- Codex: CODEX ALIMENTARIUS International Food Standards – Index of Veterinary Drugs. Available at: http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/vetdrugs/veterinary-drugs/en/
- India: Food Safety and Standards (Contaminants, Toxins and Residues) Regulations, 2011. Available at: https://www.fssai.gov.in/upload/uploadfiles/files/Compendium_Contaminants_Regulations_20_08_2020.pdf
- Indonesia: SNI-01-6366-2000: Batas maksimum cemaran mikroba dan batas maksimum residu dalam bahan makanan asal hewan. Available at: http://blog.ub.ac.id/cdrhprimasanti90/files/2012/05/SNI-Cemaran-Bakteri-Daging-Susu-Telur.pdf
- Japan: Maximum Residue Limits (MRLs) of Agricultural Chemicals in Foods. Available at: http://db.ffcr.or.jp/front/
- Malaysia: P.U.(A) 437/85 Food Regulations 1985. Available at: http://www.fao.org/faolex/results/details/en/c/LEX-FAOC027305
- Mexico. Tabla de Límites Máximos de Residuos 2020. Available at: https://www.gob.mx/senasica/documentos/limites-maximos-de-residuos-toxicos-y-contaminantes?state=published
- New Zealand: Food Notice: Maximum Residue Levels for Agricultural Compounds. Available at: https://www.mpi.govt.nz/dmsdocument/19550-Maximum-Residue-Levels-for-Agricultural-Compounds
- South Africa: Regulations Governing the Maximum Limits for Veterinary Medicine and Stock Remedy residues that may be present in Foodstuffs. Available at: https://www.ehrn.co.za/download/reg_vet.pdf
- Thailand: (Unofficial) Notification of the Ministry of Public Health (No. 303) B.E. 2550 (2007) Re: Veterinary Drugs Residues in Foods. Available at: http://extwprlegs1.fao.org/docs/pdf/tha159858.pdf
- Turkey. Türk Gıda Kodeksi Hayvansal Gıdalarda Bulunabilecek Farmakolojik Aktif Maddelerin Sınıflandırılması ve Maksimum Kalıntı Limitleri Yönetmeliği. Available at: https://www.resmigazete.gov.tr/eskiler/2017/03//20170307-4-1.pdf
- Vietnam. Maximum Limits on Residues of Veterinary Medicine in Food (promulgated together with the Circular No. 24/2013/TT-BYT dated August 14, 2013 of the Minister

of Health). Available at: https://vanbanphapluat.co/circular-no-24-2013-tt-byt-maximum-limits-on-residues-of-veterinary-medicines-in-food

- Ukraine: Ukraine's MRLs for Veterinary Drugs. Available at: https://www.fas.usda.gov/data/ukraine-ukraines-mrls-veterinary-drugs
- Uruguay. Assumed to follow the MRLs established by Mercosur. MERCOSUR/GMC/RES. Nº 54/00. Reglamento Técnico MERCOSUR Metodologías Analíticas, Ingesta Diaria Admisible Y Límites Máximos de Residuos para Medicamentos Veterinarios en Alimentos de Origen Animal. Available at: http://www.puntofocal.gov.ar/doc/r_gmc_54-00.pdf
- USA: U.S. Code of Federal Regulations (CFR) Title 21, Part 556. Available at: https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfCFR/CFRSearch.cfm?CFRPart=556%26showFR=1

