The use of autogenous vaccines in the Dutch pig industry and suggestions for new legislation of autogenous vaccines.

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Abstract

The aim of this study was to make an inventory of the total production and use of autogenous vaccines in the Dutch pig industry in 2011 and to investigate the arguments to start using an autogenous vaccine. Finally, recommendations were given to improve the current legislations of autogenous vaccines. Two different surveys were formulated, one for the veterinarians working in the Dutch pig industry and one for the producers of autogenous vaccines in the Netherlands. The veterinarians received questions about the use of autogenous vaccines on Dutch pig farms in 2011, the producers received questions about the total production and the production process of autogenous vaccines for the Dutch pig industry in 2011. Each veterinary practice used autogenous vaccines. An average of 11.72 percent of sow farms used autogenous vaccines and 18.96 percent of the total sows were vaccinated with an autogenous vaccine. Autogenous vaccines were used for *Streptococcus suis*, *Staphylococcus hyicus*, *Pasteurella multocida*, *Bordetella bronchiseptica*, *Actinobacillus pleuropneumoniae*, *Clostridium perfringens*, *Clostridium difficile* and *Escherichia coli*. There was a big difference in total production between the different Dutch producers of autogenous vaccines (40 liters – 520,5 liters). The producers produced autogenous vaccines for *Streptococcus suis*, *Staphylococcus hyicus*, *Bordetella bronchiseptica*, *Pasteurella multocida*, *Haemophilus parasuis* and *Clostridium spp.*

Introduction

The last few years, subjects like the use of antibiotics and animal welfare in the Dutch pig industry were enlarged in the media and became an important discussion topic for the Dutch society and politics. To reduce the use of antibiotics and to improve the animal welfare, preventive veterinary health care is essential. Important for preventive health care is to reduce the risk factors present at pig farms and to reduce the probability of disease. For the latter purpose, vaccination of animals is an important factor. If no vaccine is registered for a disease, it is possible to produce and apply an autogenous vaccine. Autogenous vaccines are farm specific vaccines produced with farm specific bacteria.

However, little is known about the efficacy and safety of autogenous vaccines. Safety came into attention after a serious side effect following self-injection. Besides that, in the Netherlands, the total production and application of autogenous vaccines is unknown because no central database for autogenous vaccines is available.

The aim of this study is:

- To make an inventory of the total production and use of autogenous vaccines in the Dutch pig industry in 2011 and to investigate the arguments to start using an autogenous vaccine.

- To give recommendations to improve the current legislations of autogenous vaccines.

Further efficacy and safety of the autogenous vaccines will be discussed, but first current legislation will be considered.

Current legislation
In the Netherlands, it is allowed to produce and apply autogenous vaccines if there is no registered vaccine available, or if it is demonstrated that a registered vaccine is not efficient. This is regulated by the "cascade" regulation and is called magisterial preparation (Minister van Landbouw, Natuur en Voedselkwaliteit 2005a).
Normally, it is forbidden to produce or to have a non-registered medicine in stock (Minister van Landbouw, Natuur en Voedselkwaliteit 2005h). Moreover, it is forbidden to recommend any medicine that is not registered (Minister van Landbouw, Natuur en Voedselkwaliteit 2005g). Under circumstances, an exception is made for autogenous vaccines (Minister van Landbouw, Natuur en Voedselkwaliteit 2005c). The autogenous vaccine needs to be produced from an infective agent isolated from one or more animals in the same herd and the application can only be incidental (Minister van Landbouw, Natuur en Voedselkwaliteit 2005c). After production, the autogenous vaccine must be used at the same animal or animals that are kept together with the source animals.(Minister van Landbouw, Natuur en Voedselkwaliteit 2005c).

There are no intricate requirements for the production of autogenous vaccines. Every veterinary practice or pharmacist in the Netherlands with a suitable room is allowed to produce autogenous vaccines (Minister van Landbouw, Natuur en Voedselkwaliteit 2005a, Minister van Landbouw, Natuur en Voedselkwaliteit 2005b). The labeling of the produced autogenous vaccines should be arranged according to article 67 of the Diergeneesmiddelenregeling (Minister van Landbouw, Natuur en Voedselkwaliteit 2005d).

All vaccines should be applied by a veterinarian (Minister van Landbouw, Natuur en Voedselkwaliteit 2005f), however some exceptions are made for the Dutch pig industry. Vaccines for Influenza, *Erysipelothrix rhusiopathiae*, Porcine Reproductive and Respiratory Syndrome, Atrophic rhinitis, *Escherichia coli*, *Clostridium perfringens*, *Mycoplasma Hyopneumoniae*, *Actinobacillus pleuropneumoniae*, *Parvovirus*, *Rotavirus*, *Haemophilis parasuis*, *Lawsonia intracellularis* or *Porcine Circo Virus* type two can, under specific circumstances, be vaccinated by the farmer (Minister van Landbouw, Natuur en Voedselkwaliteit 2005e).

Efficacy of autogenous vaccines
An advantage of autogenous vaccines for veterinarians is that there is no long-term registration process needed preceding the use of the autogenous vaccines. The disadvantage is that the autogenous vaccines are not tested for efficacy nor safety.
In the past, different studies were performed to evaluate the efficiency of a *Streptococcus suis* autogenous vaccine for the development of an antibody response and the protection against clinical signs. The different studies show some contradiction. Lapointe et al. (2002) developed an autogenous vaccine for *Streptococcus suis* serotype one and two. A vaccination field trial showed a significant increase ($p<0.05$) in antibody response of the vaccinated pigs compared to the non vaccinated pigs. The protection against clinical signs could not be evaluated,

because there was no outbreak of *Streptococcus suis* observed in the control or vaccinated groups.
Wisselink et al. (2002) tested different autogenous vaccines of *Streptococcus suis* serotype two. A formalin-killed wild-type *Streptococcus suis* serotype two autogenous vaccine was compared with a formalin-killed non-encapsulated mutant, a live non-encapsulated mutant and a control group. Pigs vaccinated with the formalin-killed wild-type vaccines were completely protected after challenge with a homologous serotype. The formalin-killed non-encapsulated mutant vaccine gave a partial protection, the pigs vaccinated wit the live non-encapsulated mutant group were less protected.
(Baums et al. 2009) compared a *Streptococcus suis* serotype two strain MAP autogenous vaccine with a *Streptococcus suis* serotype two strain ten bacterin autogenous vaccine. The immunogenicity and protective efficacies against *Streptococcus suis* serotypes two and nine were tested. After challenge with *Streptococcus suis* serotype two strain ten, the mean time to death was similar for the placebo vaccinated animals (5 days) and the MAP vaccinated animals (6.1 days). The mean time to death of the bacterin vaccinated animals was greater (8.9 days). The researchers concluded that pathohistological, clinical and bacteriological screenings demonstrated protective immunity against the homologous serotype two strain ten for the bacterin autogenous vaccine but not for the MAP vaccine. Challenge with *Streptococcus suis* serotype nine strain A3286/94 did not result in a significant protection against mortality neither for the bacterin vaccine as for the MAP subunit vaccine. "Clinical, histological and bacteriological differences suggested partial protection in the bacterin-immunized group."(Baums et al. 2009)
In 2010, a comparative evaluation of different bacterin immunization regimes, including sow vaccination, was performed. This study suggested protective passive maternal immunity for *Streptococcus suis* serotype two after bacterin vaccination of sows and a strong inhibitory effect on active immunization of suckling and weaning piglets, leading to highly susceptible growers (Baums et al. 2010).
(Dekker et al. 2012) studied the efficacy of an autogenous vaccine against *Streptococcus suis* serotype nine. His results show some contradiction with earlier studies. The research focuses on the transmission and colonization of *Streptococcus suis* serotype nine strain 7997. "It was concluded that vaccination against *Streptococcus suis* serotype nine did not reduce transmission, nor colonization and that there were no indications that protection against clinical signs was induced."