Annex 2 CN-codes as used in Eurostat

CN-Code[1]	Description
2061098	Fresh or chilled edible bovine offal (excl. for manufacture of pharmaceutical products, thick and thin skirt)
2062999	Frozen edible bovine offal (excl. for manufacture of pharmaceutical products, tongues, livers and thick and thin skirt)
2063000	Fresh or chilled edible offal of swine
2064900	Edible offal of swine, frozen (excl. livers)
2069099	Frozen edible offal of sheep and goats (excl. for manufacture of pharmaceutical products)
2071399	Fresh or chilled edible offal of fowls of the species Gallus domesticus (excl. livers)
2071499	Frozen edible offal of fowls of the species Gallus domesticus (excl. livers)
2072799	Frozen edible offal of turkeys of the species domesticus (excl. livers)
2109990	Edible flours and meals of meat or meat offal (excl. of primates, whales, dolphins and porpoises "mammals of the order Cetacea", manatees and dugongs "mammals of the order Sirenia", seals, sea lions and walruses and reptiles)
3029900	Fresh or chilled fish fins, heads, tails, maws and other edible fish offal (excl. livers, roes, milt and shark fins)
4021019	Milk and cream in solid forms, of a fat content by weight of <= 1,5%, unsweetened, in immediate packings of > 2,5 kg
4022118	Milk and cream in solid forms, of a fat content by weight of <= 27% but > 1,5%, unsweetened, in immediate packings of > 2,5 kg or put up otherwise
4041002	Whey and modified whey, in powder, granules or other solid forms, without added sugar or other sweetening matter, of a protein content "nitrogen content x 6.38" of <= 15% by weight and a fat content, by weight, of <= 1,5%
4041004	Whey and modified whey, in powder, granules or other solid forms, without added sugar or other sweetening matter, of a protein content "nitrogen content x 6.38" of <= 15% by weight and a fat content, by weight, of > 1,5 and <= 27%
4041006	Whey and modified whey, in powder, granules or other solid forms, without added sugar or other sweetening matter, of a protein content "nitrogen content x 6.38" of <= 15% by weight and a fat content, by weight, of > 27%
4041012	Whey and modified whey, in powder, granules or other solid forms, without added sugar or other sweetening matter, of a protein content "nitrogen content x 6.38" of > 15% by weight and a fat content, by weight, of <= 1,5%
4041014	Whey and modified whey, in powder, granules or other solid forms, without added sugar or other sweetening matter, of a protein content "nitrogen content x 6.38" of > 15% by weight and a fat content, by weight, of > 1,5% and <= 27%
4051011	Natural butter of a fat content, by weight, of >= 80% but <= 85%, in immediate packings of a net content of <= 1 kg (excl. dehydrated butter and ghee)
4051019	Natural butter of a fat content, by weight, of >= 80% but <= 85% (excl. in immediate packings of a net content of <= 1 kg, and dehydrated butter and ghee)
4051090	Butter of a fat content, by weight, of > 85% but <= 95% (excl. dehydrated butter and ghee)
4052030	Dairy spreads of a fat content, by weight, of >= 60% but <= 75%
4059010	Fats and oils derived from milk, of a fat content, by weight, of >= 99,3% and of a water content, by weight, of <= 0,5%
4059090	Fats and oils derived from milk, dehydrated butter and ghee (excl. of a fat content, by weight, of >= 99,3% and a water content, by weight, of <= 0,5%, and natural butter, recombined butter and whey butter)
4081920	Egg yolks, fresh, cooked by steaming or boiling in water, moulded, frozen or otherwise preserved, whether or not containing added sugar or other sweetening matter, unsuitable for human consumption (excl. dried)
5051090	Feathers used for stuffing and down, thoroughly cleaned and treated for preservation
5059000	Skins and other parts of birds, with their feathers or down, feathers and parts of feathers, whether or not with trimmed edges, not further worked than cleaned, disinfected or treated for preservation; powder and waste of feathers or parts of feathers (excl. feathers used for stuffing and down)
5061000	Ossein and bones treated with acid
5069000	Bones and horn-cores and their powder and waste, unworked, defatted, degelatinised or simply prepared (excl. ossein and bones treated with acid and cut to shape)
5079000	Tortoiseshell, whalebone and whalebone hair, horns, antlers, hooves, nails, claws and beaks, unworked or simply prepared, their powder and waste (excl. cut to shape and ivory)
5100000	Ambergris, castoreum, civet and musk; cantharides; bile, whether or not dried; glands and other animal products used in the preparation of pharmaceutical products, fresh, chilled, frozen or otherwise provisionally preserved
5119110	Fish waste
5119190	Products of fish or crustaceans, molluscs or other aquatic invertebrates (excl. fish waste); dead fish, crustaceans, molluscs or other aquatic invertebrates, unfit for human consumption
5119910	Sinews or tendons of animal origin, parings and similar waste of raw hides or skins
5119931	Raw natural sponges of animal origin
5119939	Natural sponges of animal origin (excl. raw)
5119985	Animal products, not elsewhere specified; dead animals, unfit for human consumption (excl. fish, crustaceans, molluscs and other aquatic invertebrates)