Safety of autogenous vaccines
Every new commercial vaccine needs to meet high demands for efficacy and safety. Autogenous vaccines however, do not need to be tested for efficacy nor safety. So, nothing is known about the safety of the vaccine for the animals and the risks for humans after self-injection.
During the production of an autogenous vaccine the pathogen needs to be inactivated. There is a risk that the pathogen, or any additional substance, is not properly inactivated. When the animals are vaccinated with an inefficient inactivated autogenous vaccine, it is, in fact, a live vaccine. To be sure the pathogens are inactivated and the vaccine is not contaminated with any fungi or yeast, a bacterial culture can be made after the production of an autogenous vaccine. In addition, there exists the danger of toxins or viral additions, which can not be exposed by a bacterial culture.

An adjuvant can be added to the vaccine to increase the efficacy. Possible negative side effects of adjuvants are not tested and might eventually be compromised by the vaccination.
Besides, there is the potential danger of transfection. If the germ does not originate from the same herd there could be a risk of introducing new resistant genes into a herd.

Materials and methods

The aim of this study is to make an inventory of the total use of autogenous vaccines in the Dutch pig industry and the possibilities for new legislation about autogenous vaccines. Two different surveys were formulated, one for the veterinarians working in the Dutch pig industry and one for the producers of autogenous vaccines in the Netherlands. See attachment one and two for the surveys.

Twelve veterinary practices with a big share in the Dutch pig industry received an e-mail with a request to participate in the study for their practice and the practices they buy their medicals with. The survey was attached to the e-mail, in which practitioners received questions about the total use of autogenous vaccines on Dutch pig farms in 2011. Following questions were directed on different pathogens, on the arguments to start using an autogenous vaccine, on the knowledge of the efficacy, on the knowledge of the safety and on the legislation about autogenous vaccines.
The second survey was directed to the producers of autogenous vaccines in the Netherlands. They received questions about the total production of autogenous vaccines for the Dutch pig industry in 2011, the diversity of pathogens, the production process, the efficacy and safety of autogenous vaccines, the advice given to the veterinarians and about the legislation around autogenous vaccines.
After a few days, the veterinary practices and the laboratories received a call for an appointment to discuss the survey. The surveys were discussed at the veterinary practices and the laboratories.

Results

<u>Survey veterinary practices</u>
In total, 12 veterinary practices were approached for the study, one of them did not cooperate with the study. Nine of them discussed the survey during a conversation; the other 2 practices answered the survey by e-mail. Only three practices answered the survey for their own practice and the practices they buy their medicals with, the other eight did not have any data of the practices they buy their medicals with.

Total uses of autogenous vaccines
All practices used autogenous vaccines on Dutch pig farms in 2011, mainly on sow farms. The percentage of pig farms that used autogenous vaccines differed per practice. Each practice used autogenous vaccines on sow farms with an average of 11.72 percent. This average is the mean percentage of used autogenous vaccines on farms by the different practices in 2011. Three percent was the least percentage, 25 percent was the highest percentage of used autogenous vaccines on Dutch sow farms by a veterinary practice. One practice did not want to release the data of total pig farms of the practices, so for that practice the percentage could not be calculated.