CN-Code[1]	Description
15012010	Pig fat, rendered or otherwise extracted, for industrial uses (excl. for the manufacture of foodstuffs, and lard)
15019000	Pig fat (including lard) and poultry fat, other than that of heading 0209 or 1503 - other
15021010	Tallow of bovine animals, sheep or goats, for industrial uses (excl. for manufacture of foodstuffs, and oil and oleostearin)
15042010	Fish fats and oils and liquid fractions, whether or not refined (excl. chemically modified and liver oils) - solid fractions
15042090	Fish fats and oils and liquid fractions, whether or not refined (excl. chemically modified and liver oils) - other
15060000	Other animal fats and oils and their fractions, whether or not refined, but not chemically modified (excl. pig fat, poultry fat, fats of bovine animals, sheep and goats, fats of fish and other marine animals, lard stearin, lard oil, oloestearin, oleo-oil, tallow oil, wool grease and fatty substances derived therefrom)
15220099	Residues from treatment of fatty substances or animal and vegetable waxes (excl. those containing oil with characteristics of olive oil, oil foots and dregs and soapstocks)
23011000	Flours, meals and pellets, of meat or offal, unfit for human consumption; greaves
23012000	Flours, meals and pellets of fish or crustaceans, molluscs or other aquatic invertebrates, unfit for human consumption
23091011	Dog or cat food, put up for retail sale, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup but containing no starch or no milk products or containing <= 10% starch and < 10% by weight of milk products
23091013	Dog or cat food, put up for retail sale- containing not less than 10% but less than 50% by weight of milk products
23091019	Dog or cat food, put up for retail sale- containing not less than 75% by weight of milk products
23091031	Dog or cat food, put up for retail sale, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 10% but <= 30% of starch and no milk products or < 10% by weight of milk products
23091051	Dog or cat food, put up for retail sale, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 30% of starch and no milk products or < 10% by weight of milk products
23091059	Dog or cat food, put up for retail sale, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 50% by weight of milk products
23091070	Dog or cat food, put up for retail sale, containing no starch, glucose, glucose syrup, maltodextrine or maltodextrine syrup but containing milk products
23091090	Dog or cat food put up for retail sale, containing no starch, glucose, maltodextrine or maltodextrine syrup, nor milk products
23099010	Fish or marine mammal solubles, to supplement feedingstuffs produced in the agricultural sector
23099031	Preparations, incl. premixes, for animal food, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup but containing no starch or no milk products or containing <= 10% starch and < 10% by weight of milk products (excl. dog or cat food put up for retail sale)
23099035	Preparations, incl. premixes, for animal food, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup but containing no starch or no milk products or containing <= 10% starch and containing > 50% but less than 75% by weight of milk products (excl. dog or cat food put up for retail sale)
23099039	Preparations, incl. premixes, for animal food, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup but containing no starch or containing <= 10% starch and >= 75% by weight of milk products (excl. dog or cat food put up for retail sale)
23099041	Preparations, incl. premixes, for animal food, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 10% but <= 30% of starch and no milk products or < 10% by weight of milk products (excl. dog or cat food put up for retail sale)
23099051	Preparations, incl. premixes, for animal food, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 30% of starch and no milk products or < 10% by weight of milk products (excl. dog or cat food put up for retail sale)
23099053	Preparations, incl. premixes, for animal food, containing glucose, glucose syrup, maltodextrine or maltodextrine syrup and containing > 30% of starch and >= 10% but < 50% by weight of milk products (excl. dog or cat food put up for retail sale)
35021110	Albumins (including concentrates of two or more whey proteins, containing by weight more than 80% whey proteins, calculated on the dry matter), albuminates and other albumin derivatives - Dried egg albumin - other
35030010	Gelatine, whether or not in square or rectangular sheets, whether or not surface-worked or coloured, and derivatives thereof (excl. impure gelatines)
35040010	Concentrated milk proteins with a protein content > 85% by weight, calculated on the dry matter
35040090	Peptones and their derivatives; other albuminous substances and their derivatives, n.e.s.; hide powder, whether or not chromed (excl. concentrated milk proteins with a protein content > 85% by weight, calculated on the dry matter

[1]CN-codes obtained from Regulation (EEC) 2658/87

Annex 3 RASFF notifications

Table A3.1 *RASFF notifications on for unauthorised or prohibited VMP residues in animal products from 1-1-2015 up to 13-11-2020*