Looking at the number of animals, there was a bigger difference. Two practices used autogenous vaccines at nine percent of the total sows, which was the least of al practices. One veterinary practice used autogenous vaccines on 60 percent of their sows, which was the most of al practices. On average, the practices used autogenous vaccines at 18.96 percent of the sows. This average is the mean percentage of used autogenous vaccines on sows by the different practices in 2011. One practice used an autogenous vaccine at five percent of their piglets.
The veterinary practices used autogenous vaccines against different pathogens. All practices used autogenous vaccines against *Streptococcus suis*; occasionally it is used against *Staphylococcus hyicus*, *Pasteurella multocida*, *Bordetella bronchiseptica*, *Actinobacillus pleuropneumoniae*, *Clostridium perfringens*, *Clostridium difficile* and *Escherichia coli*.
Reasons given for the decision to use an autogenous vaccine on a pig farm were the unavailability of a registered vaccine, excessive use of antibiotics and the presence of clinical signs. Alternative (management) measures were often taken before the start of using an autogenous vaccine.
Different reasons were given to stop the use of an autogenous vaccine on a pig farm; all veterinary practices answered that if the autogenous vaccine was not effective, they stopped using it on the pig farm; other reasons were financial considerations, the availability of a registered vaccine, other introduced measures and if the signs caused by the pathogen of the autogenous vaccine stopped.

Origin autogenous vaccines
All the veterinary practices sent in piglets for autopsy or a bacterial culture to the laboratory for the production of autogenous vaccines in 2011.
There were six veterinary practices that received all their autogenous vaccines from one external laboratory in the Netherlands. One veterinary practice received a part of their autogenous vaccines from an external laboratory in the Netherlands and a part from their own laboratory. Two veterinary practices produced all their autogenous vaccines their selves in their own laboratory. One veterinary practice got the main part of the autogenous vaccines from an external laboratory in the Netherlands, except the autogenous vaccine for two farms. One of it was produced in an external laboratory in Germany and one of it was produced in an external laboratory in the Czech Republic. One veterinary practice received a part of their autogenous vaccines from an external laboratory in the Netherlands and a part from an external laboratory in the Czech Republic.
Every veterinary practice decided to update the autogenous vaccine when there were new clinical problems with the pathogen. Four practices indicated that they renewed the autogenous vaccine every previously set period based on new bacterial isolates. One veterinary practice did not update the *Clostridium* autogenous vaccine; they preferred to check for clinical signs by omitting the autogenous vaccine.

Efficacy of autogenous vaccines
As explained in the introduction, there is not much scientific proof for the efficacy of autogenous vaccines. When the veterinarians were asked for the efficacy of the used autogenous vaccines, the only thing they could submit was practical experience. Some veterinarians said they had good experiences with autogenous vaccines for *Streptococcus suis* and bad experiences with autogenous vaccines for *Clostridium*; this was a contradiction to the practical experiences of other veterinarians. Some veterinarians thought there was a difference in efficacy between autogenous vaccines

for different serotypes of *Streptococcus suis*, but other veterinarians had the opposite opinion and thought there was no difference between the serotypes.
It can be concluded that the practical experiences of the veterinarians were very different and sometimes in conflict with each other. They did not had any proof for the efficacy of the used autogenous vaccines.

Safety of autogenous vaccines
The safety of the autogenous vaccines is not only important for the animals, but also for the veterinarians who have to inject the vaccine. To test the safety for the animals, it could be wise to vaccinate and monitor a few animals before vaccination of all animals. The survey revealed there was one practice that did this with every new batch, one practice that did this at the very early start of an autogenous vaccine on a farm and one other practice did this with every new batch of a *Pasteurella* or *Bordetella* autogenous vaccine. All other practices did never perform a test vaccination. The veterinarians did not have any problems with the safety of autogenous vaccines in the past.
Just as with the efficacy, there were conflicting answers at questions about the knowledge of the safety of the used autogenous vaccines. One veterinary practice said they did not know anything about the safety of the used autogenous vaccines. Other veterinary practices said they know autogenous vaccines are not as safe as registered vaccines.

Current legislation
In the survey, the veterinarians were asked for their knowledge about the current legislation. All veterinarians were familiar with the legislation of autogenous vaccines, they could name the most important parts of the legislation.