Active substance	Afghanistan	Argentina	Bangladesh	Belarus	Brazil	Canada	China	Egypt	India	Mexico	New Zealand	Russia	Syria	Thailand	Turkey	Ukraine	United Kingdom	United States	Vietnam	Grand Total
azaperone		1																1		2
azithromycin							1												2	3
brilliant green																			1	1
crystal violet																			2	2
diclofenac					1															1
doxycycline																			1	1
feed additive oxytetracycline												1								1
flunixin													1							1
ivermectin					2														2	4
leucomalachite green			1	1															5	7
malachite green			1																2	3
naproxen					3															3
norfloxacin							2													2
ofloxacin							2												4	6
oxyphenylbutazone						3														3
oxytetracycline																			1	1
phenylbutazone						1											3			4
ractopamine										1								1		2
streptomycin							1													1
sulfadimidine															1					1
sulfamethoxazole																			1	1

Active substance	Afghanistan	Argentina	Bangladesh	Belarus	Brazil	Canada	China	Egypt	India	Mexico	New Zealand	Russia	Syria	Thailand	Turkey	Ukraine	United Kingdom	United States	Vietnam	Grand Total
sulfathiazole																2				2
sulfonamide															1	2				3
tetracycline												1				2				3
trimethoprim																			1	1
chloramphenicol									5			1				2			4	12
nitrofuran (metabolite) nitrofurazone (SEM)	1		4				4		1		1			2	3	1			9	26
nitrofuran (metabolite) furazolidone (AOZ)							2		41										2	45
nitrofuran (metabolite) furaltadone (AMOZ)							1	2												3
metronidazole							1										1			2
zilpaterol										2										2
Grand Total	1	1	6	1	6	4	14	2	47	3	1	3	1	2	5	9	4	2	37	149

Annex 4 Substances that are authorised outside but not within the EU

Table A4.1 *Authorised substances in non-EU countries that are unauthorised within the EU, classified per substance group according to the draft Implementing Regulation (SANTE 11987-2017) for the control on residues of relevant substances. Per substance, the number of countries[1] in which the substance is authorised is mentioned*

Substance	Category	Total	Argentina	Australia	Belarus	Brazil	Canada	China	India	Indonesia	Japan	Malaysia	Mexico	New Zealand	South Africa	Thailand	United States
Trichlorfon	A3b	10	x	x	x	x		x		x	x		x	x		x	
Zeranol	A1d	9		x			x			x	x	x	x		x	x	x
Dichlorvos	A3b	9	x	x	x		x	x		x			x	x			x
Ractopamine	A1e	8		x		x	x					x	x	x	x		x
Estradiol	A1c	7	x			x	x	x				x			x		x
Testosterone	A1c	7				x	x	x		x		x			x		x
Trenbolone	A1c	7		x			x					x	x		x	x	x
Ethopabate	A3d	7	x	x				x	x	x		x					x
Coumaphos	B1b	7		x	x	x				x			x	x			x
Diminazine	A3b	6	x			x		x				x			x	x	
Fenthion	A3b	6			x			x		x	x		x				x
Isometamidium	A3b	6				x		x		x		x			x	x	
Clopidol	A3d	6	x				x	x		x				x			x
Melengestrol acetate	A1c	5				x	x			x			x				x
Zilpaterol	A1e	5				x	x						x		x		x
Malathion	A3b	5		x	x			x					x	x			
Dinitolmide (Zoalene)	A3d	5		x			x	x	x								x
Dimetridazole	A2	4						x		x		x		x			
Temephos	A3b	4		x	x					x				x			
Carbadox	A3c	4								x		x		x			x
Flavomycin	A3c	4		x	x				x								x