When the veterinarians were asked for suggestions to improve the legislation, all veterinarians named the possibility for the farmer to apply the autogenous vaccines them selves. One veterinary practice added the comment that this should only be possible when the safety of the autogenous vaccines for animals and humans can be guaranteed. As a consequence of these answers, the veterinarians were asked who applied their autogenous vaccines in 2011. All the veterinary practices answered that, with the exception of one farm of one veterinary practice, the farmers themselves vaccinated the autogenous vaccines.
There were some contradictions in the answers of the different veterinary practices when veterinarians were asked for suggestions to improve the legislation. Two practices had the opinion that the use of autogenous vaccines should be easier, two other practices advised to have more control of the use of autogenous vaccines. Four practices thought that the production of autogenous vaccines needs to be professionalized and controlled for safety. Several veterinary practices named the possibility to produce the autogenous vaccines abroad, until now, two practices used foreign magisterial prepared vaccines.

<u>Survey producers' autogenous vaccines</u>
All producers of autogenous vaccines known in advance were asked to join the survey. Also, producers of autogenous vaccines mentioned by veterinary practices during the surveys received a request. In total five Dutch producers were asked to join the survey. During the survey with the veterinary practices also two German

laboratories and one laboratory in the Czech Republic were named by the veterinarians.
All five Dutch laboratories agreed with the survey, one laboratory did not want to release all the numbers of total autogenous vaccine production.

Total production of autogenous vaccines
Four out of five Dutch laboratories produced autogenous vaccines for one veterinary practice in 2011; one laboratory did not want to release the data.
When the laboratories where asked for their total production, one laboratory did not want to release the data. Between the other four laboratories, there was a big difference in total production. One laboratory produced 40 liters autogenous vaccines for sows per year, another laboratory also produced 40 liters autogenous vaccines for sows, one laboratory produced 520,5 liters autogenous vaccines and one laboratory produced 500 liters autogenous vaccines for pigs in 2011.
Two laboratories only produced autogenous vaccines in 2011 for *Streptococcus suis* and *Staphylococcus hyicus*, one laboratory produced autogenous vaccines for *Streptococcus suis*, *Bordetella bronchiseptica* and *Pasteurella multocida*, one laboratory produced autogenous vaccines for *Streptococcus suis*, *Pasteurella*, *Bordetella*, *Haemophilus parasuis* and incidental for *Clostridium spp.* and one laboratory produced autogenous vaccines for *Streptococcus suis*, *Bordetella bronchiseptica*, various types of *Clostridium perfringens* except type C, *Pasteurella multocida* (DNT negative), *Staphylococcus hyicus* and *Haemophilus parasuis.*

The production process
The laboratories produced autogenous vaccines using materials from autopsy, obtained with a swab or with a pure culture sent by the veterinary practices.
The bacteria were killed with formalin. To check the process of killing and to check the addition of fungi or yeasts a sterility check is performed.
The labeling of the autogenous vaccines is different for four of the five Dutch laboratories. One laboratory only adds the date before using and the advice to shake before using. One laboratory adds the advice to perform a test vaccination, the date before using and the charge number on the label. One laboratory adds the name of the farm, the date of production, the date before using, the conditions for storage, the volume to inject and a reference to a control certificate on the label. Two of the five laboratories arranged the labelling similar. On the label the name of the supplier, the number of the veterinarian, the qualities of the autogenous vaccine, the possible side effects, the administration and doses, the packing, the indications, the conditions for storage and the date before using, the composition of the autogenous vaccine, the contra indications, the warnings, pharmaceutical shape, the waiting period and a disclaimer were named.

Efficacy and safety
The laboratories were asked for their efficacy demands of the autogenous vaccines. None of the laboratories had any efficacy demands for the produced autogenous vaccines. Two of five laboratories said they did have good experiences with the autogenous vaccines; the pig farms that start using the autogenous vaccines had better results than before, based on their own experience.
All the laboratories did have safety demands for the autogenous vaccines. All five laboratories performed a sterility test. The autogenous vaccines were tested for bacterial grow, fungi and yeasts. Four laboratories gave the advice to veterinarians to

do a test vaccination before the whole group of animals is vaccinated to ensure the safety of the autogenous vaccine for the animals.

Current legislation
As well as the veterinary practices, the laboratories were asked for their improvements of the current legislation. One laboratory did not have an opinion. One laboratory wanted a good and clear protocol, so they know what to expect. Two laboratories wanted clarity and more options to produce autogenous vaccines. They did not knew if it is legal or illegal what they were doing. The last laboratory wanted clarity about the legal options to produce autogenous vaccines, higher demands for the options to produce autogenous vaccines and more control of the laboratories and veterinary practices to observe the legislation.

Discussion

The disadvantage of a survey is that the results depend on the participants. The answers given by the veterinary practices or the laboratories can not be checked for truth. An example of this is the discussion of the survey at a participant. The veterinarian told they only used autogenous vaccines for *Streptococcus suis*. Because of the prior knowledge we had, we knew it was not the whole truth. Finally, they told us more about the use of autogenous vaccines in this veterinary practice. Afterwards, it is still unknown whether this veterinary practice and all other participants have told the whole truth about the use and production of autogenous vaccines.

Total use of autogenous vaccines
Comparing question two and three of the survey for veterinary practices, it is striking that the average percentage of used autogenous vaccines is higher for sows than for farms. It can be concluded that autogenous vaccines are mostly used on large pig farms. A reason for this may be that the large pig farms are more difficult to manage; the autogenous vaccines may be used as a management tool.

Comparing the current legislation with the survey results
According current legislation the application of autogenous vaccines can only be incidental. The results of the survey show a big difference for the use of autogenous vaccines between the various veterinary practices. Looking at the average number of used autogenous vaccines in the Dutch pig industry from the survey it is not incidental use.
The vaccines prepared in the Czech Republic laboratory are not autogenous vaccines, because they are not prepared with farm specific pathogens. These vaccines are prepared with pathogens already stored in the laboratory. All the vaccines for *Escherichia coli* and *Actinobacillus pleuropneumoniae*, a part of the vaccines for *Clostridium difficile*, a part of the vaccines for *Clostridium perfringens* of one veterinary practice and the *Actinobacillus pleuropneumoniae* vaccines of another practice were prepared in the laboratory in the Czech Republic.
The Dutch laboratories magisterial prepared vaccines for *Streptococcus suis*, *Clostridium perfringens*, *Clostridium difficile*, *Pasteurella multocida*, *Bordetella bronchiseptica*, *Staphylococcus hyicus*, and *Haemophilus parasuis*. According current legislation it is not allowed to use magisterial prepared vaccines for a disease when a registered vaccine is available for the disease. There are registered vaccines available for *Streptococcus suis* type 2, *Clostridium perfringens* type C, *Pasteurella multocida*,

Bordetella bronchiseptica and *Haemophilus parasuis*, so all the magisterial prepared vaccines for these pathogens are forbidden to prepare and to use in the Netherlands.
According legislation, farmers are allowed, under specifically circumstances, to apply vaccines for Influenza, *Erysipelothrix rhusiopathiae*, Porcine Reproductive and Respiratory Syndrome, Atrophic rhinitis, *Escherichia coli*, *Clostridium perfringens*, *Mycoplasma Hyopneumoniae*, *Actinobacillus pleuropneumoniae*, *Parvovirus*, *Rotavirus*, *Haemophilis parasuis*, *Lawsonia intracellularis* and *Porcine Circo Virus* type two (Minister van Landbouw, Natuur en Voedselkwaliteit 2005e). All the magisterial prepared vaccines, not on the list in article 78 of the Diergeneesmiddelenregeling should be applied by the veterinarian. When the veterinarians were asked for it, they all said, with the exception of one farm of one veterinary practice, they do not vaccinate the autogenous vaccines themselves.

Comparing the results of the survey with the current legislation, it is striking that none of the veterinary practices works according current legislation. However, it needs to be said, there certainly are veterinary practices that deliver a good job concerning autogenous vaccines. They have good reasons to start using an autogenous vaccine and they know the possible dangers and possible inefficiency of autogenous vaccine.