Substance	Category	Total	Argentina	Australia	Belarus	Brazil	Canada	China	India	Indonesia	Japan	Malaysia	Mexico	New Zealand	South Africa	Thailand	United States
Kitasamycin	A3c	4	x	x				x		x							
Ormetoprim	A3d	4					x			x	x						x
Carbofuran	A3b	3								x	x		x				
Fluvalinate	A3b	3						x		x				x			
Haloxon	A3b	3							x	x							x
Lindane	A3b	3								x			x	x			
Propetamphos	A3b	3		x	x			x									
Olaquindox	A3c	3		x				x		x							
Nequinate	A3d	3		x						x							x
Gonadotropin	A3e	3						x	x								x
Pyrantel	B1b	3					x			x							x
Nandrolone	A1c	2						x	x								
Nifurstyrenate	A2	2								x	x						
1,2-Dichlorobenzene	A3b	2		x					x								
Cambendazole	A3b	2								x			x				
Famphur	A3b	2								x							x
Naphthalophos	A3b	2		x						x							
Niclosamide	A3b	2		x					x								
Avoparcin	A3c	2								x		x					
Cefuroxime	A3c	2	x	x													
Clindamycin	A3c	2			x					x							
Hygromycin B	A3c	2						x		x							
Norfloxacin	A3c	2			x					x							
Oleandomycin	A3c	2		x						x							
Polymyxin B	A3c	2					x			x							
Arsanilic acid	A3d	2	x					x									
Buquinolate	A3d	2					x			x							
Acepromazine	A3f	2	x						x								
Metoserpate hydrochloride	A3f	2								x							x
Pentobarbitone	A3f	2	x						x								

Substance	Category	Total	Argentina	Australia	Belarus	Brazil	Canada	China	India	Indonesia	Japan	Malaysia	Mexico	New Zealand	South Africa	Thailand	United States
Promazine hydrochloride	A3f	2	x						x								
Kaolin	-	2						x	x								
Clostebol	A1c	1									x						
Proligestone	A1c	1							x								
Lubabegron	A1e	1															x
Chloramphenicol	A2	1								x							
Chlorpromazine	A2	1						x									
Dapsone	A2	1								x							
Furaltadone	A2	1								x							
Furazolidone	A2	1								x							
Metronidazole	A2	1						x									
Nitrofurazone	A2	1								x							
Ronidazole	A2	1								x							
Chlordimeform	A3b	1								x							
Cymiazole	A3b	1								x							
Diethylcarbamazine	A3b	1							x								
Fenchlorphos	A3b	1											x				
Fenobucarb	A3b	1									x						
Milbemectin	A3b	1		x													
Nitroscanate	A3b	1							x								
Pyraclofos	A3b	1		x													
Quinapyramine	A3b	1							x								
Suramin	A3b	1							x								
Tetrachlorvinphos	A3b	1		x													
Bicozamycin	A3c	1									x						
Destomycin A	A3c	1						x									
Efrotomycin	A3c	1															x
Fosfomycin	A3c	1									x						
Halquinol	A3c	1				x											
Josamycin	A3c	1	x														

Substance	Category	Total	Argentina	Australia	Belarus	Brazil	Canada	China	India	Indonesia	Japan	Malaysia	Mexico	New Zealand	South Africa	Thailand	United States
Ofloxacin	A3c	1			x												
Pefloxacin	A3c	1			x												
Sulfomyxin	A3c	1								x							
Tribromsalan	A3c	1								x							
Buparvaquone	A3d	1							x								
Glycalpyramide	A3d	1									x						
Laidlomycin	A3d	1															x
Roxarsone	A3d	1						x									
Chloral hydrate	A3f	1							x								
Diazepam	A3f	1						x									
Lithium antimony thiomalate	A3f	1							x								
Nimesulide	A3f	1							x								
Propofol	A3f	1							x								
Antipyrine	B1d	1							x								
Berberine	-	1						x									
Carboprost tromethamine	-	1							x								
Chlorpyridazine	-	1							x								
Dexcloprostenolum	-	1							x								
Fenprostalene	-	1															x
Mepyramine	-	1							x								
Methyl hydroxybenzoate	-	1							x								
Scopolamine	-	1						x									
Tripelennamine	-	1															x
Total		259	13	23	12	10	14	28	28	44	11	11	14	11	8	5	27

[1]Legislation used is indicated in Annex 1

Wageningen Food Safety Research
P.O. Box 230
6700 AE Wageningen
The Netherlands
T +31 (0)317 48 02 56
www.wur.eu/food-safety-research

WFSR report 2021.018

To explore the potential of nature to improve the quality of life

Wageningen Food Safety Research
P.O. Box 230
6700 AE Wageningen
The Netherlands
T +31 (0)317 48 02 56
www.wur.eu/food-safety-research

WFSR report 2021.018

The mission of Wageningen University & Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 6,800 employees (6,000 fte) and 12,900 students, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.