Recommendations according future legislation
To prevent a new inventory study is needed in a number of years and to control the production and use of autogenous vaccine in the Dutch pig industry a few recommendations can be made:

- The use of autogenous vaccines in the Dutch pig industry should become transparent. To achieve this transparency, one may consider to establish a central databank for the production and use of autogenous vaccines. The producer, the veterinarian, the farm, the date, the amount of autogenous vaccine and the pathogens of the autogenous vaccines should be recorded.
- There needs to be a protocol to check the efficiency of the used autogenous vaccines. According the results of autogenous vaccines all veterinary practices that participated used autogenous vaccines in 2011. None of them could submit any proof of the efficiency of autogenous vaccines. Considering the lack of information about the safety, the autogenous vaccines that are used should be efficient. A protocol needs to be developed to check the efficiency.
- The safety of the autogenous vaccines needs to be guaranteed. When the veterinarians were asked for suggestions to improve the current legislation, they all named the possibility for the farmers to vaccinate an autogenous vaccine. Until now the autogenous vaccines do not need to be tested for safety, so the safety for animals and humans can not be guaranteed. When it will be possible for a farmer to vaccinate an autogenous vaccine in the future, at least the safety for the farmer needs to be guaranteed. This is possible with a GMP procedure or a license system for the laboratories manufacturing autogenous vaccines.
- It needs to be checked if laboratories and veterinary practices follow the legislation. As seen in the results, at this moment not all laboratories and veterinary practices follow the legislation concerning autogenous vaccines. Autogenous vaccines are prepared for diseases when registered vaccines are available, magisterial prepared vaccines and autogenous vaccines from foreign countries are used in the Dutch pig industry, autogenous vaccines are vaccinated by the farmers and the labelling of the autogenous vaccines is not arranged according current legislation at all laboratories.

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Attachment 1

Survey veterinary practice:

Inventory research for the use of autogenous vaccines in the Dutch pig industry

The use of autogenous vaccines

1. Did you use autogenous vaccines on pig farms in 2011?

2. On how many pig farms did you use autogenous vaccines in 2011? How many pig farms did the practice serve in total in 2011?

3. For how many growing pigs, sows or piglets did you use an autogenous vaccine? In terms of percentage of total pigs?

4. Based on what arguments did you decide to start using autogenous vaccines on the pig farms?

5. For which pathogens did you use autogenous vaccines?

6. When registered vaccines were available, did you test them before start using an autogenous vaccine? Did you perform a field-test?

7. Was a test vaccination performed before you started to vaccinate animals with an autogenous vaccine?

8. Based on what arguments did you decide to stop vaccinate an autogenous vaccine on a pig farm?

Production of autogenous vaccines

9. At which laboratory were the autogenous vaccines produced?

10. Which materials did you sent in for production of autogenous vaccines?

11. Based on what arguments did you decide to renew the autogenous vaccines?

Safety and efficacy

12. What do you know about the efficacy of the used autogenous vaccines?

13. What do you know about the safety of the used autogenous vaccines?

Legislation

14. Are you familiar with the current legislation regarding autogenous vaccines?

15. What would you like to improve about the current legislation?

Attachment 2

Survey producer autogenous vaccines:

Inventory research for the production of autogenous vaccines for the Dutch pig industry

1. For which pathogens did you produce autogenous vaccines for the Dutch pig industry?

2. For how many veterinary practices did you produce autogenous vaccines for the Dutch pig industry in 2011?

3. For how many sows, piglets and growing pigs did you produce autogenous vaccines in 2011? How many doses per pathogen?

4. With which materials did you produce autogenous vaccines?

5. What is the procedure for the production of autogenous vaccines?

6. What recommendations do you give at the veterinary practices? How is the labelling arranged?

7. Do you have any efficacy demands for the autogenous vaccines?

8. Do you test the efficacy?

9. Do you have any safety demands for the autogenous vaccines?

10. How do you test the safety?

11. What would you like to improve about the current legislation?